# APPENDIX N
Resumes

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# Robert Battalio, PE

## Chief Engineer

**EDUCATION**

M.E., Civil Engineering (Coastal Engineering), University of California, Berkeley

B.S., Civil Engineering, Virginia Polytechnic Institute and State University, Summa Cum Laude

**33 YEARS EXPERIENCE**

**CERTIFICATIONS/ REGISTRATION**

Civil Engineer, State of California, C41765

Professional Engineer, State of Washington, #42109;

State of Louisiana, #34927

State of Oregon, #83446

State of Florida, #80940

State of Alabama, #37035-E

**PROFESSIONAL AFFILIATIONS**

American Society of Civil Engineers

American Shore and Beach Preservation Association

The Surfrider Foundation

Appointed, Engineering Criteria Review Board, San Francisco Bay Conservation and Development Commission

A registered professional engineer with a Masters in Engineering from UC Berkeley, Bob Battalio has 30 years of experience with flood management, restoration design, coastal engineering, preparation of construction documents, and project management. His training and work experience is focused in the coastal and estuarine areas, wetland and creek restoration design, and waterfront civil engineering projects. Bob was also one of the study leaders in the development of FEMA's Pacific Coast Flood Hazard Mapping Guidelines, as well as Project Director for a study of coastal erosion response to climate change for Pacific Institute and the California Ocean Protection Council. He was the lead coastal engineer for managed retreat shore enhancement projects constructed at Surfers Point, Ventura, CA and Pacifica State Beach, Pacifica, CA.

## Relevant Experience

**Technical Methods Manual for Adjusting FEMA Coastal Flood Maps to Account for Future Sea Level Rise, 2016.** Bob led development of a manual to assist planners and engineers with planning for sea level rise by extension of FEMA coastal flood hazard maps typically used by municipalities. This Manual was developed as part of a multi-agency effort funded by the NOAA Coastal and Ocean Climate Adaptation (COCA) Program, The California Department of Water Resources (DWR) with coordination support from the California Ocean Science Trust (OST), to develop guidance products to help local communities adapt and plan for sea level rise.

**Ocean Beach Master Plan, San Francisco, CA**. Bob was the senior, lead coastal engineer supporting development of a plan to adapt to rising sea levels on the Pacific Coast of San Francisco. Provided coastal processes and engineering to the San Francisco Urban Planning + Research (SPUR) in support of a Master Plan for San Francisco's Ocean Beach that resulted in a long-term shore management vision for the City / County of San Francisco and the National Park Service, Golden Gate National Recreation Area. ESA subsequently led a team of engineers which further developed the shore modifications, and assessed the vulnerability and identified a protective scheme for a $100M wastewater tunnel in the erosion hazard zone. ESA also contributed to a strategy to manage risks in the interim until the project can be implemented, including a monitoring program and sand placement.

**National Park Service, Golden Gate Parks Conservancy, and Presidio Trust, Crissy Field Wetland Inlet Studies, San Francisco, CA.** Led the coastal processes evaluation of the inlet and adjacent shore following construction of a new tidal lagoon in Crissy Field Park. One study resulted in a quantified conceptual model of inlet closure and natural breaching frequency to aid in the adaptive management of the system and evaluation of the benefits of expansion of the wetland.

**Monterey Bay Sanctuary Foundation, Monterey Bay Sea Level Rise Vulnerability Assessment, California**. *Project Director*. With funding from the California Coastal Conservancy, the Natural Capital Project, and the City of Capitola, ESA modeled future coastal erosion and flooding influenced by sea level rise and precipitation changes. The results are posted on TNC's Coastal Resilience website, and being used to inform local coastal program updates.

**Elkhorn Slough Management Studies: Inlet Stability and Alternatives Engineering, Moss Landing, CA.** Mr. Battalio led the analysis of tidal inlet morphology for two new inlets including evaluation of inlet cross section and associated tide range, and planform dynamics with and without stabilizing jetties. Mr. Battalio also directed the engineering estimates for the enhancement alternatives which included re-routing the main channel, new mouth locations, and large tidal damping structures and sand placement to halt and reverse sediment export and loss of intertidal wetlands.

**Association of Monterey Bay Area Governments (AMBAG), Southern Monterey Bay Coastal Regional Sediment Management Plan and Erosion Mitigation Alternatives, CA.** Bob help develop the first coastal regional sediment management plan in CA in 2008. This project also applied a cost- benefit analysis that included ecological and recreational values along with the more easily estimated land, development and shore protection values. The work was led by the Monterey Bay Marine Sanctuary Foundation, and included an advisory body called the Southern Monterey Bay Coastal Erosion Workgroup.

**Monterey Regional Water Pollution Control Agency, Southern Monterey Bay Coastal Erosion Studies, Monterey County, CA**. *Project Director*. Assessed the Risks to regional sanitary sewer facilities from coastal erosion over the next 50 years; prioritized facilities based on their vulnerability to future erosion and the severity of anticipated damages; and recommended a plan to minimize damages. The assessment included shore morphology and the response to sea level rise, shore recession due to a sand deficit, seasonal and storm-induced responses, and wave runup.

**California Department of Parks and Recreation and California State Coastal Conservancy, Carmel River Lagoon Enhancement, Carmel, CA**. The project recreated a historic lagoon to create valuable habitat for endangered steelhead trout. The project also enhanced river and floodplain connectivity by lowering an existing roadway and removing levees. Bob provided civil engineering during the preliminary and final design stages of the project. Project construction, completed in 2004, and included excavation of over 150,000 cubic yards to recreate the historic lagoon channel.

**Elkhorn Slough Tidal Wetland Project, Elkhorn Slough Foundation, Moss Landing, Monterey Bay, CA**. Mr. Battalio led the evaluation of a new inlet as one of the major alternatives. The evaluation involved the application of geomorphic tools and historic data to estimate the likely equilibrium dimensions of the inlet, using outputs from modeling of ocean waves and inlet tidal exchange, which force sand transport.

**Publications**

Brew, David S., Robert T. Battalio, Edward B. Thornton, Clifton Davenport, Brad Damitz, Coastal Regional Sediment Management Planning In Southern Monterey Bay, California, Littoral 2010, 05009 (2011).

# Michael Burns, CHG, CEG, PG, QSD

## Director Geo-Hydro-HazMat Technical Services Group

**EDUCATION**

B.S., Geology, San Jose State University, 1980

**30+ YEARS EXPERIENCE**

**CERTIFICATIONS/ REGISTRATION**

Certified Hydrogeologist (CHG), No.280, CA, 1995

Certified Engineering Geologist (CEG), No.1846, CA, 1993

Professional Geologist (PG), No.4532, CA, 1989

Qualified SWPPP Developer (QSD) #PG4532

**PROFESSIONAL AFFILIATIONS**

National Groundwater Association - Association of Groundwater Scientists and Engineers

Groundwater Resources Association of California

Michael Burns is a highly skilled and effective project manager with more than 30 years of experience in the environmental and geological sciences. He provides expert services in CEQA and NEPA planning and permitting, site characterization, Superfund sites, Remedial Investigation/Feasibility Studies (RI/FS), waste management, litigation support, property assessments, development and redevelopment, soil and groundwater remediation, groundwater banking, and water rights. His projects include municipal and regional water supply, industrial and manufacturing facilities, airports, levees, landfills, refineries, research and development facilities, hazardous waste management, vineyards, and commercial properties.

## Relevant Experience

### Water Supply and Water Rights

**Monterey Peninsula Water Supply Project Environmental Impact Report, Monterey, CA.** *Hydrogeologist and Hazardous Materials Analyst.* Michael provided senior-level technical consultation and analysis for geology, seismicity, groundwater hydrology and water quality, and hazardous materials, and was responsible for evaluating the results of coastal hydrogeological investigations and groundwater modeling in support of the design of the seawater intake system, the geological and groundwater hydrology and water quality impacts, and project alternatives. Key issues included potential impacts to sensitive beach and dune habitat associated with construction and maintenance of the seawater intake system; minimizing effects on the Salinas Valley Groundwater Basin associated with the operation of the proposed subsurface slant wells; sustainably managing the storage of treated water in an aquifer storage and recovery system; and the effects of future coastal erosion and retreat due to anticipated sea level rise.

**San Francisco Public Utilities Commission Groundwater Supply Project Environmental Impact Report, San Francisco, CA.** *Hydrogeologist***.** Michael provided senior-level consultation, technical input, and review for the hydrology and hazardous materials portions of the Westside groundwater basin portion of the project. This included detailed evaluation of the potential impacts of changes in groundwater levels to Lake Merced, which is incised into the water table. The evaluation analyzed the relationship of water quality parameters relative to lake levels using historical data.

TRAINING

40-Hour OSHA Hazardous Materials & Waste Operations, Current

30-Hour OSHA Construction

CEQA Practice Forum, ongoing

Groundwater Resources Association of California -ongoing

Sustainable Groundwater Management Act Conferences, GRA, 2015

NBWA Climate Change Conference, 2012

Water Quality Goals Conference, State Water Board, 2012

Managed Aquifer Recharge Symposium, NWRI, 2011

Groundwater-Surface Water Interaction: California's Legal and Scientific Disconnect, GRA, 2011

Development & Preservation of Water Rights, Sheppard Mullins et al, 2009

**Cadiz Groundwater Conservation, Recovery, and Storage Project Environmental Impact Report, Cadiz, CA.** *Analyst for Geology, Hydrology, Mineral Resources, and Hazardous Materials.* Michael provided senior-level technical consultation and analysis of the geologic, hydrologic, hazardous materials, and mineral resources impacts for the Environmental Impact Report for the proposed Cadiz Groundwater Conservation, Recovery, and Storage Project. The Storage and Recovery component would actively manage the groundwater basin as a conjunctive use project. Up to 1 million acre feet of water originating from the Colorado River, directly or by exchange, would be conveyed to the watershed from the Colorado River Aqueduct through the pipeline constructed under the Conservation and Recovery Component of the project. This water would be recharged into the aquifer system via spreading basins and recovered when needed.

**City of Daly City Vista Grande Drainage Basin Tunnel Analysis, Daly City.** *Hydrogeologist.* Michael provided senior-level consultation and technical input for the hydrology portion of the project. This included providing technical input to develop the monitoring program in the existing canal to evaluate existing hydrological and chemical conditions. The project will examine alternatives for a pipeline and outfall construction for stormwater management in Daly City.

**San José/Santa Clara Water Pollution Control Plant Master Plan Program Environmental Impact Report, San José, CA.** *Hydrogeologist.* Michael provided senior-level consultation, technical input, and review for the hydrology and hazardous materials portions of the project. This included technical input and senior-level review of the sites historical uses that may have resulted in residual chemical concentration in soil and/or groundwater that could exceed action levels. The Program/Project Environmental Impact Report was prepared for the City of San José's master plan to rebuild the San José/Santa Clara wastewater facility and convert land uses on the plant's 2,700-acre site on the South Bay's shoreline.

**West Basin Desalination Project, El Segundo, CA.** *Geologist and Hazardous Materials Analyst.* Michael provided senior-level technical consultation and analysis for geology, seismicity, and hazardous materials, and was responsible for evaluating the results of sea level rise modeling. The project would construct and operate a seawater desalination plant on an existing ocean-front power plant facility to replace imported public water supplies. Key issues included potential impacts of sea level rise on the existing sea wall and the construction of pipelines through areas with known hazardous materials sites.

# Erick Cooke

## Program Manager

**EDUCATION**

M.S. Environmental Science, University of Massachusetts, Boston

B.A. Biology, University of Hawaii, Manoa

**19 YEARS EXPERIENCE**

Erick Cooke is a project manager with 19 years of diverse industry experience and focused areas of technical expertise. His technical expertise is in water resources, flooding, hydrology and water quality, groundwater resources, and hazardous materials regulations. He has prepared and managed NEPA and CEQA documents, and has been a part of project management teams for levee projects, flood control projects, water supply projects, and other water resources related projects. Erick is currently the deputy project manager on the California Department of Water Resources (DWR) Water Supply Contract Extension Project CEQA Services Team. Erick was a key team member on the U.S. Army Corps of Engineers (USACE), Sacramento District CALFED Levee Stability Program (LSP) by providing project management services and managing the preparation of project management plans (PMPs), Feasibility Cost Sharing Agreements (FCSAs), and other plan formulation documents for over 28 levee stability projects within the CALFED LSP. Erick has monitored and reported on specialized projects for water quality, dredge material disposal, groundwater remediation, watershed modeling, and superfund sites. He has managed projects for DWR, water agencies, reclamation districts, and other local and state agencies.

### Relevant Experience

**Monterey Peninsula Water Supply Project (MPWSP) EIR/EIS, California Public Utilities Commission (CPUC). Monterey County, CA.** *CEQA/NEPA Technical Expert*. The project includes construction of a desalination plant, seawater intake system, source water conveyance pipelines, desalinated water conveyance pipelines and associated facilities, and expansion of an existing aquifer storage and recovery system, to replace part of CalAm’s existing water supplies, which have been constrained by legal decisions affecting CalAm’s diversions from the Carmel River and pumping from the Seaside Groundwater Basin. Erick prepared the Alternatives Analysis chapter of the April 2015 Draft EIR. Upon further project refinements and application for development within Monterey Bay National Marine Sanctuary, Erick prepared a more extensive analysis of alternatives to meet both CEQA and NEPA standards. The Draft EIR/EIS alternatives analysis covers a broad range of alternative components to the proposed MPWSP, including different technologies and/or locations of ocean water intakes, desalination plants, brine discharge outfalls, and associated pipeline locations in Monterey Bay. In addition, Erick helped review other sections of the Draft EIR/EIS prior to publication. Erick assisted with the preparation of responses to comments and the Final EIR/EIS.

**Montague Water Conservation District (MWCD) Conservation and Habitat Enhancement and Restoration Project (CHERP), Montague, CA.** *Project Manager.* Erick is providing expert advice to MWCD on environmental obligations (e.g., CEQA), regulations (e.g., Section 404 permitting), grant writing assistance, and associated schedule constraints for the proposed implementation of the to improve water conservation by lining sections of its Main Canal to increase delivery efficiency, and allow more water to be available for increased instream flows to provide salmonid habitat enhancement and restoration. Associated modifications to other facilities that will be constructed under the CHERP and include construction of a fish screen and fish passage facility, modifications to existing facilities located at Dwinnell Dam's outlet to the Shasta River, and the restoration and enhancement of wetland habitat associated below Dwinnell Dam and the Shasta River. The CHERP will allow MWCD to continue delivery of water to its customers in its service area while meeting salmonid habitat restoration goals in the Shasta River watershed. ESA was hired to provide MWCD expertise in the planning, design, permitting, and CEQA services to construct and operate the CHERP. ESA services include engineering designs for infrastructure (including pipelines), preparation of a Section 404 permit package (including a Biological Assessment and Compensatory Mitigation Plan), grant writing to help fund planning and design efforts, and CEQA documentation.

**DWR NBA Alternate Intake Project EIR. Sacramento, Yolo, Solano and Napa Counties, CA.** *Deputy Project Manager.* Erick is managing the preparation of a comprehensive EIR on the construction and operation of the proposed project. DWR proposes to construct and operate an alternate intake on the Sacramento River and connect it via an underground pipeline to the existing NBA to provide NBA State Water Project Contractors with more reliable deliveries. The proposed intake would be operated in combination with the existing NBA intake at Barker Slough. ESA worked with DWR on project development including identification of a pipeline route that minimizes impacts to wetland resources and existing land use conflicts. ESA also assisted DWR with locating the alternate intake facility based on environmental and engineering factors. In addition, as part of the project development process, ESA is providing technical support for the DWR land owner outreach process. ESA will also be supporting DWR with coordinating permitting efforts with the USACE, USFWS, CDFW and NMFS.

**Monterey Amendment to the State Water Project (SWP) Contracts Including Kern Water Bank Transfer and Associated Systems as part of a Settlement Agreement (Monterey Plus) Environmental Impact Report, California Department of Water Resources.** *Deputy Project Manager.* Erick, prior to joining ESA, served as deputy project manager providing key technical expertise and services for the preparation of the EIR. She continued in her role as project manager for this project as a consultant to DWR. His primary responsibilities included: coordinating public meetings and hearings; working with DWR staff to develop the strategy for the Draft and Final EIRs; preparing and reviewing chapters and technical sections in the Draft and Final EIRs; and, managing the CEQA process. The EIR evaluated the potential environmental effects of implementing the Monterey Amendment to the SWP water contracts and the potential environmental effects of additional actions that may be implemented through the proposed settlement agreement. The proposed project was determined to have the potential to increase supplies for certain SWP contractors. As a result, the analysis focused on the potential impacts to Delta aquatic resources and the potential for the water to support population in some contractor service areas. The analysis also evaluated potential impacts associated prolonged draw-down of SWP reservoirs and construction and operation of groundwater storage that could be attributed to project implementation.

# Elijah A. Davidian, AICP, LEED AP

# Senior Managing Associate

**EDUCATION**

M.S., Natural Resource Policy, University of Michigan, Ann Arbor

M.U.P, University of Michigan, Ann Arbor

B.A., Environmental Studies, University of California, Santa Cruz

**12 YEARS EXPERIENCE**

**CERTIFICATIONS/ REGISTRATION**

American Institute of Certified Planners (AICP)

LEED Accredited Professional, US Green Building Council

Elijah has 12 years of experience working on environmental planning projects with a focus on coastal resource planning and regulatory compliance. Elijah's responsibilities primarily include managing and drafting technical sections of NEPA and CEQA compliance documents, as well as preparing regulatory permit applications and supporting agency consultations. Elijah has technical expertise in the areas of land use policy and planning, water resources management, and negotiation and dispute resolution. Prior to joining ESA, Elijah served as staff to the California Coastal Commission, the agency charged with regulating land use planning and development along the State's 1,100-mile Pacific coastline.

## Relevant Experience

**California Public Utilities Commission, Monterey Peninsula Water Supply Project EIR/EIS, Monterey Peninsula, California.** *Technical Analyst; Land Use and Recreation, and Aesthetics*. Elijah assisted with the preparation of CEQA and NEPA compliance for the MPWSP. The project traverses six coastal local government jurisdictions on the Monterey Peninsula. In addition to assisting with project team coordination, Elijah drafted the Land Use and Recreation, and Aesthetic resources sections and provides senior review of other sections. Elijah is also advising on compliance with applicable coastal laws and regulations (e.g., CZMA, Coastal Act, and LCPs).

**Elkhorn Slough Foundation/Elkhorn Slough National Estuarine Research Reserve, Elkhorn Slough Tidal Marsh Restoration IS/MND and Permitting.** *Regulatory Compliance Manager*. Elijah is managing the regulatory compliance component of a multifaceted effort to restore 140 acres of eroding tidal marsh within the Elkhorn Slough National Estuarine Research Reserve. Elijah managed the CEQA compliance process for this initiative, along with preparation of regulatory permit applications. Agencies with jurisdiction include the California Coastal Commission, Regional Water Quality Control Board, Department of Fish and Wildlife, U.S. Army Corps of Engineers, U.S. Fish and Wildlife Service, National Marine Fisheries Service, among others. Elijah continues to support the Reserve with regulatory agency consultations in support of project approvals.

**Soquel Creek Water District Advanced Purified Groundwater Replenishment Project.** *Deputy Project Manager.* Elijah is supporting ESA's project manager and technical team in the development of CEQA compliance, regulatory permitting, and public outreach efforts for this indirect potable reuse project. The project involves development of an advanced water purification system for treating wastewater to indirect potable reuse standards, and injecting the treated water into the District's groundwater aquifers to supplement its limited supply and combat overdraft and sea water intrusion in the groundwater basin.

**Sonoma County, Local Coastal Plan Update, Sonoma County, CA.** Elijah is supporting the County with its first comprehensive Local Coastal Plan update in more than 15 years. His work involves preparing background documentation and drafting land use policies and programs for each of the Local Coastal Plan's nine elements. Elijah is also advising County staff on matters of Coastal Act compliance, representing the County in policy negotiations with the California Coastal Commission, and assisting with public engagement. The LCP governs all major land use and planning decisions within Sonoma County's coastal communities. The plan area spans the length of Sonoma's 55-mile coastline and includes the communities of Jenner, Bodega Bay, and Sea Ranch among others.

**Daly City, Vista Grande Drainage Basin Improvement Project EIR/EIS.** *Regulatory Task Leader.* Elijah is supporting Daly City's efforts to complete CEQA and NEPA compliance documentation and obtain authorization from the State Lands Commission, California Coastal Commission, and coastal local governments, for improvements to its stormwater system. The project involves improvements to Daly City's stormwater conveyance canal adjacent to Lake Merced, enlargement of the drainage tunnel beneath Fort Funston, and replacement of the beach outfall structure. As part of the CEQA/NEPA and permitting effort, Elijah is working with ESA technical staff and the affected agencies to ensure the project conforms to applicable coastal laws, regulations, and policies, including the CCC's sea level rise policy guidance.

**National Park Service, Merced River Comprehensive Management Plan and EIS, Yosemite National Park.** *Project Manager*. Elijah managed and provided technical support for the preparation of the Merced River Wild and Scenic River Management Plan and Environmental Impact Statement. Under strict deadlines imposed by a judicial settlement agreement, Elijah worked closely with Yosemite National Park staff and ESA's team of technical experts to ensure the Merced River Plan complied with the terms of the settlement agreement, as well as applicable federal laws, regulations, and agency guidelines. The ESA team also prepared a biological assessment, wetlands and floodplain statements of findings, a general conformity determination, and extensive graphics and maps, several planning workbooks for the public, analysis and responses to public comment, and the administrative record.

**San Francisco Planning and Urban Research Association (SPUR), Ocean Beach Master Plan Implementation Project.** *Regulatory Task Leader*. Elijah is spearheading the development of a regulatory strategy for implementing portions of SPUR's Ocean Beach Master Plan. This project focuses on the shoreline management and sea level rise adaptation aspects of the Ocean Beach Master Plan, and issues of erosion at the south end in particular. The project area is subject to the jurisdiction of numerous state and federal agencies, including the California Coastal Commission (CCC), National Park Service, and Army Corps of Engineers. ESA is providing technical coastal engineering services and Coastal Commission permitting support. The ESA team recently worked with SFPUC to obtain a CCC coastal development permit for interim shoreline protection measures at South Ocean Beach.

## STEVEN JOHN DEVEREL, Ph.D., P.G.
## Principal Hydrologist

**Education**
- Ph.D., Soil Science, University of California, Davis, CA (1983)
- BS, Agricultural Science and Management, University of California, Davis, CA (1979)
- BA, Zoology, University of California, Berkeley, CA (1974)

**Licenses/Registrations**
- Professional Geologist, California, #8690
- Professional Geoscientist, Texas, #10856
- Registered Professional Hydrologist, American Institute of Hydrology

**Areas of Expertise**
- Geochemical, hydrologic and biogeochemical analysis and modeling
- Use of environmental tracers to understand hydrologic systems
- Interdisciplinary scientific integration for development of creative solutions

**Years of Experience**
- Founding Principal Hydrologist, *HydroFocus, Inc.*: 20 yrs
- Senior Hydrologist, *Hydrologic Consultants, Inc., Davis, CA.*: 1.5 yrs
- Supervisory Hydrologist and Research Geochemist, *U.S. Geological Survey, Sacramento CA*: 10 yrs
- Lecturer and Associate in the Experiment Station, *UC Davis:* 3 years
- Research Associate, *UC Davis*: 4 yrs

**Professional Affiliations**
- American Geophysical Union
- American Institute of Hydrology
- California Groundwater Resources Association
- International Association of Hydrogeologists

## QUALIFICATIONS

Steven John Deverel is a founding principal of HydroFocus, Inc. He has over 33 years of hydrologic and hydrogeologic problem-solving experience in California and throughout the western United States. Dr. Deverel analyzes groundwater systems, quantifies chemical and physical processes in soils, and evaluates groundwater- and surface-water quality and interactions. Additionally, Dr. Deverel develops models to evaluate water movement and solute transport, applies statistical techniques to analyze land and water resources, and evaluates subsidence and subsidence mitigation. His career has included conduct and direction of many hydrogeologic and hydrologic field investigations. Dr. Deverel is a registered Professional Geologist in California, a registered Professional Geoscientist in Texas and a registered Professional Hydrologist certified by the American Institute of Hydrology. The results of his work are documented in over 40 peer-reviewed publications.

## RELEVANT PROJECT EXPERIENCE

Groundwater quality evaluation and monitoring (2013-present): Under Dr. Deverel's direction, HydroFocus gathered and analyzed available groundwater quality and hydrologic data for the project area which includes 600,000 acres of irrigated agricultural land in Contra Costa, San Joaquin and Stanislaus County to meet the requirements of the State Irrigated Lands Regulatory Program. The HydroFocus team: 1) developed an extensive Access database and Geographic Information System that included over 300,000 lines of hydrologic, land use, well and water quality data, 2) analyzed groundwater, soils and land-use data with respect to a variety of associated variables, such as land use, soil types, depth of water table, 3) utilized geostatistics, the EPA DRASTIC model and groundwater flow and solute transport modeling to delineate areas of varying vulnerability to groundwater quality degradation related to irrigated agriculture and 4) produced a Groundwater Quality Assessment Report (GAR) that identified factors contributing to groundwater quality degradation, especially by nitrate and delineated areas of varying vulnerability. A key issue was the assessment of current and future vulnerability of municipal supply wells to nitrate movement from irrigated agriculture. The team also developed, based on the results of the GAR, a long-term groundwater monitoring plan which will provide information about the effectiveness of implementing management practices to reduce agricultural contributions to groundwater quality degradation.

Evaluate processes affecting water quality, Sacramento-San Joaquin Delta (2012-2016): Dr. Deverel oversaw an extensive field data collection including well installation and chemical and physical data collection (lithology, water quality, aquifer tests, water levels, isotopic data) to estimate organic carbon and salt loads for different wetland and agricultural water management practices. He employed MODFLOW groundwater models to simulate changes in groundwater conditions, drain flow volumes, and groundwater-surface water interactions and employed the solute transport model MTD3D to simulate constituent transport in groundwater and seasonal water quality changes. Additionally, he evaluated methyl mercury loads and processes affecting loads from farmed islands throughout the Delta.

Dr. Deverel's additional relevant project experience includes:

- Groundwater modeling to evaluate potential subsurface extraction for desalination, Huntington Beach, CA. Dr. Deverel oversaw the HydroFocus team which reviewed the model structure, verified model inputs and outputs, assessed groundwater flow patterns, and evaluated the sensitivity of the model. HydroFocus used particle tracking to determine the source of groundwater flowing to the proposed slant wells and to evaluate groundwater travel times for various scenarios. (2016)
- Groundwater quality evaluation and data collection related to irrigated agriculture in Monterey, San Luis Obispo, San Benito and Santa Barbara Counties. Work included extensive water-quality and hydrologic analysis and groundwater flow modeling. (2013–2015)
- Evaluated factors affecting the spatial distribution of water quality, water use, and well yields for a California Energy Commission Project (Hydrogen Energy California). He reviewed regional groundwater-flow models employed to calculate basin water balances and assessed potential impacts from increased pumping on groundwater storage and quality. (2010-2011)
- Led the Willow Slough Watershed Study, which assessed how carbon, nutrients, sediments, and salts are produced and transported in agricultural landscapes. He oversaw development of a quantitative understanding of processes affecting groundwater-surface water interactions and groundwater quality; employed innovative data collection and modeling such as isotopes and groundwater age dating; worked with the local water agency and growers to implement collection of chemical and physical data for surface water, groundwater, and soils; and developed the technical basis for management practices for reducing nitrate loading to groundwater and movement to surface water. (2006-2011)
- Assessment, data collection and modeling of groundwater and surface water interactions in Coastal Lagoon watershed slated for development in Del Norte County. (2014–2016)
- Field data collection and modeling to quantify subsidence and greenhouse gas emissions from Delta organic soils and evaluate different wetland management strategies for stopping and reversing the effects of subsidence and reducing greenhouse gas emissions. (2012-present)
- Geochemical analysis, extensive field data collection, groundwater flow and solute transport modeling related to chromium contamination, Texas. (2009–2012)
- Evaluate subsurface flow and canal leakage, Nevada and Tuolumne counties. Used water isotopes and modeling to determine effects, rates and nature of leakage to wells and surface-water features. (2010–present)
- Provides technical guidance to the Frontier Fertilizer Superfund Oversight Group to ensure that the Superfund site will be effectively remediated. (1996-present)

**CHRISTINE DOUGHTY**
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esd.lbl.gov/profiles/christine-doughty/

## EDUCATION

**B.Sc**. 1978, (Engineering Physics), University of California, Berkeley.
**M.Sc**. 1991, (Material Science and Mineral Engineering), University of California, Berkeley, advisor P.A. Witherspoon
**Ph.D.** 1995, (Material Science and Mineral Engineering), University of California, Berkeley, advisor P.A. Witherspoon

## EXPERIENCE

Staff Scientist, Earth Sciences Division, Lawrence Berkeley Natl. Lab., Berkeley, CA, 10/78 - Present.
Consultant, Ormat Technologies, Reno, NV, 6/14.
Consultant, BP Exploration, Houston, TX, 8/97-10/97, 6/02-9/02.
Consultant, Oxbow Geothermal, Reno, NV, 2/86 – 3/94.
Technical Assistant, Energy and Environment Division, Lawrence Berkeley Natl. Lab., Berkeley, CA, 7/77 - 9/77.

## SELECTED PUBLICATIONS

Doughty, C., G. Hellstrom, C.-F. Tsang, and J. Claesson, A dimensionless parameter approach to the thermal behavior of an aquifer thermal energy storage system, Water Resour. Res., 18(3), 571-587, 1982.

Doughty, C. and K. Pruess, A similarity solution for two-phase water, air, and heat flow near a linear heat source in a porous medium, Journal of Geophysical Res., 97(B2), 1821-1838, 1992.

Doughty, C., J.C.S. Long, K. Hestir, and S.M. Benson, Hydrologic characterization of heterogeneous geologic media with an inverse method based on iterated function systems, Water Resour. Res., 30(6), 1721-1745, 1994.

Doughty, C., Investigation of conceptual and numerical approaches for evaluating moisture, gas, chemical, and heat transport in fractured unsaturated rock, Journal of Contaminant Hydrology, 38(1-3), 69-106, 1999.

Doughty, C. and K. Karasaki, Flow and transport in hierarchically fractured rock, Journal of Hydrology, 263(1-4), 1-22, 2002.

Doughty, C. and K. Pruess, Modeling supercritical carbon dioxide injection in heterogeneous porous media, Vadose Zone Journal, 3(3), 837-847, 2004.

Doughty, C. and C.-F. Tsang, Signatures in flowing fluid electric conductivity logs, Journal of Hydrology, 310(1-4), 157-180, 2005.

Doughty, C., Modeling geologic storage of carbon dioxide: comparison of hysteretic and non-hysteretic curves, Energy Conversion and Management, 48(6), 1768-1781, doi:10.1016/j.enconman.2007.01.022, 2007.

Doughty, C. and B.M. Freifeld, Modeling $CO_2$ injection at Cranfield, Mississippi: Investigation of methane and temperature effects, Greenhouse Gas Science and Technology, doi:10.1002/ghg.1363, 2013.

Salve, R. C. Doughty, M. Kelly and T. Tokunaga, Water availability assessment framework for solar energy production in deserts, 13th IWA Specialized Conference on Watershed and River Basin Management, San Francisco, September 9th-12th, 2014.

Pan, L., B. Freifeld, C. Doughty, S. Zakem, M. Sheu, B. Cutright, and T. Terrall, Fully coupled wellbore-reservoir modeling of geothermal heat extraction using $CO_2$ as the working fluid, Geothermics, 53, 100-113, 2015.

**CURRENT RESEARCH INTERESTS**

Mathematical modeling of multi-component, multi-phase fluid flow and transport in heterogeneous geologic media; development and application of techniques for analyzing well-log, well-test, and tracer data to infer the distribution of hydrologic properties in heterogeneous geologic settings, including fractured rock; analysis of watershed and groundwater-basin hydrologic cycles; coordination of modeling studies with laboratory and field work; collaboration with geophysicists, geochemists, and geologists in interdisciplinary studies.

**SYNERGISTIC ACTIVITIES**

- Teacher, TOUGH short course
- Member, TOUGH steering committee, 2015 TOUGH Symposium organizing committee
- Guest Editor, Computers and Geosciences
- Session Convener, AGU Fall Meeting
- WESTCARB representative to the Simulation and Risk Assessment Working Group of the Regional Carbon Sequestration Partnership Initiative
- Community service: Math and science tutor for middle- and high-school students

**COLLABORATORS**

Diana Bacon, Pacific Northwest National Laboratory

Goran Hellstrom, Lund University, Sweden

Susan Hovorka, Texas Bureau of Economic Geology

Tom Johnson, University of Illinois

Yousif Kharaka, U.S. Geological Survey

Jane C.S. Long, University of California, Berkeley

Steve Martel, University of Hawaii

Larry Myer, Leonardo Technologies

Auli Niemi, Uppsala University, Sweden

Catherine Peters, Princeton University

Christine Shoemaker, Cornell University

Chin-Fu Tsang, Uppsala University, Sweden

Masahiro Uchida, Japan Atomic Energy Agency

Tianfu Xu, Jilin University, China

Hajime Yamamoto, Taisei Corporation, Japan

Steve Zakem, Echogen Power Systems, Inc.

**STUDENT AND POSTDOCTORAL ADVISOR**

Francois Cotte, Institut National Des Sciences Appliquees, Lyon, France

Andre Espinet, Cornell University

Martin Larsson, Uppsala University, Sweden

Clifford Ndiweni, University of Witwatersrand, South Africa

Magnus Oden, Uppsala University, Sweden

Chris Patterson, Clemson University

Prabhakar Sharma, Uppsala University, Sweden

Tien Dung Tran Ngoc, Institut National de la Recherche Scientifique, Canada

# Matt Fagundes

## Air Quality and Noise Analyst

**EDUCATION**

B.S., Environmental Studies (emphasis in Water Technology and Hazardous Materials Management), Sonoma State University

**20 YEARS EXPERIENCE**

**TRAINING**

Mitigation Measure Implementation & Monitoring, UC Davis Extension, March 2005

The Air Pollution Model, San Francisco State University (SFSU), Spring 2004

Climatology Masters Seminar, SFSU, Fall 2003

Matt is an environmental scientist with more than 20 years of experience evaluating potential impacts to the physical environment, particularly with regard to air quality, greenhouse gases, hazards, noise, and transportation for compliance with the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA). Matt has vast experience with the review of energy infrastructure and other industrial projects and has experience serving as project manager and deputy project manager for such clients as the California Public Utilities Commission (CPUC), California State Lands Commission (CSLC), the Los Angeles Unified School District (LAUSD), Sonoma County Waste Management Agency (SCWMA), and Contra Costa County.

## Relevant Experience

**CPUC, California American Coastal Water Project, Monterey County.** *Air Quality and Noise Analyst*. Under contract to the CPUC, Matt was responsible for the preparation of the air quality and noise EIR analyses for this extremely controversial project, which included the construction and operation of a desalination plant and associated water supply facilities in coastal Monterey County. The Coastal Water Project would consist of several distinct components, including a seawater intake system, a desalination plant, a brine discharge system, product water conveyance pipelines and storage facilities, and an aquifer storage and recovery system. The final EIR was certified in November 2009.

**CPUC, Monterey Peninsula Water Supply Project EIR and EIR/EIS, Monterey, CA.** *Air Quality and GHG Emissions Analyst.* Under contract with the CPUC, Matt was responsible for the preparation of the air quality, GHG emissions, and energy analyses for the CalAm-proposed Monterey Peninsula Water Supply Project (MPWSP) Draft EIR, published in May 2015. Subsequent to the release of the Draft EIR, the applicant made changes to the project and Monterey Bay National Marine Sanctuary determined that NEPA compliance was required. Matt prepared the EIR/EIS sections with the MBNMS as the NEPA lead agency.

**California Public Utilities Commissions (CPUC), Presidential Substation Project, Ventura County, CA.** *Air Quality, Greenhouse Gases, Noise, and Hazards and Hazardous Materials Analyst.* Under contract with the CPUC, Matt was responsible for the preparation of the air quality, greenhouse gas emissions, noise, and hazards and hazardous materials analyses for the completion of the Environmental Impact Report (EIR) for Southern California Edison's proposed Presidential Substation Project, which would have included the development of a new substation and controversial subtransmission line alignment in the Thousand Oaks area of Ventura County. Based on ESA's alternatives evaluation, the CPUC ended up approving a system alternative that avoided the need for the construction the Presidential Substation.

**CPUC, Artesian Substation Project, San Diego, CA.** *Air Quality and GHG Emissions Analyst:* Under contract to the CPUC, Matt is the lead analyst for the air quality and GHG emissions  sections for the Initial Study/Mitigated Negative

Declaration (IS/MND) for this substation expansion project proposed by San Diego Gas and Electric (SDG&E), who are seeking a Permit to Construct for the Project. The Draft IS/MND is expected to be released first quarter of 2018.

**CPUC, Moorpark-Newbury Subtransmission Line Project. Ventura County.** Project Manage*r, Air Quality, Greenhouse Gases, and Noise Senior Reviewer.* Under contract with the CPUC, Matt is serving as the Team's Project Manager for the completion of an EIR. The project includes a new 66 kV subtransmission line between Moorpark and Newbury Park. The project has gained much attention from local agencies and the public because CPUC authorized SCE to begin construction of the project in 2010 under an exemption, but later ruled that all construction had to cease immediately. SCE submitted its application in October 2013 to finish construction of the project. The Draft EIR was released in June 2015, and the Final EIR was published in October 2015. Construction of the project began in October 2016, and  was completed in December 2018.

**CPUC Missouri Flat-Gold Hill Reconductoring Project IS/MND, El Dorado County.** *Air Quality, Greenhouse Gases, and Noise Senior Reviewer.* Matt served as the Team's air quality, GHG emissions, and noise senior technical reviewer for this IS/MND for PG&E's reconductoring project located in El Dorado County and the City of Folsom. The proposed project involves the replacement of existing conductor, pole replacement, and steel tower modifications to an existing 115 kV power line between the City of Folsom in Sacramento County and Shingle Springs in El Dorado County. The project would also modify and upgrade existing substations and temporarily convert a 60 kV line to 115 kV during project construction.

**CPUC, Circle City Substation and Mira Loma Subtransmission Line Project. Riverside and San Bernardino counties, CA.** *Project Manager, Air Quality, Greenhouse gases, and Noise Senior Reviewer.* Under contract with the CPUC, Matt is serving as the Team's Project Manager for the completion of an EIR. The project includes replacing existing conductors and support structures on two segments of SCE's system, and construction of a new 66/12 kV substation. Matt is also leading the project alternatives screening process that includes evaluation of several innovative alternatives, including battery storage, which was shown to be a viable alternative based on the flow analysis  conducted for the project. The Draft EIR is expected to be released first quarter of 2018.

**CPUC, Klamath Rural Broadband Joint CEQA/NEPA Document, Humboldt County, CA.** *Air Quality, GHG Emissions, and Noise Analyst.* Matt is the senior technical analyst for a joint CEQA and NEPA document assessing the potential impacts of installing approximately 90 miles of broadband fiber optic cable in rural Humboldt County. The project will provide high speed internet service to several remote communities along the Klamath River.

**CPUC, Hollister 115 kV Power Line Reconductoring Project. San Benito and Monterey Counties, CA.** *Project Manager, Air Quality, Greenhouse Gases, and Noise Senior Reviewer and Hazards and Hazardous Materials and Transportation and Traffic Analyst.* Under contract with the CPUC, Matt served as the Team's Project Manager for the completion of an Initial Study/Mitigated Negative Declaration (IS/MND). The project includes replacing existing conductors and support structures on two segments of PG&E's system, including the Hollister Tower Segment, which is approximately seven miles long; and the Hollister Pole Segment, which is approximately nine miles long. The project was approved in January 2011, and construction began in October 2011. The Project was completed in Fall 2013.

# Hilary Finck

## Associate III

**EDUCATION**

M.A., Geography and Environment, San Francisco State University

B.A., Environmental Studies, San Francisco State University

**5 YEARS EXPERIENCE**

As a part of the Northern California Water and Energy Group, Hilary prepares environmental documents pursuant to CEQA/NEPA for water infrastructure projects. She acts as deputy project manager and technical analyst for a range of projects, from desalination plants and reservoir expansion to local watershed improvements and municipal groundwater wells. Hilary has experience drafting environmental impact analyses for agriculture, mineral resources, utilities, geology and soils, population and housing, recreation, and land use and planning. Prior to ESA, Hilary was an Environmental Specialist with Recology's environmental compliance team, where she assisted with compliance and permitting for Recology's landfills, composting operations, and transfer stations.

## Relevant Experience

**California Public Utilities Commission and Monterey Bay National Marine Sanctuary, Monterey Peninsula Water Supply Project EIR/EIS, Monterey County, CA.** *Deputy Project Manager and Technical Analyst.* Hilary assisted the project management team with publication of the Draft EIR/EIS, compilation of the administrative record, the public review process, responses to comments organization, and publication of the Final EIR/EIS. Hilary conducted environmental analyses of the effects of the project on utilities, agriculture, and mineral resources. The project would replace existing CalAm water supplies that have been constrained by legal decisions affecting diversions from the Carmel River and pumping from the Seaside Groundwater Basin. The primary project elements include a seawater intake system comprised of subsurface slant wells along the coast, a desalination plant, aquifer storage and recovery facilities, and over 20 miles of conveyance pipelines and associated infrastructure.

**City of Antioch, Brackish Water Desalination Project, Environmental Impact Report, Antioch, CA.** *Deputy Project Manager.* Hilary assisted the Project Manager with project kick-off and project set-up tasks. Hilary authored several resource sections, including population and housing, land use and planning, recreation, and public services and utilities. The proposed project would pump brackish water from the Bay Delta, construct a new desalination facility at the City of Antioch's existing water treatment plant, and dispose of treated brine and wastewater effluent through the Delta Diablo outfall into the Delta.

**Soquel Creek Water District, Advance Purified Groundwater Replenishment Project. Santa Cruz County, CA.** *Project Analyst.* Hilary assisted the Project Management team with the public scoping process and the preparation of Initial Study resource impact analyses. The Advance Purified Groundwater Replenishment Project would develop an advanced water purification system for treating wastewater to indirect potable reuse standards, and inject the treated water into the District's groundwater aquifers to supplement its limited supply and combat overdraft and sea water intrusion in the groundwater basin.

**Erler & Kalinowski, Inc., Pad D Groundwater Well Focused EIR, East Palo Alto, CA.** *Project Analyst*. Hilary assisted the Project Manager with the public scoping process and with the preparation of the Initial Study and Draft Focused EIR by conducting research, draft review, and publication tasks. The project includes a new 500 gallon-per-minute municipal groundwater production well at the City of East Palo Alto-owned Pad D site.

**Santa Clara Valley Water District, Almaden Lake Project EIR, San Jose, CA.** *Deputy Project Manager and Project Analyst*. Hilary conducted research for hazards and hydrology and water quality technical sections, and the cumulative impact scenario. Hilary assisted the Project Manager with section review and coordination of analysts. The Almaden Lake Project would reduce impacts to anadromous fish from mercury containing sediment and high water temperatures in Almaden Lake. The EIR addresses the technical methylmercury issue, as well as potential impacts to adjacent recreational resources, and residential areas, including a proposed change in park design.

**Sonoma County, Local Coastal Plan Update, Sonoma County, CA.** *Project Analyst*. Hilary assisted with Sonoma County's first Local Coastal Plan Update in more than 15 years by comparing current plans and policies with proposed draft plans and policies to ensure that the LCP Update provides a comprehensive plan for all nine elements of the Local Coastal Plan. The LCP governs all major land use and planning decisions within Sonoma County's coastal communities. The plan area spans the length of Sonoma's 55-mile coastline and includes the communities of Jenner, Bodega Bay, and Sea Ranch among others.

**McMillen Jacobs Associates, Vista Grande Drainage Basin Improvement Project, Daly City and San Francisco, CA.** *Project Analyst.* Hilary assisted with the preparation of a joint EIR/EIS on behalf of the City of Daly City and the National Park Service – Golden Gate National Recreation Area. Hilary helped with public outreach and other CEQA/NEPA administrative requirements, including the Responses to Comments and Mitigation Monitoring and Reporting Program. In addition, Hilary assisted with the application for grant funding with the California State Water Resources Control Board's Stormwater Grant Program, for which Daly City was awarded $10 million in grant funding for the implementation of the project. The project would replace a portion of Daly City's stormwater drainage canal with a debris screening structure, box culvert, and treatment wetland, with some storm and authorized non-storm flows diverted to Lake Merced, and would enlarge the existing drainage tunnel beneath Fort Funston to mitigate flooding in the Vista Grande watershed resulting from large storms.

## Publications

**Stormwater Fees: An Equitable Path to a Sustainable Wastewater System.** *SPUR Report*, San Francisco Planning and Urban Research Association, 2012.

**Green Water Infrastructure: The Road to a Healthy Watershed.** *Urban Action – A Journal of Urban Affairs*, San Francisco State University, 2011.

**Water Conservation: The Unsung Hero of California's Water Woes.** *Urban Action – A Journal of Urban Affairs*, San Francisco State University, 2010.

**JOHN L. FIO**
**Principal Hydrologist**

**Education**
MS, Civil Engineering, University of California, Davis, CA (1987)

BS, Soil and Water Science, University of California, Davis, CA (1984)

**Areas of Expertise**
- Groundwater-Flow Hydraulics and Modeling (MODFLOW)
- Chemical Fate and Transport Modeling (MT3D)
- Geochemical Modeling (PHREEQC)
- Water Quality

**Years of Experience**
Founding Principal, Principal Hydrologist, *HydroFocus, Inc.*: 20 yrs

Senior Project Hydrologist, *Hydrologic Consultants, Inc.*: 2 yrs

Hydraulic Engineer, Civil Engineer, and Hydrologist, *U.S. Geological Survey*: 10 yrs

**Professional Affiliations**
- American Society of Civil Engineers
- Association of Groundwater Scientists and Engineers
- California Groundwater Resources Association

## QUALIFICATIONS

John L. Fio is a founding principal of HydroFocus, Inc. He has more than 30 years of hydrologic problem-solving experience. Mr. Fio analyzes groundwater systems, quantifies chemical transport in the subsurface, and evaluates groundwater surface-water interactions. Mr. Fio develops and employs numerical MODFLOW models for site, water district, and basin-wide investigations; calculates extraction effects on groundwater levels, stream flow, and lake levels; establishes water quality monitoring programs; conducts and analyzes aquifer tests; designs water management plans; evaluates groundwater quality effects of wastewater and recycled water disposal to land; develops and implements Geographic Information System (GIS) databases; and determines water sources using chemical and age-dating techniques. Mr. Fio's professional experience includes ten years of research and project leadership with the U.S. Geological Survey, and more than 20 years of experience in private consulting. His work is published in 16 peer-reviewed journal articles and government reports.

## RELEVANT PROJECT EXPERIENCE

Hydraulic Continuity of San Francisco Bay Area Aquifers for Groundwater Management Decision Making (2011-present): Mr. Fio developed a regional MODFLOW groundwater-flow model to quantify groundwater extraction from aquifers in San Mateo County and its effects on groundwater conditions beneath San Francisco Bay and adjacent basins located in San Francisco, Alameda, and Santa Clara counties. The groundwater-flow model was developed using reports, maps, digital databases, computer models, and paper records compiled and archived in a Geographic Information System (GIS) data base developed under his supervision. The model was calibrated to represent average hydrologic conditions and verified by reliably reproducing measured water level changes during a historical pumping test conducted in the 1960s by the California Department of Water Resources. The favorable comparison between simulated and observed water levels indicated that the model reliably represents the hydraulic connection between wells extracting groundwater located on either side of San Francisco Bay. The calibrated model was then utilized to estimate expected yields from hypothetical shallow wells located in areas adjacent to San Francisco Bay, and to simulate the hydraulic effects of shallow aquifer pumping on other existing groundwater users in the region. Model sensitivity analyses identified data gaps and model uncertainty to direct the prioritization of future data collection and aquifer testing activities. Starting in 2016, the model grid was refined and pumpage and recharge input updated using detailed information from existing local models. The model capability was expanded to calculate groundwater level and storage changes during the period 1991-2015 for applications to support groundwater management efforts in San Mateo County.

Westside Groundwater Basin, San Francisco and San Mateo Counties (1998-present): Since 1998, as a consultant to Daly City, Mr. Fio has provided key technical analyses and consensus building efforts toward improved management of the Westside Groundwater Basin located in San Francisco and San Mateo Counties. The basin is a source of drinking water for the City of San Francisco, City of Daly City, Town of Colma, City of South San Francisco, and City of San Bruno. John was a key contributor toward development of the basin management plan and oversaw development and technical acceptance of the groundwater-flow model utilized to quantify basin hydrogeology. The effort to achieve model consensus required extensive coordination and effective communication with multiple basin stakeholders and their technical representatives. The model has since been employed to design and analyze proposed groundwater development projects in the City of San Francisco and an in-lieu conjunctive use project in San Mateo County to increase drinking water supply reliability for the greater San Francisco Bay area.

Model Review, update, and implementation for estimating future response to project pumping (2015-2016): In the Monterey area, a water supply project is proposed that would employ subsurface ocean water intake system using slant wells near the coast. Mr. Fio reviewed and updated a MODFLOW groundwater flow model using new information to better represent the conceptual hydrogeologic groundwater-flow system. He then evaluated the model's ability to match historical water levels and a recent pumping test. Mr. Fio employed the theory of superposition to isolate the drawdown cone-of-depression for various future scenarios effectively mapping which areas would be affected by project pumping. He characterized the sensitivity of the model results to both model assumptions and parameter values. Finally, using MODPATH particle tracking, he determined both the areal extent of ocean water that would be captured from the slant pumping wells and areas where seawater intrusion would be affected due to future project pumping.

Mr. Fio's additional relevant data and modeling analyses includes:

- Assisted Energy Commission Staff in ten power plant permitting reviews and one compliance project. In most of these projects, Mr. Fio was relied upon to review, critique, and implement the various groundwater-flow and well hydraulic models that simulated water budget and groundwater level changes in response to the proposed pumping and power plant water use (2008-2016).
- Developed the conceptualized understanding of subsurface hydrogeologic and water quality conditions, and then employed MODFLOW to construct a numerical model to quantitatively represent groundwater hydraulics beneath the Ironhouse Sanitary District wastewater treatment facility and its surrounding area, MODPATH to simulate groundwater-flow paths and conduct time-of-travel calculations, and PHREEQC to assess chemical reactions that may occur from mixing recycled water and native groundwater and the likelihood for chemical clogging of the well screen and surrounding aquifer. A variety of scenarios were run to assess injection well hydraulic and water quality effects, and the results helped the client determine preliminary feasibility of recycled water injection.
- Groundwater recharge and age dating groundwater study, South Westside Basin. Incorporated stable water isotopes, nitrogen isotopes, and age dating well-water samples with an existing soil moisture accounting model and groundwater-flow model to assess groundwater recharge and its relationships to land used and dissolved constituents (2014-2015).
- Groundwater-flow, solute-transport, and water-quality impacts from wastewater disposal to land: San Joaquin and Contra Costa Counties, California (2000-present).

# Michelle Giolli

## Senior Associate Biologist and Regulatory Permitting Specialist

**EDUCATION**

B.S., Ecology and Systematic Biology / Cal Poly State University, San Luis Obispo

**13 YEARS OF EXPERIENCE**

**CERTIFICATIONS**

Federal Recovery Permit for listed vernal pool Branchiopods (#TE09389A-0)

California Scientific Collecting Permit # 10215 (801169-04)

**TRAINING**

Advanced Wetland Delineation (2017)

CRAM – Estuarine and Riverine Models (2016)

Wetland Delineation 40-Hour Training Course (2011)

California Tiger Salamander Biology and Larval Techniques Workshops (2006 and 2009)

Biology and Management of the California Red-Legged Frog (2006)

Western Pond Turtle Workshop (2008)

California Anostracan and Notostracan Identification Course (2005)

Michelle is a Senior Associate in ESA's Bay Area Biological Resources and Land Management Group who specializes in permitting, preparing applications for federal, state and local permits for infrastructure improvements, maintenance projects, restoration projects, and land development projects affecting regulated habitats and special-status species. She is adept with CEQA compliance and preparing mitigation and monitoring plans, and also performs wildlife habitat assessment and jurisdictional wetland delineations. She has direct permitting experience with the U.S. Army Corps of Engineers (404 permits), U.S. Fish and Wildlife Service (Biological Assessments), California Department of Fish and Wildlife (Incidental Take Permit Applications and Lake and Streambed Alteration Agreements), San Francisco Bay Conservation and Development Commission (Major and Minor Permit), Regional Water Quality Control Board (401 Water Quality Certification and Waste Discharge Requirements), and State Lands Commission (Land Use Lease). Michelle has broad experience with special-status plant and wildlife species including listed fairy shrimp, California red-legged frog, California tiger salamander, western pond turtle, California clapper rail, and western burrowing owl.

## Relevant Experience

**California Public Utilities Commission CalAm Monterey Peninsula Water Supply Project, Monterey County, CA.** *Biologist.* Michelle prepared the biological resources section of the CEQA/NEPA document for the California America Water Company's (CalAm) Monterey Peninsula Water Supply Project and responded to public comments on the document. She also conducted presence/absence surveys for special status plant species within the project boundary. The proposed project is a desalination project to provide water supply to CalAm's Monterey service area.

**Elkhorn Slough National Estuarine Research Reserve, Elkhorn Slough Tidal Wetland Restoration Project. Moss Landing, CA**. *Permitting Specialist.* Michelle prepared several permit applications (including the Request for Incidental Harassment Authorization, USFWS and NMFS Biological Assessment, and the CDFW Notification of Lake or Streambed Alteration) for Phase 1 of the Elkhorn Slough Tidal Wetland Restoration Project. The proposed project would restore vegetated tidal marsh, upland ecotone, and native grasslands in and around Elkhorn Slough. The marshes of Elkhorn Slough have been subjected to human-induced and natural stressors that have resulted in extensive marsh loss through "ecological drowning."

**San Francisco Public Utilities Commission, San Antonio Backup Pipeline Project, Sunol, CA.** *Biologist and Permitting Specialist.* Michelle prepared the federal and state permit applications for this San Francisco Public Utilities District (SFPUC) water supply infrastructure improvement project in the Alameda Creek watershed. The project, which involves improvements to existing water supply facilities along sensitive riparian habitat, will improve the overall reliability of the regional water system with respect to water quality and seismic reliability. Permit applications for the project include U.S. Army Corps Pre-Construction Notification/Nationwide Permit, USFWS Biological Assessment, CDFG Incidental Take Permit Application, RWQCB 401 Water Quality Certification, and CDFG Lake and Streambed Alteration Agreement.

**Contra Costa Water District, Los Vaqueros Watershed Biological Services CA.** *Biologist.* Michelle coordinated and conducted two years of California red-legged frog and California tiger salamander egg mass, larval, metamorph, and adult surveys within 89 ponds on the Los Vaqueros Watershed. Following the surveys she prepared reports on the findings. She also compiled oak woodland mitigation monitoring data and prepared a report on the findings. Annual surveys and reporting are required as part of mitigation and monitoring requirements for the development of the Los Vaqueros Reservoir.

**San Francisco Public Utilities Commission, Alameda Creek Recapture Project, Sunol, CA.** *Biologist and Regulatory Permitting Specialist.* Michelle prepared a terrestrial habitat assessment and wetland delineation for the original Filter Gallery Project. She mapped and described all habitats within the project boundary and discussed the potential for special-status terrestrial wildlife species, including California red-legged frog, California tiger salamander, and Alameda whipsnake to occur within the project area. Additionally, she prepared the biological resources section of the Draft Environmental Impact Report, CDFW Incidental Take Permit application, and amendment to an existing USFWS Biological Opinion for the Alameda Creek Recapture Project. The proposed Alameda Creek Recapture Project would recapture water released from Calaveras Reservoir and the water historically diverted at the Sunol Filter Galleries and would reintroduce the recaptured water into the SFPUC's water supply portfolio.

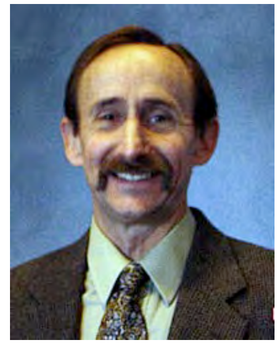
**Harkin Slough Improvements (Pajaro Valley Water Management Agency). Watsonville, CA.** *Biologist and Permitting Specialist.* Michelle conducted the jurisdictional wetland delineation and prepared the CDFG Lake and Streambed Alteration Agreement for the Harkins Slough Improvement project. The goal of the project was to remove non-native vegetation and accumulated sediment from the pump within Harkins Slough so the Pajaro Valley Water Management Agency could pump at full capacity.

**Zone 7 Water Agency, Zone 7 Stream Maintenance Projects. Livermore-Amador Valley, CA.** *Biologist.* Michelle conducted site assessments and protocol-level surveys for California red-legged frogs at nine locations in the Livermore-Amador Valley. Zone 7 performs channel maintenance in these areas and California red-legged frog surveys are required under Zone 7's permits for channel maintenance. Surveys were conducted under the direction of a 10(a)1(A) California red-legged frog permit holder.

**San Francisco Public Utilities Commission, Bay Tunnel Project, Palo Alto, CA.** *Biologist and Construction Monitor.* Michelle was a biologist and construction monitor for the Bay Tunnel Project site. The Bay Tunnel project intends to construct a tunnel underneath the San Francisco Bay connecting water pipelines in the East Bay to the Peninsula. She conducted pre-construction nesting bird surveys, including western burrowing owl, for several work sites and was a USFWS-approved biologist to monitor construction sites within the vicinity of California clapper rail and salt marsh harvest mouse habitat.

APPLIED marine SCIENCES

# RESUME
# Dane D. Hardin
# Sr. Marine Biologist, Principal



**EXPERTISE**

Program Design and Management
Environmental Impact Assessments
Ecological Baseline and Monitoring Programs
Petroleum-related Environmental Issues

**CREDENTIALS**

**Education:** Ph.C 1976 Biology Department, University of California, Santa Cruz
B.A. 1967 Biology Department, University of California, Santa Cruz

**Honors & Certifications:** SCUBA certification from National Association of SCUBA Diving Schools, Reviewer for Marine Environmental Research, Scientific advisor to the State of California Water Resources Control Board in the design of a comprehensive monitoring program for San Francisco Bay

**EMPLOYMENT HISTORY**

| | |
|---|---|
| 1994-Present | Sr. Marine Biologist, Principal, Applied Marine Sciences Inc., Livermore, CA |
| 1992-1993 | Sr. Oceanographer and Vice-President, Marine Research Specialists, Soquel, CA |
| 1975-1991 | Sr. Oceanographer and Regional Manager, Kinnetic Laboratories, Inc., Santa Cruz, CA |
| 1972-1973 | Research Assistant, Department of Biology, University of California, Santa Cruz, CA |

**EXPERIENCE**

Mr. Hardin has over 30 years experience in the study of aquatic ecology. He specializes in the application of statistically-sound sampling and analytical methods to the study of natural variations and anthropogenic influences on marine benthic communities. Mr. Hardin has conducted programs for both industry and various levels of government, over a broad geographic range. His work includes serving as Program Manager and Principal Investigator on several studies funded by the US Department of the Interior investigating natural and human-induced variation in intertidal and subtidal communities in the Pacific Outer Continental Shelf and Gulf of Mexico regions. He has also participated in nine studies of municipal wastewater discharges across the country, including work on the large consolidated discharge in Massachusetts Bay for the Massachusetts Water Resources Authority. Mr. Hardin supervised the first commercial application of periphyton communities and transplanted bivalves to measure water quality in central California and conducted five years of bivalve monitoring at the Selby slag disposal site near Carquinez Strait in San Francisco Bay. Mr. Hardin also has performed environmental evaluations of petroleum related activities in the Russian Arctic and nearshore regions of the Caspian Sea in Kazakhstan. He currently is Director of the Central Coast Long-term Environmental Assessment Network, a regional monitoring program being conducted for a consortium of municipal and industrial dischargers in the Monterey Bay area under the auspices of the Central Coast Regional Water Quality Control Board.

In the course of his experience, Mr. Hardin has contributed to the design and modification of photoquadrat sampling techniques, laser-aided quantitative sampling, and intertidal point-contact sampling methods. His contributions to laser-aided quantitative sampling have become the state-of-the-art technique in photographic sampling of benthic epifauna with remotely operated vehicles. Mr. Hardin has 21 publications in peer-reviewed scientific journals.

## REPRESENTATIVE PUBLICATIONS

### Scientific Journals

Nairn, R., J.A. Johnson, D. Hardin, J. Michel. 2004. A biological and physical monitoring program to evaluate long-term impacts from sand dredging operations in the United States outer continental shelf. *Journal of Coastal Research*. 20(1):126-137.

Gunther, A.J., J.A. Davis, D.D. Hardin, J. Gold, D. Bell, J.R. Crick, G.M. Scelfo, J. Sericano, M. Stephensen. 1999. Long-term Bioaccumulation Monitoring with Transplanted Bivalves in the San Francisco Estuary. *Marine Pollution Bulletin.* 38(3):170-181.

Hardin, D.D., J. Toal, T. Parr, P. Wilde, and K. Dorsey. 1994. Spatial variation in hard-bottom epifauna in the Santa Maria Basin: The importance of physical factors. Marine Environmental Research, **37**(2):165–193.

Hyland, J., D. Hardin, S. Steinhauer, D. Coats, R. Green, and J. Neff. 1994. Environmental impact of offshore oil development on the outer continental shelf and slope off Pt. Arguello, CA. Marine Environmental Research, **37**(2):194–229.

Hardin, D.D., D. Graves, and E. Imamura. 1992. Investigating seafloor disturbances with a small ROV. Marine Technology Society Journal, **26**(4):40–45.

Brewer, G., J. Hyland, and D. Hardin. 1991. Effects of oil drilling on deep-water reefs offshore California. American Fisheries Society Symposium, **11**:26–38.

Foster, M.S., C. Harrold, and D.D. Hardin. 1991. Point vs. photo quadrat estimates of the cover of sessile marine organisms. Journal of Experimental Marine Biology and Ecology, **146**:193–203.

Hyland, J., D. Hardin, E. Crecelius, D. Drake, P. Montagna, and M. Steinhauer. 1990. Monitoring long-term effects of offshore oil and gas development along the southern California outer continental shelf and slope: Background environmental conditions in the Santa Maria Basin. Oil & Chemical Pollution, **6**:195–240.

Spies, R., D. Hardin, and J. Toal. 1988. Organic enrichment or toxicity? A comparison of the effects of kelp and crude oil in sediments on the colonization and growth of benthic infauna. Journal of Experimental Marine Biology and Ecology, **124**:261–282.

Caimi, F.M., R.F. Tusting, and D. Hardin. 1987. Laser-aided quantitative sampling of the sea bed. Proceedings of Oceans '87, pp 1234–1238.

### Reports

Hardin, D.D. 1996. Use of Sand Islands in Mertvyi Kultuk: Environmental Technical Review. Report submitted to Arctic GeoScience, Inc. and Oryx Kazakhstan Energy Company.

Hardin, D.D. 1996. Environmental Protection Plan for the Mangystau Exploration Area: Technical Review of issues Pertaining to the Caspian Sea and Mertvyi Kultuk. Report to Arctic GeoSciences, Inc. and Oryx Kazakhstan Energy Company.

Hardin, D.D. 1996. Effects of Nearshore Structures on Arctic Anadromous Fishes. Report to Conoco Inc.

Hardin, D. 1994. Bivalve Bioaccumulation. In 1993 Annual Report, San Francisco Estuary Regional Monitoring Program for Trace Contaminants. Report by the Aquatic Habitat Institute, 180 Richmond Field Station, 1301 South 46th Street, Richmond, CA 94804.

Hardin, D., D. Heilprin, G. Cailliet, and M. Love. 1992. A Pilot Study of Rockfish Feeding Habits in the Santa Maria Basin, California. In: Imamura, E. and J. Hyland (eds.), Effects of OCS Oil and Gas Production Platforms on Rocky Reef Fishes and Fisheries. Report to the U.S. Department of the Interior, Minerals Management Service, Pacific OCS Region, 770 Paseo Camarillo, Camarillo, CA 93010 under Contract No. 14-12-0001-304

# PETER HUDSON PG, CEG

Principal/Senior Geologist

**EDUCATION**

BA, Geology, San Francisco State University.

Civil Engineering Coursework. San Francisco State University

**28 YEARS EXPERIENCE**

**CERTIFICATIONS/ REGISTRATION**

Professional Geologist, California Registration No. 6730.

Certified Engineering Geologist, California Registration No. 2368.

Qualified SWPPP Practitioner QSP Certificate No. 21673.

Peter Hudson has more than 28 years of broad-based experience in engineering geology, hydrogeology, environmental, geotechnical and surface water hydrology. He is a professional geologist and certified engineering geologist in the state of California and a registered geologist/engineering geologist in the state of Washington. His general role as a principal at Sutro Science includes providing geological, geotechnical, geophysical and hydrogeological technical support in water quality assessments, water resource and geological studies for planning, permit assistance, environmental impact assessments with emphasis on hydrological and geologic issues, soils investigations and erosion/geomorphic investigations, planning/policy assessments, and mitigation planning and monitoring. Peter has authored numerous geoscience and hydrology-related technical sections under CEQA and NEPA and provides technical input and senior review for completion of work products including EIRs and EISs, and EAs. Peter has contributed his technical expertise to resource management plans, reclamation/restoration plans, erosion control plans, draft permits, (e.g., NPDES), land development environmental feasibility analyses, and site selection/constraints studies. He is a Qualified SWPPP Practitioner (QSP) as required under California's Construction General Permit. Prior to co-founding Sutro Science LLC, Peter was a senior geologist/hydrogeologist in the Water Group staff at Environmental Science Associates, contributing to a wide range of water supply and infrastructure projects.

## Relevant Experience

**Monterey Peninsula Water Supply Project EIR/EIS, Monterey, CA. *Lead Geologist/Hydrogeologist.*** . Peter is providing geotechnical and hydrogeologic technical support for the analysis of local and regional groundwater impacts connected with this multi-dimensional and highly visible project. Peter authored the recent Groundwater Resources chapter and is providing technical review of geologic resources analyses.

**CalAm Coastal Water Project EIR, Monterey County, CA. *Lead Geologist/Hydrogeologist.*** Pete provided geotechnical and hydrogeologic technical support for the analysis of local and regional groundwater impacts connected with this multi-dimensional and highly visible project. Pete was involved with senior review, preparation of master responses, and provision of technical expertise to the team in the areas of groundwater, hydrology, and geology. Technical areas included beach bluff erosion protection, subsurface beach intake wells, water conveyance pipelines, and aquifer storage and recovery.

**Roblar Road Quarry, Sonoma County, California *Senior Geologist/ Hydrogeologist*.** This project was a proposed aggregate quarry in Sonoma County, adjacent to a closed, unlined landfill. As senior technical lead, Peter was responsible for managing efforts to analyze potential impacts associated with slope stability, groundwater migration (from the adjacent landfill), alteration of surface water flow, and impacts from reclamation. Peter authored relevant EIR chapters and participated in several public hearings.

**Henry Cornell Winery, Sonoma County, California, *Senior Geologist/Hydrogeologist.*** Peter contributed his expertise in hillslope geologic processes, surface water hydrology, and hydrogeology to this controversial proposed winery project. Peter was responsible for the CEQA analysis of slope stability, local groundwater balance, and surface water management. Contentious issues included neighboring groundwater effects and slope stability.

**Dry Creek Rancheria, Geyserville, Sonoma County, California. *Senior Geologist/Hydrogeologist.*** Peter provided technical consultation for geologic and hydrologic resources throughout the initial planning and permitting process for this project. He analyzed the geologic, hydrologic and hazardous materials issues and authored key chapters of the final constraints analysis. Peter provided ongoing technical consultation for associated projects.

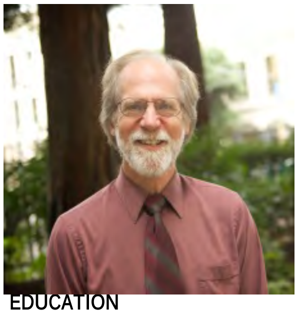
**Cloverdale Rancheria Fee to Trust and Resort Casino Project, Cloverdale California, Sonoma County.** Peter was involved in this proposed casino and resort project for several years. Work included assessment of offsite groundwater contamination, water supply assessment, surface water impacts to the Russian River, and groundwater withdrawal effect. Peter completed NEPA and CEQA level analyses and completed associated chapters for the draft documents.

**Livermore-Amador Valley Water Management Agency Export Pipeline Facilities Project Program EIR. *Geologist/Hydrologeologist.*** Peter completed technical review of key CEQA technical sections and remained involved in the project through its implementation. He provided technical assistance regarding surface water quality, waste discharge requirements, and NPDES during the construction phase. He also consulted with the client, contractor and other staff on mitigation monitoring for surface water quality.

**Fairfield-Suisun Sewer District (FSSD) Outfall Study, System and Treatment Master Plan EIR. *Senior Geologist/Hydrologist.*** Peter supervised completion of geology and hydrology analyses and preparation of chapters for the EIR. He provided senior review for key technical issues including the project proximity to active faults, structural integrity of levees, performance of outfall structures, and comPeternce of engineered fills. He also reviewed surface water modeling assumptions and provided input to EIR presentation of data.

**San Francisco Public Utilities Commission (SFPUC) Niles Dam and Sunol Dam Removal Project. *Senior Geologist/Hydrogeologist*.** Peter conducted preliminary analysis of groundwater, site geology, and potentially hazardous sediments in connection with the proposed removal of existing dams in Niles Canyon. Issues included impact of dam removal on groundwater levels and the impact of those lowered levels on riparian areas.

**EBMUD Water Treatment and Transmission Improvements Program (WTTIP) EIR. *Senior Geologist and Hydrologist*.** Peter was senior reviewer/technical contributor on the consulting joint venture team that prepared the EIR for EBMUD's WTTIP project. He provided technical expertise for the impact analysis and development of mitigation in the areas of slope stability, seismic reliability, effects to groundwater, construction impacts including erosion hazard, and potential flooding impacts.



**EDUCATION**

M.Eng., Transportation Engineering, Pennsylvania State University (as part of the Bureau of Highway Traffic program)

B.S., Civil Engineering, University of Connecticut

**40 YEARS EXPERIENCE**

**CERTIFICATIONS/ REGISTRATION**

Registered Traffic Engineer, State of California # 1411

**PROFESSIONAL AFFILIATIONS**

Institute of Transportation Engineers

Transportation Research Board

# Jack Hutchison, PE

## Senior Transportation Engineer

Jack is a registered Traffic Engineer in the State of California. He has 40 years of experience in a wide range of transportation analyses, from planning-level impact analyses to operations and design evaluations, as well as for a wide range of project types and locations. In addition to his role as primary technical analyst, he provides critical peer review of analyses conducted by other firms and third party analysis to ensure compliance with CEQA and NEPA requirements.

## Relevant Experience

**CalAm Coastal Water Project, Monterey County, CA.** *Transportation Analyst.* Jack is providing transportation analysis for a combined environmental impact statement / environmental impact report (EIS/EIR) that analyzes the impacts associated with construction and operation of a desalination plant; conveyance pipelines; aquifer storage and recovery facilities; and related facilities. The EIS/EIR is a follow-up to a 2009 EIR for a previous version of the project. The analysis is focused primarily on construction-related traffic effects, because long-term operation and maintenance of the project would generate a limited number of vehicle trips. Therefore, identified mitigation measures focus on reducing the short-term project construction effects; long-term mitigation measures are not needed.

**Fort Ord Dunes State Park General Plan and Environmental Impact Report, Marina, CA.** *Transportation Analyst*. Prepared transportation analyses for CEQA documentation. The environmental analysis identified the impacts of the General Plan alternatives on key environmental resources, including historic buildings, biological resources, hydrological resources, cultural resources, and recreation.

**Asilomar State Beach and Conference Grounds General Plan and Environmental Impact Report, Pacific Grove, CA.** *Transportation Analyst*. Jack prepared transportation analyses for the General Plan and environmental impact report for Asilomar State Park, located in Monterey County. The primary concern for development of the General Plan was traffic, circulation and parking, both within the Park and along adjacent roadways. A traffic analysis and circulation study was required at the onset to assist in planning strategy and the development of alternative concepts.

**San José/Santa Clara Water Pollution Control Plant Master Plan Program Environmental Impact Report. Santa Clara County, CA**. *Peer Reviewer of Transportation Subconsultant.* Jack provided peer review of transportation analysis for the Program-Project Environmental Impact Report being prepared by ESA for the City of San José's master plan to rebuild the San José/Santa Clara Water Pollution Control Plant (WPCP) and plan uses on the plant's 2,700-acre site on the South Bay shoreline adjacent to the Don Edwards San Francisco Bay National Wildlife Refuge. The City's Environmental Services Department operates the Plant and prepared the Plant Master Plan (PMP); the City's Planning Division is the CEQA Lead Agency. The 30-year PMP was developed to address a number of challenges such as aging infrastructure and sea level rise, and to advance City policies, and includes a wide range of projects – both near-term and long-term. Key issues investigated by ESA and joint venture partner ICF included effects on biological resources, transportation, aesthetics, cultural resources, surface hydrology, water quality, air quality, and alternatives.

**DWR California Aqueduct East Branch Extension Environmental Impact Report, San Bernardino County, CA.** *Transportation Analyst.* Jack prepared transportation analyses for the environmental impact report for an extension of the east branch of the California aqueduct, for the California Department of Water Resources. Issues of concern included the effect of haul trucks on area roadways as they passed through residential, school and commercial areas.

**CALFED Los Vaqueros Reservoir Expansion Project Environmental Impact Statement/Environmental Impact Report, Contra Costa County, CA.** *Transportation Analyst.* Jack provided transportation analysis for an environmental impact statement/environmental impact report for the proposed Los Vaqueros Reservoir expansion. Issues of concern were the effects of construction trucks and workers on local roads, including Vasco Road, which has a history of traffic safety problems.

**DWR North Bay Aqueduct Alternate Intake Project Environmental Impact Report, Yolo and Solano Counties, CA.** *Transportation Analyst.* Jack prepared the transportation analysis for the environmental impact report for construction and operation of a new intake and pumping plant on the Sacramento River, conveyance pipeline, and inline storage to divert and convey water from the Sacramento River connecting to the existing NBA pipeline near the North Bay Regional Water Treatment Plant. The analysis focused primarily on construction-related traffic effects, because long-term operation and maintenance of the project would generate a limited number of vehicle trips. Therefore, identified mitigation measures focus on reducing the short-term project construction effects; long-term mitigation measures are not needed.

**DWR South Bay Aqueduct Improvement and Enlargement Project Environmental Impact Report, Alameda County, CA.** *Transportation Analyst.* Jack was the author of the transportation section of this environmental impact report for construction of various water facility components (pumping plant, pipelines, surge tank, reservoir, and improvements to existing canals) in the Livermore area of Alameda County. Tasks included site visits, estimate of project-generated construction traffic (trucks and worker vehicles) on the basis of engineering estimates of the work, and evaluation of potential impacts to traffic flow, traffic safety, and roadway pavement conditions. Recommended mitigation measures focused on minimizing the temporary and intermittent effects during construction work periods.

**EBMUD Water Treatment and Transmission Improvement Program (WTTIP) Environmental Impact Report, Contra Costa County, CA.** *Transportation Analyst.* Jack provided transportation and traffic analysis for the environmental impact report for this project which provides water supply and treatment to the Cities of Moraga, Orinda, Lafayette and portions of Walnut Creek in the East-of-Hills service area. Upgrades to water treatment plants serving the area are needed in anticipation of future treatment capacity shortages. Key environmental issues are truck traffic; tree loss and effects on sensitive habitats; aesthetics; and potential for general community disruption (e.g., noise, light and glare, dust).

APPLIED marine SCIENCES

# RESUME
## Jay A. Johnson
## Sr. Oceanographer, Managing Principal

## EXPERTISE

Environmental Permitting, Compliance and Agency Liaison
Project Management, Development & Coordination
Ecological Baseline and Monitoring Programs
Environmental Evaluation and Impact Assessment
Third-Party Independent Environmental Compliance Monitoring

## CREDENTIALS

| | | | |
|---|---|---|---|
| **Education:** | M.S. | 1986 | Biology (Marine Ecology), San Diego State University, San Diego, CA |
| | B.S. | 1976 | Oceanography, Humboldt State University, Arcata, CA |
| | B.A. | 1976 | Biology (Marine Emphasis), Humboldt State University, Arcata, CA |

**Professional Affiliations:** Deep Submersible Pilots Association and American Association of Underwater Scientists

**Honors & Certifications:** Eagle Scout, Basic Open Water and Advanced SCUBA, certifications through Scuba Schools International and National Association of Underwater Instructors, Member National Natural Resources Honor Society - Xi Sigma Phi

## EMPLOYMENT HISTORY

| | |
|---|---|
| 1997-Present | Senior Oceanographer, Managing Principal, Applied Marine Sciences Inc., Livermore, CA. |
| 1993-1996 | Senior Environmental & Safety Coordinator, Conoco International Petroleum Co – Russia Exploration & Production, Houston, TX |
| 1991-1993 | Environmental Director, Conoco Inc. Exploration Production International, Houston, TX |
| 1988-1991 | Supervisor of Environmental & Regulatory Affairs, Conoco Inc. Exploration & Production-Gulf of Mexico Operations, New Orleans, LA. |
| 1986-1988 | Environmental Coordinator, Conoco Inc. Exploration & Production, Western States Division, Ventura, CA |
| 1981-1986 | President and Senior Oceanographer, Johnson & Associates, Oceanside, CA |
| 1983-1984 | Manager, Special Projects and Submersible Operations, Nekton, Inc., San Diego, CA |
| 1978-1981 | Biological Oceanographer, Lockheed Environmental Services, Carlsbad, CA |

## EXPERIENCE

Mr. Johnson has over 40 years experience assessing marine and aquatic ecosystems and the impacts of industrial activities, discharges and accidental releases into aquatic environments. His wealth of scientific knowledge and expertise has been gained through more than 29 years employment as an oceanographer and marine ecology consultant and eleven years working for a major international oil and gas company as an Environmental Director and Manager. He has worked on projects throughout San Francisco Bay and Estuary, throughout California, along both the Pacific and Atlantic coasts of the United States, offshore Alaska, the Gulf of Mexico, the Gulf of Arabia, and the North Sea, Mediterranean, Barents, Bering, and Caspian Seas.

He has extensive experience working on National Environmental Protection Act (NEPA) and California Environmental Quality Act (CEQA) documents and Clean Water Act, NPDES permits both as a consultant and a permittee. He has worked closely with the RWQCB, EPA, BAAQMD, California Coastal Commission, California Dept. of Fish and Wildlife and the California State Lands Commission, as well as the National Marine Fisheries Service, Army Corps of Engineers, National Park Service, and Bureau of Ocean Energy Management on various projects throughout California. He is intimately familiar with current California Ocean Plan water quality objectives as they relate to stormwater, desalination, and point source discharges. He has worked on major baseline and marine monitoring programs involving nuclear power plant, thermal effluent and POTW discharges along the southern and central California coast. He has extensive experience in dealing with complex scientific, regulatory and environmental issues, and effectively interacting with local, state, and federal agencies. He recently served as the lead scientist and Project Manager for a five-year project responsible for the development of marine monitoring programs for the Department of the Interior, Bureau of Ocean Energy Management to assess long-term effects of Pacific OCS operations and ocean energy on marine associated ecosystems, as well as to assess long-term changes to seafloor ecology resulting from offshore sand mining.

Mr. Johnson has worked on major baseline and marine monitoring programs involving nuclear power plant, thermal effluent and POTW discharges along the southern and central California coast. He has been involved in assessing the environmental impacts of establishing new marinas in San Francisco Estuary, the 34th America's Cup races in 2012 and 2013 in San Francisco, the redevelopment of Treasure Island and Pier 70 in San Francisco, aggregate sand mining, a new break-bulk marine terminal on the Vallejo River, multiple coastal seawater desalinization projects in Central and Southern California, and establishing marine sanctuaries along California's central coast. He has designed and conducted Essential Fish Habitat investigations, invasive species assessments, and prepared Biological Assessments for special status species, including marine mammals. He has extensive experience in dealing with complex scientific, regulatory and environmental issues, and effectively interacting with local, state, and federal agencies. Mr. Johnson routinely performs third-party independent environmental mitigation and permit compliance monitoring for California state agencies on projects throughout California's coastal waters.

## REPRESENTATIVE PUBLICATIONS & REPORTS

Mr. Johnson has authored and co-authored more than 125 technical reports, environmental impact assessments and professional presentations and publications. The following are a few select publications.


Environmental Science Associates (ESA). 2017. CalAm Monterey Peninsula Water Supply Project, Draft Environmental Impact Report, Environmental Impact Statement. Section 4.5 Marine Resources. Prepared for the California Public Utilities Commission and the Monterey Bay National Marine Sanctuary. January 2017.

Applied Marine Sciences, Inc. (AMS) 2016. Seafloor Habitat & Biological Characterization Assessment of the SEA-US Fiber Optic Cable Route Offshore Hermosa Beach, California by Remotely Operated Vehicle (ROV). Prepared for ICF International. February.

Applied Marine Sciences (AMS). 2015. Subtidal Habitats and Associated Macrobenthic and Fish Communities Observed Offshore Coastal California Along Fiber Optic Cable Routes. Prepared for ICF International. May.

Applied Marine Sciences, Inc., 2009. Benthic Survey of Commercial Aggregate Sand Mining Leases in San Francisco Bay and Western Delta, August 2008. Prepared for ESA and the California State Lands Commission. March 2009.

Applied Marine Sciences, Inc. (AMS) 2008. Survey Report: Remotely Operated Vehicle (ROV) Biological Characterization Survey of the Asia America Gateway (AAG) S-5 Project Fiber Optic Cable Route Offshore Morro Bay, California. Prepared for AT&T and the California State Lands Commission. May 2008. 52 pp

Applied Marine Sciences, Inc., Mariposa Environmental, and Reese-Chambers System Consultants, Inc. 2005. Draft International Environmental Impact Assessment for the Full Field Development of The Kashagan Oil and Gas Field Located in the North Caspian Sea, Kazakhstan. Prepared for AGIP Kazakstan and North Caspian Operating Company N.V. 250pp.

Applied Marine Sciences, Inc. (AMS) 2003. Tyco Global Network (TGN) Fiber Optic Cable Project; Environmental Mitigation and Permit Compliance Monitoring Report for Onshore Cable Landing and Installation Activities at Hermosa Beach, CA. Prepared for California Coastal Commission. January 2003.

Nairn, R., Johnson, J.A., Hardin, D., and Michel, J. 2002. Development and Design of a Biological and Physical Monitoring Program for the Evaluation of Long-term Impacts to the Marine Environment from Offshore Sand Dredging Operations in the U.S. Outer Continental Shelf. Journal of Coastal Research. 20:1 pp 126-137.

Boehm, P.D. Turton, A. Raval, D. Caudle, D. French, N. Rabalais, R. Spies, and J. Johnson. 2001. Deepwater Program: Literature Review, Environmental risks of Chemical Products Used in Gulf of Mexico Deepwater Oil and Gas Operations; Volume : Technical Report. OCS Study MMS 2001-011. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. 326 pp.

Arthur D. Little, Inc. & Boatman, M. 2000. Draft Report. Gulf of Mexico OCS Region. Deepwater Program: Literature review, environmental risks of chemical products used in Gulf of Mexico deepwater oil and gas operations.

Applied Marine Sciences, Inc. 1999. Estimate of Environmental Impact for Salkenskaya Exploration Well No. 1.; Exploration Activities. Prepared for Kerr-McGee and Oryx Kazakhstan Energy Company.

Conoco Inc. & Arkhangelskgeologia. 1996. Due Diligence/Environmental Baseline Assessment Northern Fields Area, Timan Pechora Region, Russia; Phase III.

E&P Forum. 1993. Exploration and Production (E&P) Waste Management Guidelines. E&P Forum Report No. 2.58/196.

Johnson, J.A., Hardin, D., Spies, R. 1985. An Investigation of the Effects of Discharged Drilling Fluids from Exploratory Drilling on Hard Bottom Communities in the Western Santa Barbara Channel. Symposium Proceedings, Oceans '85, Marine Technology Society.

Kinnetic Laboratories and Johnson & Associates. 1987. An Ecological Study of Discharged Drilling Fluids on a Hard Bottom Community in the Western Santa Barbara Channel. Final Report. Prepared for Texaco USA. Co-author.

Johnson, J.A. 1984. The Use of a Manned Submersible in a Deep Water Hard Bottom Monitoring Program. Paper Presented at the American Academy of Underwater Sciences Symposium. November, 1984. La Jolla, CA.

**Preston D. Jordan**
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(510) 486-6774
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**Education:** B.A., Geology, University of California, Berkeley, 1988
M.S. in Eng. Sci., Geotechnical Engineering, University of California, Berkeley, 1997

**Research Interests:** Risk analysis of geologic carbon storage, reservoir uncertainty for geologic carbon storage, fluid flow through heterogeneous porous rocks and fault zones.

**License:** California Professional Geologist No. 6942 (since 1998)
California Certified Hydrogeologist No. 880 (since 2007)

**Career:** Staff Research Associate, 2010-present, Earth Science Division, Lawrence Berkeley National Laboratory. Analyze risk of geologic carbon storage, characterize reservoir uncertainty for geologic carbon storage, characterize hydrogeology and subsurface contaminant distributions, develop conceptual models of subsurface gas and fluid flow, consult on the environmental and engineering geology of proposed building and infrastructure projects and conduct investigations, conduct environmental analysis related to environmental and engineering geology under NEPA and CEQA, manage research staff

Principal Research Associate, 1998-2010, Earth Science Division, Lawrence Berkeley National Laboratory. Analyze risk of geologic carbon storage, characterize reservoir uncertainty for geologic carbon storage, characterize hydrogeology and subsurface contaminant distributions, develop conceptual models of subsurface gas and fluid flow, consult on the environmental and engineering geology of proposed building and infrastructure projects and conduct investigations.

Senior Research Associate, 1995-1998, Earth Science Division, Lawrence Berkeley National Laboratory. Characterize environmental geology, manage geologic data gathering activities, manage excavation activities, collect geologic data, implement and manage geographic information systems for subsurface environmental data, supervise temporary personnel performing geologic data tasks, advise geologic database design teams.

Research Associate, 1994-1995, Earth Science Division, Lawrence Berkeley National Laboratory. Manage soil sampling, monitoring well installation, and field mapping activities, perform borehole logging and geologic field mapping, interpret geologic structure, participate in design of geologic visualization systems.

Research Technician, 1990-1994, Earth Science Division, Lawrence Berkeley National Laboratory. Assist in paleoseismic studies, perform geologic field mapping and collect subsurface geologic data, interpret geologic structure, manage soil sampling and monitoring well installation activities.

**Selected Publications, Reports, and Conference Contributions:**

**Jordan, P.D.**, and J. Gillespie (2015). Produced water disposal injections in the southern San Joaquin Valley: no evidence of leakage. Environmental Geosciences. Accepted pending revision.

Long, J.C.S., L.C. Feinstein, J. Birkholzer, **P. Jordan**, J. Houseworth, P. Dobson, M. Heberger, D. Gautier (2015). An independent assessment of well stimulation technology in California, Volume I: well stimulation technologies and their past, present, and potential future use in California. 406 pp.

**Jordan, P.**, A. Brandt, K. Ferrar, L. Feinstein, and S. Phillips (2015). An independent assessment of well stimulation technology in California, Volume III: case studies of hydraulic fracturing and acid stimulation in select regions: offshore Monterey Formation, Los Angeles Basin and San Joaquin basin,, Chapter 5: a case study of the potential risks associated with hydraulic fracturing in existing oil fields in the San Joaquin basin. 79 pp.

**Jordan, P.**, and J. Gillespie (2013). Potential impacts of future geological storage of $CO_2$ on the groundwater resources in California's central valley: southern San Joaquin basin oil and gas production analog for geologic carbon storage. Prepared for the California Energy Commission. CEC-500-2014-029. 122 pp.

**Jordan, P.D.**, C.M. Oldenburg and J.-P. Nicot (2012). Measuring and modeling fault density for $CO_2$ storage plume-fault encounter probability estimation. *AAPG Bulletin*, 97:597-618.

**Jordan, P.D.**, C.M. Oldenburg and J.-P. Nicot (2011). Estimating the probability of $CO_2$ plumes encountering faults. *Greenhouse Gases: Science and Technology*, 1:160-174.

**Jordan, P.D.**, and Doughty, C. (2009). Sensitivity of $CO_2$ migration estimation on reservoir temperature and pressure uncertainty. *In*: Gale, J., Herzog, H., and Braitsch, J. (eds), *Greenhouse Gas Control Technologies 9, Proceedings of the 9th International Conference on Greenhouse Gas Control Technologies (GHGT-9), 16–20 November 2008, Washington DC, US*, Energy Procedia, February 2009, 1: 2587-2594.

**Jordan, P.D.,** and Javandel, I., 2007. Hydrogeology and tritium transport in Chicken Creek Canyon, Lawrence Berkeley National Laboratory, LBNL-63557.

**Jordan, P.D.**, Oldenburg, C.M. and Su, G.W., 2005. Analysis of aquifer response, groundwater flow, and plume evolution at Site OU 1, Former Fort Ord, California, LBNL, Berkeley, CA, LBNL-57251.

Su, G.W., Freifeld, B.M., Oldenburg, C.M., **Jordan, P.D.** and Daley, P.F., 2005. Simulation of In-Situ Permeable Flow Sensors for Measuring Groundwater Velocity. Ground Water, 44 (3): pp. 386-393, LBNL-57084.

Zhou, Q., Birkholzer, J.T., Javandel, I. and **Jordan, P.D.**, 2004. Modeling Three-Dimensional Groundwater Flow and Advective Contaminant Transport at a Heterogeneous Mountainous Site in Support of Remediation Strategy. Vadose Zone Journal, 3 (3): pp. 884-900, LBNL-54318.

Oldenburg, C.M., Daley, P.F., Freifeld, B.M., Hinds, J. and **Jordan, P.D.**, 2002. Three-dimensional groundwater flow, aquifer response and treatment system monitoring at Site OU 1, former Fort Ord, California, LBNL Report, pp. LBNL-49586.

Lawrence Berkeley National Laboratory, 2000. Draft Final RCRA Facility Investigation Report, Environmental Restoration Program, Lawrence Berkeley National Laboratory, Berkeley, California, September, 2000.

# Heidi Koenig, M.A. RPA

## Senior Archaeologist

**EDUCATION**

M.A., Cultural Resources Management, Sonoma State University

B.A., Anthropology, San Francisco State University

**17 YEARS EXPERIENCE**

**CERTIFICATIONS/ REGISTRATION**

Register of Professional Archaeologists (RPA), 15140

Hazardous Waste Operations and Emergency Response 40 hour course completion and active renewal

**PROFESSIONAL AFFILIATIONS**

Society for California Archaeology

Society for Historical Archaeology

Heidi is a Registered Professional Archaeologist specializing in California archaeology. She has prepared numerous cultural resources studies in compliance with the California Enviornmental Quality Act and Section 106 of the National Historic Preservation Act, including surface surveys, subsurface surveys, site significance evaluation, mitigation recommendations, and consultation with the State Historic Preservation Officer. Heidi has developed several interactive GIS databases to assist regulatory agencies with cultural resources management and preservation decisions. Heidi has conducted numerous records searches at the California Historical Resources Information System and has assisted with consultation efforts with several Native American tribes.

### Relevant Experience

**Monterey Peninsula Water Supply Project, Monterey County.** *Archaeologist*. Heidi prepared the Cultural Resources Survey Report for this CalAm-proposed desalination project in Monterey County. As the NEPA Lead Agency on the EIR/EIS, MBNMS is required to comply with Section 106 of the National Historic Preservation Act. Heidi completed the background research, contacted Native Americans, and conducted a surface survey in the Area of Potential Effects. The State Historic Preservation Officer concurred with the findings.

**Elkhorn Slough Tidal Slough Wetland Restoration Project, Monterey County.** *Archaeologist*. In support of the Elkhorn Slough Foundation, ESA conducted planning, design and regulatory compliance tasks to restore tidal marsh in Elkhorn Slough. Heidi completed a cultural resources assessment for the project that included development of an Archaeological Survey Report. She worked closely with the Elkhorn Slough National Estuarine Research Reserve and the U.S. Army Corps of Engineers to ensure archaeological site avoidance and appropriate mitigation during construction activities.

**EBMUD West of Hills Project, Contra Costa County.** *Archaeologist*. Heidi prepared the Cultural Resources Survey Report and EIR section for pipeline replacement/improvement of approximately 10 miles of the Wildcat Aqueduct and Central Pressure Zone Pipelines, in Richmond, San Pablo, El Cerrito, and Berkeley. The project was completed to comply with both Section 106 of the National Historic Preservation Act and the California Environmental Quality Act. Heidi completed background research, contacted Native Americans, and conducted a surface survey in the project Area of Potential Effects. Heidi worked with EBMUD staff to identify appropriate and timely recommendations for additional subsurface study to be completed following EIR approval.

**West County Wastewater District State Revolving Fund Application Projects, Alameda County.** *Archaeologist.* Heidi prepared the cultural resources analysis for the West County Wastewater District Master Plan and resulting projects for the State Water Resources Control Board (SWRCB) application process. SWRCB is required to comply with Section 106 and concur with the State Historic Preservation Officer (SHPO). Heidi created an interactive GIS-based database that provides cultural resources site location information within the District operation area so specific projects could be compared and effects determined. Heidi has provided SHPO documentation for SWRCB to use in their consultation efforts on two separate applications with additional applications forthcoming.

**North San Pablo Bay Restoration and Reuse Project, Sonoma, Marin, and Napa Counties.** *Archaeologist*. Heidi prepared the cultural resources section for four wastewater utilities and one water agency in the North San Pablo Bay region of California who have joined forces to plan a project that would considerably expand the use of recycled water region wide. The study area includes pipeline segments throughout Marin, Sonoma, and Napa counties. A records search and several updates were conducted at the Northwest Information Center of the California Historical Resources Information System. Approximately 250 archaeological sites and historic structures have been previously recorded within the study area. Surface surveys and extended subsurface surveys were conducted to assess previously known archaeological resources and determine whether additional resources may be affected by the project. A finding of No Adverse Effect to Historic Properties was determined by the lead agency, the Bureau of Reclamation.

**San José/Santa Clara Water Pollution Control Plant Master Plan, San José, Santa Clara County.** *Archaeologist*. Heidi is the archaeologist for the City of San José's master plan to rebuild the San José/Santa Clara Water Pollution Control Plant and convert land uses on the plant's 2,700-acre site on the South Bay's shoreline. ESA completed a cultural resources assessment for the Project, which included a records search at the Northwest Information Center, a surface survey, and an analysis for the sensitivity of cultural resources. Numerous archaeological sites have been uncovered in the Santa Clara Valley that are buried beneath feet of alluvial fill, naturally deposited by the San Francisco Bay environment. While no cultural resources were identified during the investigation for the WPCP Project, mitigation measures for Program-level additional research and accidental discovery were recommended.

**Lower Berryessa Creek Project, San José, Santa Clara County.** *Archaeologist*. To facilitate compliance with the U.S. Army Corps of Engineers Section 106 requirements, Heidi completed a cultural resources assessment for the Santa Clara Valley Water District's Lower Berryessa Creek project, including a records search at the Northwest Information Center and a survey of the unsurveyed alignments. The project includes flood control improvements in three creek alignments (Berryessa, Calera, and Tularcitos) that would result in the containment of the channels' design flow. The assessment included both project-level (near term) and program-level (long-term) components. Heidi updated the Lower Berryessa and Lower Calera Creek components of the project with a revised records search, survey, and analysis.

# Wes McCullough

## Senior GIS Analyst

**EDUCATION**

BA, Geography with GIS emphasis, University of California, Santa Barbara

**10 YEARS EXPERIENCE**

Wes is a Senior Geographic Information Systems (GIS) Analyst based out of ESA's Petaluma office. He has an academic background in geography and urban planning, and has experience in GIS in both the public and private sectors. His accomplishments include developing GIS models, enterprise-level data management, Geodatabase design, GPS-GIS applications, large scale habitat mapping, and advanced spatial analysis. Wes routinely provides technical input for Environmental Impact Reports (EIRs) pursuant to California Environmental Quality Act (CEQA).

### Relevant Experience

**California Public Utilities Commission, CalAm Coastal Water Project and Monterey Peninsula Water Supply Project, Monterey, CA.** *GIS Analyst.* Wes provided GIS support in the form of maps and analysis for the preparation of an EIR/EIS that evaluated the potential environmental effects of a project proposed by California American Water Company (CalAm) to provide a new water supply for the Monterey Peninsula. The proposed project would produce desalinated water, convey it to the existing California American Water (CalAm) distribution system, and increase the system's use of storage capacity in the Seaside Groundwater Basin. The project would consist of several distinct components: a seawater intake system; a desalination plant; a brine discharge system; product water conveyance pipelines and storage facilities; and an aquifer storage and recovery (ASR) system.

**California Department of Water Resources, Enlargement to the California Aqueduct East Branch. Southern, CA.** *GIS Analyst.* Wes managed a mapping application that used multiple GIS datasets from many sources to weave a comprehensive GIS of Southern California, incorporating GIS, Global Positioning Systems (GPS), and GPS-linked photographs taken on site; all housed in an interactive, on-line project library. The East Branch Extension project will increase aqueduct capacity and extend the aqueduct's already 400 plus mile reach over an additional 100-miles through the Tehachapi pass and into the Antelope Valley. Wes's development of the spatial database streamlines data inflow and outflow to the client, creating an accurate GIS resource available for the use anytime.

**North Bay Water Reuse Authority, North San Pablo Bay Restoration and Reuse Program EIR/EIS, North Bay Area, CA.** *GIS Analyst.* Wes was responsible for managing information and producing maps used for decision making purposes by the North Bay Water Reuse Authority and the Sonoma County Water Agency. The Reuse Program is a product of several local recycled water project planning efforts to create a regional recycling program, with the hopes of diverting recycled waste water for local agricultural and habitat restoration uses. Wes's alternatives analyses were mapped to provide solutions for the decision-making process Wes' mapping was used to detail possible nearby water users that could implement local reclaimed water supplies in their current operations.

**California Public Utilities Commission, San Joaquin Cross Valley Loop, Tulare County, CA.** *GIS Analyst.* Wes provided mapping and analysis support to the California Public Utilities Commission (CPUC) for the preparation of CEQA and related environmental documentation for proposed new and upgraded electric transmission line, substation, and gas pipeline projects throughout California. Current projects ESA is performing under this contract include preparation of an Environmental Impact Report (EIR) for a proposed 20-mile 220 kV new transmission line in southern Tulare County, and 3rd party review of a joint NEPA/CEQA document for a transmission line and substation upgrade on the 29 Palms Marine Corps Base.

**Zone 7 Water Agency, Stream Management Master Plan, Alameda County, CA.** *GIS Analyst.* Wes created a series of maps and graphics that assisted Zone 7 in the preparation of a Stream Management Master Plan (SMMP), designed to identify and implement a series of projects within the upper Alameda Creek Watershed to meet multiple objectives, including: flood protection, water supply, sediment management, habitat corridors, water quality and recreational corridors. The SMMP was developed through a series of stakeholder meetings to identify projects that meet these multiple objectives on a subwatershed basis. The SMMP identifies 45 projects within 10 subwatershed areas. These projects range in project type, scale, engineering detail, and level of potential environmental effect. As such, ESA led the CEQA process and prepared a Master EIR to examine the project set as a whole and identify potential impacts on a watershed, subwatershed, and flood control channel reach basis as appropriate.

**San Francisco Public Utility Commission, WSIP Habitat Reserve Program Technical Studies, Alameda, San Francisco and San Joaquin Counties, CA.** *GIS Analyst.* Wes developed a GIS that for the preparation of a Habitat Restoration Program. ESA is providing environmental analysis services for the Water System Improvement Program (WSIP) Habitat Reserve Program. The Program will provide a coordinated and consolidated approach to compensate for habitat impacts that would result from implementation of WSIP facility improvement projects. ESA provided comprehensive technical studies in support of the Habitat Reserve Program for thousands of acres of habitat improvements located in San Joaquin Valley, Sunol Valley, Bay Division, and Peninsula regions of the SFPUC water system.

**San Francisco Public Utility Commission, Lower Crystal Springs Dam Improvement EIR, San Mateo County, CA.** *GIS Analyst.* Wes conducted GIS analysis and produced maps for the Biological Assessment portion of the Lower Crystal Springs Dam Improvement project. The SFPUC is proposing to implement the Lower Crystal Springs Dam Improvements project to lift the DSOD-imposed restriction and to restore lost water storage in Crystal Springs Reservoir. The proposed improvements would enable safe passage of very large and infrequent floods over Lower Crystal Springs Dam. The dam spillway would be widened, its crest would be reshaped and raised, and a new stilling basin would be built at the toe of the dam to replace the existing stilling basin. After completion of the proposed project, the SFPUC would operate Crystal Springs Reservoir in much the same way as it does under existing conditions except that the maximum normal water surface elevation would be four feet above its current level. Through elevation analysis Wes played a key role in determining impact to native species do to water level inundation.

# Christine Mueller

## Technical Associate II

**EDUCATION**

M.C.P., Environmental Policy and Planning, Massachusetts Institute of Technology

B.A., Earth Sciences and Environmental Studies, University of California, Santa Cruz

**18 YEARS EXPERIENCE**

**PROFESSIONAL AFFILIATIONS**

Association of Environmental Professionals

Chris has more than 18 years of experience preparing and managing CEQA documents primarily for water and solid waste management projects. She conducts research and technical analysis for a range of planning and environmental projects, including water and wastewater infrastructure projects, solid waste facilities, and public land management projects. Over the past few years, Chris's emphasis has been on providing technical analysis of growth inducement, and water supply and demand.

## Relevant Experience

**California Public Utilities Commission, Monterey Peninsula Water Supply Project Environmental Impact Report/Statement, Monterey County, CA.** *Technical Analyst.* The project includes construction of a desalination plant, seawater intake system, source water conveyance pipelines, desalinated water conveyance pipelines and associated facilities, expansion of an existing aquifer storage and recovery system, and brine discharge via an existing wastewater treatment plant effluent outfall. Chris prepared the Draft EIR/EIS's Growth Inducement section and a chapter describing the water demand and supply assumptions for the project, assisted in the preparation of chapters on project alternatives and the project variant, and provided technical review of other EIR/EIS sections.

**City of Sunnyvale, Sunnyvale Water Pollution Control Plant Master Plan Program Environmental Impact Report, Santa Clara County, CA.** *Technical Analyst.* Chris prepared the Environmental Impact Report's growth inducement analysis and provided senior technical review for other Environmental Impact Report sections. The Master Plan would guide improvements to the City's existing water pollution control plant over the next 20 years to meet current and foreseeable water quality, biosolids, and air quality requirements, among other objectives. The Master Plan includes rehabilitation of existing facilities; construction of new secondary and tertiary treatment, solids processing, and support facilities; decommissioning of the existing oxidation ponds; construction of a flood wall; and relocation of an access point to the San Francisco Bay Trail, which borders the treatment plant. The Environmental Impact Report also evaluated a variation of the Master Plan that involves a partnership between the City and the Santa Clara Valley Water District; the project variation includes construction of water purification facilities to increase the production and distribution of potable recycled water in Sunnyvale and other parts of Santa Clara County.

**City of San Jose, San Jose/Santa Clara Water Pollution Control Plant(WPCP) Master Plan Environmental Impact Report, San Jose, CA.** *Technical analyst.* Chris prepared the growth inducement section for the Environmental Impact Report and assisted with preparation and senior level review of responses to comments on the Draft Environmental Impact Report. The Plant Master Plan identifies Plant improvement projects needed to address aging infrastructure, reduce odors, accommodate projected service area population growth, and comply with changing regulations that affect the WPCP; it also includes a comprehensive land use plan for the entire project site, including the development of various environmental, social, and economic uses on areas of the project site no longer needed for Plant operations or as bufferlands. The analysis of growth inducing impacts considered the growth inducement potential of changes in Plant capacity and the proposed development of new economic uses at the site, including potential impacts of nitrogen deposition on serpentine habitat as a consequence of growth resulting from project implementation.

**Department of Water Resources, Bay Delta Conservation Plan Environmental Impact Report/Environmental Impact Statement, Sacramento/San Joaquin River Delta region, CA.** *Technical Analyst*. Chris assisted in the preparation of the growth inducement analysis for the Environmental Impact Report/Environmental Impact Statement. The Environmental Impact Report/Environmental Impact Statement includes nine action alternatives that propose different combinations of conveyance facilities and associated changes to routing, timing and amount of flow through the Delta with actions to restore and manage physical habitats and reduce stressors on covered species. The amount of water delivered to State Water Project and Central Valley Project contractors would vary by alternative and thus the project could affect water supply in much of the State. Given that water is used to support urban growth, changes in water deliveries, particularly but not exclusively deliveries to municipal and industrial contractors, have growth-inducement implications. The analysis included an overview of the relationship between land use planning and water supply, land and water use profiles of the affected hydrologic regions, evaluation of the project alternatives' direct and indirect growth inducement potential, and a summary of the secondary effects of induced growth of the project alternatives.

**City and County of San Francisco, San Francisco Public Utilities Commission (SFPUC) Water System Improvement Program Environmental Impact Report.** *Technical Analyst*. The project included improvements to the San Francisco regional water system to address issues concerning water quality, seismic response, water delivery, and water supply to meet water delivery needs through the year 2030. The system provides water to 2.4 million people in San Francisco and the 30 Bay Areas cities, towns, and unincorporated areas served by the City's 27 wholesale water customers. Chris examined key factors used in estimating future demand that relate to growth, and compared assumptions regarding population and employment growth used to develop water demand projections with the growth forecasted by regional and local planning agencies (i.e., ABAG and the cities and counties in the water service area). The secondary effects of growth, which largely had already been identified and addressed by mitigation in the Environmental Impact Reports prepared for the adopted General Plans of the jurisdictions in the service area, also were summarized.

# Two-Page Curriculum Vitae


## Curtis M. Oldenburg

Geological Senior Scientist
Earth Sciences Division, 74-0209
Lawrence Berkeley National Laboratory
Berkeley, CA 94720
(510) 486-7419 fax: (510) 486-5686
cmoldenburg@lbl.gov
http://esd.lbl.gov/ESD_staff/oldenburg/index.html


### Education

1979-1983 University of California, Berkeley. A.B. in geology, Dec. 1983.
1985-1989 University of California, Santa Barbara. Ph.D. in geology, Sep. 1989.

### Research Interests

- Geologic Carbon Sequestration
    - Injection of $CO_2$ for carbon sequestration and enhanced gas recovery (CSEGR)
    - Near-surface leakage and seepage of $CO_2$
    - Risk assessment of geologic carbon sequestration sites
- Porous media compressed air energy storage (PM-CAES)
- Heat and mass transfer in geologic systems
- Dynamic behavior of subsurface systems where convection or gravity-driven flow processes occur (e.g., geothermal systems, gas reservoirs, magmatic systems, saturated and vadose zone hydrology, ferrofluid flow)
- Code development and applications

    http://esd1.lbl.gov/TOUGH2

    http://esd1.lbl.gov/FILES/research/projects/tough/licensing/TOUGH_EOS7C_flyer.pdf

    http://lnx.lbl.gov/GasEOS

### Professional Experience

Geological Senior Scientist, LBNL, September 2013–present.
Geologic Carbon Sequestration Program Lead, June 2008–present.
Staff Geological Scientist, LBNL, October 1994–August 2013.
Geologic Carbon Sequestration Program Deputy Lead, April 2007–May 2008.
Hydrogeology Department Head, LBNL, May 2002–January 2006.
Geological Scientist, LBNL, July 1992–September 1994.
Post-doctoral Fellow, LBNL, October 1990–June 1992.

### Selected Professional Activities

Editor in Chief, *Greenhouse Gases: Science and Technology*, Wiley, January 2010 to present.

## SELECTED AWARDS

DOE Secretary's Achievement Award 2011 for Deepwater Horizon Oil Spill Flow Rate Technical Group work, October 2011.

USGS Director's Award for Exemplary Service to the Nation, 2010 Deepwater Horizon Oil Spill Response.

## SELECTED PEER-REVIEWED JOURNAL ARTICLES

1. Oldenburg, C.M., S. Mukhopadhyay, and A. Cihan, On the use of Darcy's law and invasion percolation approaches for modeling large-scale geologic carbon sequestration, *Greenhouse Gases Science and Technology*, in press, 2015.
2. Birkholzer, J., C.M. Oldenburg, and Q. Zhou, $CO_2$ Migration and Pressure Evolution in Deep Saline Aquifers, *Int. J. Greenhouse Gas Control*, *40*, 203-220, 2015.
3. Oldenburg, C.M., and N. Spycher, Will mercury impurities impact $CO_2$ injectivity in deep sedimentary formations? I. Condensation and net porosity reduction, *Greenhouse Gases: Sci. Tech.*, 2015.
4. Pan, L., and C.M. Oldenburg. "T2Well—An integrated wellbore–reservoir simulator." *Computers & Geosciences* 65 (2014), 46-55.
5. Jordan, P.D., C.M. Oldenburg, and JP Nicot, Measuring and modeling fault density for $CO_2$ storage plume-fault encounter probability estimation, *AAPG Bulletin*, 97(4), 597-618, 2013.
6. Su, G.W., B.M. Freifeld, C.M. Oldenburg, P.D. Jordan, and P.F. Daley, Interpreting Velocities from Heat-Based Flow Sensors by Numerical Simulation, *Ground Water*, *44*(3), 386-393, 2005. *LBNL-57975.*
7. Oldenburg, C.M. and K. Pruess, Dispersive transport dynamics in a strongly coupled groundwater brine flow system, *Water Resour. Res.*, *31*(2), 289–302, 1995. *LBL-34487*.
8. Oldenburg, C.M. and K. Pruess, On numerical modeling of capillary barriers, *Water Resour. Res.*, *29*(4), 1045–1056, 1993. *LBL-32229*.

## BOOKS

1. Smit, B., J.A. Reimer, C.M. Oldenburg, and I.C. Bourg (2014), *Introduction to Carbon Capture and Sequestration*, Imperial College Press, London, 580 pp.

## SELECTED COMPUTER USER GUIDES

1. Pruess, K., C.M. Oldenburg, and G.J. Moridis. TOUGH2 User's Guide Version 2. E. O. Lawrence Berkeley National Laboratory Report *LBNL-43134*, 1999; and *LBNL-43134* (revised), 2012.
2. Oldenburg, Curtis M. and K. Pruess. A Two-Dimensional Dispersion Module for the TOUGH2 Simulator, Lawrence Berkeley Laboratory Report *LBL-32505*, 1993.

## SELECTED REPORTS

1. Oldenburg, C.M., P.F. Daley, B.M. Freifeld, J. Hinds, and P.D. Jordan, Three-dimensional groundwater flow, aquifer response, and treatment system monitoring at site OU 1, Former Fort Ord, California, Lawrence Berkeley National Laboratory Report *LBNL-49586*, February 2002.

## PUBLICATION METRICS FROM WEB OF SCIENCE

Total of 95 results, 1956 citations, h-index = 27 as of December 23, 2015.

**Curriculum Vitae**

**Philip J. Roberts**

**Professor**
Environmental Fluid Mechanics and Water Resources

**404/894-2219**

**proberts@ce.gatech.edu**

**Biography**
Dr. Roberts' professional interests are in environmental fluid mechanics, particularly its application to the engineering design of water intakes and ocean outfalls for disposal of wastewaters and desalination brine, and density-stratified flows in lakes, estuaries, and coastal waters. This includes mixing and dynamics of natural water bodies, mathematical modeling of water quality, field studies, and laboratory studies of turbulent mixing.

He is an authority on the fluid mechanics of outfall diffuser mixing and the development and application of mathematical models of wastewater fate and transport. He has extensive international experience in marine wastewater disposal including the design of ocean outfalls, review of disposal schemes, numerical modeling, and the design and analysis of oceanographic field study programs. Dr. Roberts has lectured widely on outfall design and is presently Co-Chairman of the IAHR/IWA Committee on Marine Outfall Systems.

Dr. Roberts' mathematical models and methods have been adopted by the U.S. EPA and are widely used around the world. He is a regular lecturer at workshops for the U.S. EPA on mixing zone analyses and on the use of mathematical models and outfall design for the Pan American Health Organization. He has developed innovative experimental techniques for research on diffuser mixing processes using three-dimensional laser-induced fluorescence and has published extensively in this area. For this research he was awarded the Collingwood Prize of ASCE in 1980 and was UPS Foundation Visiting Professor at Stanford University in 1993-94. He is presently one of only two Distinguished Scholars in the National Ocean and Atmospheric Administration (NOAA) Oceans and Human Health Initiative (OHHI) in which he is conducting research on the hydrodynamic aspects of bacterial and pathogen transport in coastal waters.

Dr. Roberts holds a professional engineering (PE) license.

**Education**
- Ph.D., Environmental Engineering Science, California Institute of Technology, 1977.
- M.S., Environmental Engineering Science, California Institute of Technology, 1972.
- S.M., Mechanical Engineering, Massachusetts Institute of Technology, 1970.
- B.Sc. (Eng), Mechanical Engineering, First Class Honors, Imperial College of Science and Technology, 1968.

**Research Interests**

- Environmental fluid mechanics, mixing and dynamics of rivers, lakes, coastal waters, and estuaries
- Outfalls for wastewater discharge
- Mathematical models of wastewater fate and transport
- Oceanographic field programs and data interpretation

**Honors**

- Appointed to and Chairman of “Expert Panel on Fate and Effects of Brine Discharge” State of California Water Resources Control Board, October 2011 -
- Distinguished Scholar, NOAA Oceans and Human Health Initiative, 2006-2008
- UPS Foundation Visiting Professor, Stanford University, 1993-94
- Member of the Hydrologic Transport and Dispersion Committee, ASCE, 1988 to present.
- Fellow, American Society of Civil Engineers
- Adjunct Professor of Oceanography, Skidaway Institute of Oceanography, Georgia
- Associate Editor, Journal of Hydraulic Engineering, 1987 to 1992
- Chairman of the ASCE Hydraulics Division Research Committee, 1986-1987
- Co-Chairman, IAHR/IWA Committee on Marine Outfall Systems
- Registered Professional Engineer number GA 12476, Georgia, United States
- 1980 Collingwood Prize of ASCE for paper: "Line Plume and Ocean Outfall Dispersion"

**Awards**

- 1999-2000 Outstanding Interdisciplinary Activity Award, School of CEE (with Don Webster).

**Articles**

1. Gandhi, V. N., Roberts, P. J. W., and Kim, J.-H. (2013). "Visualizing and Quantifying Dose Distribution in a UV Reactor Using Three-Dimensional Laser-Induced Fluorescence." ES&T, 46(24), 13220-13226.

2. Nekouee, N., Roberts, P. J. W., Schwab, D. J., and McCormick, M. J. (2013). "Classification of Buoyant River Plumes from Large Aspect Ratio Channels." J. Hydraul. Eng., 139(3), 296-309.

3. Tian, X., and Roberts, P. J. W. (2011). "Experiments on Marine Wastewater Diffusers with Multiport Rosettes." J. Hydraul. Eng., 137(10), 1148-1159.

4. Roberts, P. J. W., Hunt, C. D., Mickelson, M. J., and Tian, X. (2011). "Field and Model Studies of the Boston Outfall." J. Hydraul. Eng., 137(11), 1415-1425.

5. Tian, X., and Roberts, P. J. W. (2011). "Experiments on Marine Wastewater Diffusers with Multiport Rosettes." J. Hydraul. Eng., 137(10), 1148-1159.

6. Roberts, P. J. W., Tian, X., and Jung, Y. (2011). "Physical Model Study of an Alternating Diffuser for Thermal Discharge." J. Hydraul. Eng., 137(9), 1027-1036.

7. Kim, D., Nemlioglu, S., Roberts, P.J.W., and Kim, J.-H. (2010). "Ozone Contactor Flow Visualization and Quantification Using Three-Dimensional Laser-Induced Fluorescence (3DLIF)." Journal AWWA, 102(1), 90-99.

8. Kim, D.-i., Elovitz, M., Roberts, P. J. W., and Kim, J.-H. (2010). "Using 3D LIF to investigate and improve performance of a multichamber ozone contactor " Journal of the American Water Works Association, 102(10), 61-70.

# Chris Rogers

## Senior Ecologist / Botany and Wetlands Program Director

**EDUCATION**

B.S., Biology, emphasis in Botany, San Francisco State University

Graduate Studies, Ecology and Systematics, San Francisco State University

**27 YEARS EXPERIENCE**

**CERTIFICATIONS/ REGISTRATION**

California Endangered, Threatened and Rare Plant Collecting Permit #09026

**TRAINING**

Arid West Wetland Delineation Workshop, USACOE, 2007

Property Analysis Record, Center for Natural Lands Management, 2004

Hydrology of Constructed Wetlands, Wetland Training Institute, 2001

California Wetlands, CLE International, 2000, 2007, 2015

Federal Endangered Species Act, CLE International, 1995

Wetlands Delineation Certification Training, 1995

Wetland Impacts and Mitigation, U.C. Davis Extension, 1992

Wetlands Delineation Training, 1991

Chris serves in both managerial and technical roles in ESA's Bay Area Biological Resources and Land Management Group. He specializes in permitting and regulatory compliance for water supply and wasetwater management clients. He oversees large-scale and fast-track biological resource analyses and jurisdictional wetland delineations in support of multi-agency permits, construction compliance monitoring and reporting, preparation of accurate and defensible environmental documentation, habitat assessments and mapping and analysis, endangered species evaluations, restoration and mitigation planning, peer review, and public meeting presentations. Chris frequently acts as a technical liaison between project design and engineering clients and ESA's environmental planning and permitting specialists.

### Relevant Experience

**EBMUD Moraga Pipeline Project, Contra Costa County, CA.** *Permitting and Restoration Specialist.* Chris designed and supervised construction of a seasonal wetland at Lafayette Reservoir Recreation Area to mitigate construction impacts of this new water delivery pipeline. He identified the appropriate site based on soils, hydrology, and consideration of potential conflicts with pipeline maintenance and recreational use. Chris worked with ESA's hydrologist to develop the water balance model to optimize size and depth of the pond to achieve the desired wetland plant community, and specified the planting palette. Chris continues to oversee long term monitoring and compliance reporting on behalf of EBMUD.

**California Department of Water Resources (DWR) South Bay Aqueduct Improvement and Enlargement Project EIR, Alameda County, CA.** *Biologist and Wetland Permit Specialist.* Chris assessed wetland and sensitive species habitat along 44-mile South Bay Aqueduct, and obtained multiple permits. Chris was integrally involved in review of preliminary engineering designs to identify environmental constraints, working with DWR design engineers to refine final plans and specifications to avoid or minimize environmental issues, in particular to reduce regulatory requirements. He coordinated permit applications and negotiated permit conditions with ACOE (Sacramento and San Francisco Districts), USFWS, CDFG, and the San Francisco Bay RWQCB. Chris assisted to identify suitable and available land for mitigation and developed conservation easement strategies, and continues to supervise the maintenance and monitoring of the conservation lands.

**Crystal Springs Trunk Sewer Improvement Project, Town of Hillsborough.** *Biologist and Wetland Permit Specialist.* Chris supervised environmental compliance monitoring for replacement a failing and undersized sewer line for the Town of Hillsborough, located in a highly constrained utility corridor owned by the San Francisco Public Utilities Commission (SFPUC) and parallel with San

Mateo Creek. The project relied on an innovative pipe-bursting method to minimize construction impacts to high quality riparian habitat, but experienced substantial difficulties with implementation. Chris coordinated with SFPUC on the preparation of a restoration plan to replace high quality riparian habitat and provide erosion control, and oversaw implementation of the plan, as well as annual monitoring and reporting.

**Fairfield-Suisun Sewer District, FSSD Treatment Plant Expansion & Outfall Project EIR.** *Lead Biologist and Wetland Permit Specialist.* Prior to completion of improvements to this wastewater treatment facility, and according to the Mitigation and Monitoring Plan and permits he obtained for the project, Chris supervised an assessment of a population of a special status plant, Suisun marsh aster that was to be impacted by the construction of an outfall structure on a tidal creek. Chris's team identified appropriate local transplanting sites, monitored construction to minimize the impacts, harvested and transplanted them to comparable habitat nearby, and collected baseline data. Following construction, Chris supervised restoration of the outfall construction footprint with native plant material. Chris continues to supervise annual monitoring and reporting to the regulatory agencies on the successful transplant and restoration effort.

**Livermore-Amador Valley Water Management Agency (LAVWMA), Export Pipeline Facilities EIR.** *Biologist and Wetland Permit Specialist.* Chris prepared assessments of riparian and wetland habitats along a 16-mile wastewater export pipeline for LAVWMA in Alameda County, which terminates at a major discharge collector pipeline in the San Leandro Marsh. He prepared applications and negotiated wetland permits for multiple federal, state and local regulatory agencies, and developed the construction monitoring compliance program, wetland mitigation plans and bid specifications for mitigation of impacts to biological resources. Chris also assisted in preparation of detailed plans and specifications for restoration of saltmarsh and upland habitats as part of the project's mitigation program.

**San Jose/Santa Clara Recycled Water Facility Master Plan Projects, San Jose, CA.** *Lead Biologist.* Chris has conducted wetland delineations, rare plant surveys, wildlife surveys (including for burrowing owl), and prepare permitting strategies and biological resource sections of CEQA Addenda and Initial Study/Mitigated Negative Declarations for individual capital projects as part of the overall Plant Master Plan. He also developed and presented regulatory training module for City and Facility staff, and prepared a narrated PowerPoint for the City's training program.

**Napa Sanitation District, MST Service Area RWP Project, Napa County, CA.** *Wetland Permit Specialist*. Chris performed a preliminary delineation of waters and subsequent environmental permitting documents submitted to the U.S. Army Corps of Engineers, California Department of Fish and Wildlife, and the Regional Water Quality Control Board for 19 in-road culvert trenching projects and 2 creek crossings of perennial streams. Sensitive species in the area include steelhead, California red-legged frog, and nesting birds.

## Publications and Presentations – available on request

# Chris Sanchez

## Senior Technical Associate

**EDUCATION**

B.S., Environmental Science, University of California, Berkeley

U.C. Berkeley Extension; Toxic Air Contaminants

**24 YEARS EXPERIENCE**

Chris Sanchez has more than 24 years of experience managing, conducting and monitoring air quality, greenhouse gas, noise and energy investigations and surveys for urban development, transportation, and infrastructure projects. He has prepared greenhouse gas emission inventories for nine years since the passing of Assembly Bill 32. His professional training and experience have augmented an academic background in air quality, physics, chemistry, meteorology, and energy. Chris has a bachelor's degree from U.C. Berkeley in Environmental Science with additional studies from U.C.B. in toxic air contaminants. He is trained and proficient in the CalEEMod air quality emissions model as well as in air dispersion modeling using the AERMOD dispersion model. He is proficient in use of the traffic noise model of the Federal Highway Administration (FHWA) and the Roadway Construction Noise Model. He has been involved in dozens of major projects including major commercial airport master plans, divestiture of the State of California's power plants, mining projects and reclamation plans, rail transit extension projects and arena construction projects.

### Relevant Experience

**Monterey Peninsula Water Supply Project Environmental Impact Report, Monterey, CA.** *Noise Analyst.* Under contract with the California Public Utilities Commission (CPUC), Chris prepared the noise impact analysis of an EIR/EIS for the California American Water Company (CalAm) Monterey Peninsula Water Supply Project (MPWSP). The primary project elements include a seawater intake system, a desalination plant, aquifer storage and recovery facilities, and over 20 miles of conveyance pipelines and associated infrastructure. Key issues include potential impacts from 24-hour drilling and operation of slant wells and aquifer storage and recovery wells open trench pipeline installation and construction and operation of a desalination plant. Much of the construction work was assumed to occur 24-hours a day and analysis of noise impacts to adjacent sensitive receptors had to account for this possibility.

**Contra Costa Water District, Los Vaqueros Reservoir Phase 2 Expansion, Draft Supplemental EIR/EIS, Contra Costa County, CA.** *Air Quality, Greenhouse Gas and Noise Analyst***.** Chris conducted the air quality, GHG and noise analysis for the proposed expansion of Los Vaqueros reservoir. The Phase 2 Expansion project would expand Los Vaqueros Reservoir from the existing 160 thousand acre feet (TAF) to a proposed 275 TAF storage capacity as well as upgrade existing conveyance facilities, and construct new conveyance facilities. Analysis included an estimate of construction-related emissions from excavation and off-haul of materials a, a comparison of emissions with project revisions and an estimated change in GHG emissions associated with energy demand from conveyance. Construction noise impacts and operational noise impacts of new facilities were also estimated.

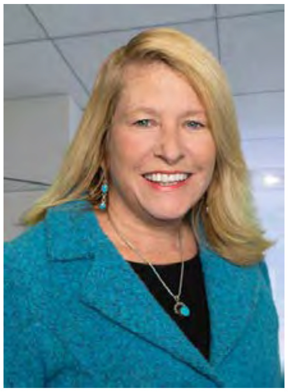
**Energize Eastside Power Transmission Project Draft Environmental Impact Statement.** *Greenhouse Gas and Noise Analyst.* Chris prepared technical analysis for a new 18 mile long transmission line for Puget Sound Electric on the eastside of its service area beginning in Bellevue and crossing through multiple local jurisdictions. Impacts were considered for multiple transmission options including overhead transmission lines, underground transmission lines, and underwater transmission lines as well as a host of alternatives to the project including installation and operation of natural gas fired peaker plants. Greenhouse gas emissions were estimated from construction and operation including life-cycle emissions from concrete to be used in transmission tower footings, and underground line encasement. Potential noise from peaker plant operations was also assessed.

**San José/Santa Clara Water Pollution Control Plant Master Plan Program Environmental Impact Report, San José, CA.** *Air Quality Analysis.* Chris used CalEEMod to estimate emissions associated with long-term development in a proposed Clean Tech Center. Master Plan would designate areas of the project site for light industrial, institute, and office/R&D, as well as retail uses and these future development scenarios would result in both operational and construction-related emissions that were quantified and assessed for impacts related to CEQA thresholds.

**The 34th Americas Cup and James R. Herman Cruise Terminal and Northeast Wharf Plaza Environmental Impact Report, Environmental Assessment (NEPA) and General Conformity Determination, San Francisco, CA.** *Air Quality, Greenhouse Gas and Noise Analyst.* Chris prepared fast-track CEQA and NEPA documentation as well as a federal General Conformity Determination and technical and logistical support for complex multi-agency regulatory compliance. For the environmental impact report, relative to CEQA, an emissions inventory was assembled for a variety of unique sources including race support vessels, race-sponsored spectator vessels, spectator vessels, helicopter operations and cruise ship hoteling emissions resulting from the temporary decommissioning of shore side power. For the NEPA documentation, a greenhouse gas emission inventory was developed to account for AC34 impacts to existing federal GHG inventories. The noise analysis for both the CEQA and NEPA documentation examined noise impacts associates with construction, generators supplying temporary power, amplified music at event venues, helicopter noise, fireworks and noise from increased traffic volumes. A General Conformity Determination was conducted to verify compliance with the 1993 Amendments to the Clean Air Act and the State Implementation Plan, which included dispersion modeling to demonstrate that federal air quality standards would not be exceeded.

**Pilarcitos Rock Quarry Expansion Environmental Impact Report, San Mateo County.** *Air Quality/Noise Analyst.* Chris prepared the criteria air pollutant analysis and noise impact analysis for the proposed long-term expansion that would result in this facility excavating an additional 256 acres of new areas. Issue areas included operational emissions of on-site excavation equipment on-site processing equipment and heavy duty-diesel truck transfer of mined materials. Noise analysis included the impacts of rock blasting practices and impacts.

burke
BURKE, WILLIAMS & SORENSEN, LLP



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**Practice Groups**

Environmental, Land Use, and Natural Resources

Real Estate & Business Law

**Education**

J.D., Cornell Law School, 1986

B.A., Urban Studies, University of California, Davis, 1983

**Admissions**

California State Bar

# Anna C. Shimko

Anna Shimko is Chair of Burke's Real Estate and Business Practice Group. She focuses her practice on all areas of land use, real estate development, and environmental law, representing both public agencies and private landowners and developers in administrative and court proceedings. Ms. Shimko has particular expertise in compliance with the California Environmental Quality Act (CEQA) and the National Environmental Policy Act (NEPA). She works closely with project proponents, public agencies, and environmental consultants on preparing and defending CEQA and NEPA documents such as negative declarations, environmental impact reports (EIRs), and environmental impact statements (EISs), including for complex projects such as water rights transfers, desalination plants and alterations to nuclear plants. Ms. Shimko helps private clients through all stages of the land use approval process, obtaining entitlements to build or expand large shopping centers, stand-alone retail stores, mixed-use projects, hospitals, hotels and resorts, golf courses, residential developments, and quarries, among others. She also assists cities, counties, special districts, and state agencies in regulating land and development, negotiating real estate transactional documents and development agreements, and updating general plans, specific plans, and zoning codes. Ms. Shimko represents clients in matters involving the Subdivision Map Act, annexation, historic resources, public-private partnership transactions and financing mechanisms, the Coastal Act, air quality regulations, water supply, climate change regulations, transportation planning, eminent domain, and inverse condemnation. Ms. Shimko litigates land use, CEQA, and NEPA matters for public and private clients at trial court and appellate court levels, and serves as an expert witness throughout California in cases involving land use issues.

## Affiliations

President, Harbor Equity Group, Waldo Point Harbor, April 2015 – present

Advisory Council and Board of Directors, San Francisco Planning and Urban Research Association, 2003-2014

California Building Industry Association/California Business Properties Association, CEQA Reform Task Force, 1992-present

Treasure Island/Yerba Buena Island Citizens Advisory Board, 2001-2004

San Francisco Juvenile Probation Commission, 1996-2000

Marin Montessori School Campus Planning Committee, 2015-present

## Publications & Presentations

"California Environmental Quality Act: Key Developments Affecting Water Projects," Annual California Water Law Conference, San Francisco, November 2016

"Current Developments in CEQA Law and Practice," The Administrative and Public Environmental Law Conference, June 2015

Speaker, "Current Issues in Land Use Regulation and Development," California Environmental Quality Act Update Cases Late 2011 to Present, California Continuing Education of the Bar, September 2012

"Aetna Springs Resort," California Building Industry Association Select Conference on Industry Litigation, April 2012

"Hydraulic Fracturing: Permitting and Environmental Reviews," The Seminar Group, November 2011

"Americans with Disabilities Act Primer," 2011 for insurance company

"Cumulative Impacts," Climate Change, Cumulative Impacts and Compliance: 6th Annual National Environmental Policy Act (NEPA) CLE International Conference, January 2010

"Coming Soon to Your State or Federal Government: the Climate Change Regulation Experience in California," ICSC U.S. Shopping Center Law Conference, October 2009

"The Benefits of Development Agreements," League of California Cities Planners Institute, March 2009

"Land Use in Northern California," Law Seminars International, March 2009

"AB 32 Session Climate Change: Science, Law & Policy," California Business Properties Association, Fall 2008

"The Changing Climate of California Real Property Law," California Continuing Education of the Bar, Fall 2008

"Green Building Conference," CLE International, February 2008

"The Challenges of Urban Development: Trends and Legal Issues for Real Property Practitioners," California Continuing Education of the Bar, Fall 2007

"Land Use Regulation and Development," California Continuing Education of the Bar, Fall 2006

"Regulatory Takings Conference," CLE International, 2003

## Recognitions

American College of Real Estate Lawyers, Elected Member

Lambda Alpha International (global land economics society), Elected Member

California's Top 50 Development Lawyers, Daily Journal, 2014

Super Lawyers – The Top 50 Women Attorneys in Northern California, 2004-2005

Northern California Super Lawyers, 2004-2017

Best Lawyers in America (Land Use and Zoning), 2012 - 2016

# JUSTIN TAPLIN, MS

## Principal/Senior Environmental Scientist

**EDUCATION**

M.S. Environmental Management. University of San Francisco, California.

B.S. (Hons) Biological Sciences. University of Westminster, UK

**14 YEARS EXPERIENCE**

**CERTIFICATIONS/ REGISTRATION**

Certified Fisheries Professional (#3146), American Fisheries Society

Association of Environmental Professionals (AEP)

**TRAINING**

Advanced CEQA Workshop. AEP, 2015.

CEQA Case Law Updates, Issues, Trends. Sohagi Law Group, 2010.

Stormwater Regulations in CA. NWET, September, 2009.

Management of Water in CA. UC Berkeley Extension, 2008.

A skilled and effective scientist, technical manager, and strategic thinker, Justin brings more than 14 years of California based consulting experience to the environmental review and compliance process. He applies expertise in the arenas hydrology, water quality, and water resource regulation/policy with a discerning eye to produce comprehensive and defensible environmental assessments and mitigation strategies. He acts as technical manager, senior reviewer, and lead author for large-scale, often contentious, complex program- and project-level Environmental Impact Reports, Environmental Impact Statements, and other documents pursuant to the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA). As technical manager he routinely coordinates with engineering and technical sub-consultants with expertise in a variety of fields such as discharge structure design, dilution modeling, and water quality. Prior to co-founding Sutro Science LLC, Justin worked at Environmental Science Associates as a technical manager contributing to a wide range of water supply and infrastructure projects.

### Relevant Experience

**Monterey Peninsula Water Supply Project (MPWSP) EIR/EIS, Monterey, CA.** ***Technical Lead: Hydrology and Water Quality.*** Justin is technical manager and lead author supporting preparation of the EIR/EIS section addressing water quality impacts related to the discharge of desalination brine into Monterey Bay and subsequent impacts to water quality and marine organisms, including from salinity and shear stress. His responsibilities include evaluating all water quality impacts related to construction and operation, with a focus on the discharge of desalination brine, and the development of feasible and defensible mitigation strategies. Additionally, analyses have covered a wide range of alternatives that include open ocean intakes, new discharge structures, and a reduced capacity desal plant paired with additional supplies from reversis osmosis treatment of agricultural return water. As part of the project, Justin has collaborated closely with Professor Phil Roberts of Georgia Tech., a leading expert in desalination regulation and discharge plume model analysis, and also coordinated with experts in marine resources, water quality model analysis, and discharge structure design. The impact analyses will also assess compliance with the recently amended California Ocean Plan regarding numeric salinity limits and impacts from shear stress on marine organisms.

**CalAm Coastal Water Project, Monterey, CA.** ***CEQA Lead Technical Analyst.*** Justin was responsible for evaluating geologic and hydrologic impacts for the various project components for the EIR, including consideration of potential liquefaction hazards for new facilities resulting from temporary groundwater storage. As part of the team assembling a complex EIR that considered a range of potential facilities, alternatives, and project- and program level analyses, Justin was responsible for developing an impact assessment template that was adopted for the EIR to simplify and standardize disclosure of environmental impacts for all facilities and phases of the project throughout all resource sections. Justin also participated in public meetings and answered queries on project alternatives, and technical topics including potential liquefaction hazards, groundwater storage, water quality, regulatory requirements. The alternatives considered in the EIR included a desalination plant at one of several locations; various methods of water intake and outfall; conveyance pipelines; aquifer storage and recovery facilities; and other treatment, storage and conveyance facilities.

**West Basin Municipal Water District Ocean Water Desalination Project.** ***Technical Lead: Hydrology and Water Quality.***
The Ocean Water Desalination Project proposed by the West Basin Municipal Water District is a desalination facility that would produce 20 million gallons per day (MGD) of potable water supply, with potential expansion of the facility to a future capacity of up to 60 MGD. The project will allow West Basin to develop a locally-sourced supply that will reduce the dependence of imported water, increase drought resiliency and water security while further diversifying West Basin's water supply mix by. Justin, in collaboration with Phil Roberts, and Applied Marine Science, will bring technical expertise to the environmental review and planning process for this project under the CEQA and NEPA leadership of ESA. Justin is technical manager and lead author supporting preparation of the EIR/EIS in accordance with NEPA and CEQA requirements and is responsible for the evaluation of all potential impacts relating to the offshore marine environment, the coastal zone interface, and inland surface water and groundwater from implementation of the both the 20 MGD and 60 MGD projects. Additionally, justin is responsible for the development of feasible and defensible mitigation strategies.

**SFPUC Water System Improvement Program (WSIP) PEIR.** ***Technical Lead: Fisheries / Hydrology.*** The WSIP PEIR included over 30 facility improvement projects along the regional water system for the purposes of improving water quality, seismic reliability, and reliability. Justin was lead author for impact assessments and mitigation development for the Alameda Creek watershed. Mitigation development needed to account for short, medium, and long term flow regimes and compliance criteria for a watershed that has the potential for restored listed salmonids prior to construction.

**34th America's Cup and Cruise Terminal EIR, San Francisco, CA.** ***Task Manager: Hydrology and Water Quality.*** Environmental review for two projects was completed through a single EIR: 1) the 34th America's Cup (AC34) sailing events; and 2) a new San Francisco Cruise Terminal.The America's Cup Event Authority proposed a variety of facilities. Justin managed all tasks related to the hydrologic and water quality impacts analysis for the EIR and was the section lead author. Technical management required coordination of engineering and technical sub-consultants as well as an internal team of hydrologists, coastal process engineers, and water quality specialists. Justin evaluated the various project components, which posed a number of unique hydrologic and water quality impacts. Key issues included use of various temporary project facilities, such as wave attenuators, in-water construction impacts, and temporary land use changes.

**EDUCATION**

M.A., Urban Planning, UCLA Luskin School of Public Affairs

B.A., Peace and Conflict Studies, UC Berkeley

**10 YEARS EXPERIENCE**

**PROFESSIONAL AFFILIATIONS**

Association of Environmental Professionals

# Alexandra Thompson

## Managing Associate, Energy Group

Alexandra (Al) coordinates the preparation of environmental compliance evaluations under the California Environmental Quality Act (CEQA) and National Environmental Policy Act (NEPA) for a variety of developers, agencies, and utility clients throughout California and the West. She has also assisted with the preparation of permitting compliance documents including under the Endangered Species Act and Clean Water Act and for hydroelectric relicensing. Along with a planning and regulatory background, Al has technical expertise in the areas of environmental justice, land use and zoning, utilities and infrastructure, social sciences, and energy conservation.

### Relevant Experience

**California Public Utilities Commission, Monterey Peninsula Water Supply Project, Monterey County, CA. *Project Manager*.** Managed the preparation of the CEQA/NEPA analysis identifying potential impacts of California American Water Company's (CalAm) proposal to develop a new source of potable water for several coastal communities in Monterey County through the development of a coastal desalination plant. Al served as overall project manager for the EIR/EIS, as well as technical task lead for the cumulative impacts analyses in all environmental topic areas.

**San Francisco Public Utilities Commission, Bayview-Hunters Point Environmental Justice Evaluation, San Francisco, CA. *Project Manager*.** ESA prepared a report evaluating existing conditions in the Bayview-Hunters Point neighborhood relevant to environmental justice issues. Relying on input from community groups and on existing research from a number of local, regional, and state sources, the report evaluates over 50 "indicators" of environmental justice concern, such as poverty, air pollution, housing displacement, hazardous waste sites, and access to services, to determine what economic, social, and environmental burdens are experienced disproportionately in this neighborhood. Following this existing conditions assessment, Al prepared an analysis of the potential effects of the SFPUC Biosolids Digester Facilities Project on the various environmental justice indicators and an assessment of the SFPUC's Community Benefits Program's impact on improving these indicators, finishing with recommended actions the SFPUC could take to make improvements in both undertakings relative to environmental justice.

**McMillen Jacobs Associates, Vista Grande Drainage Basin Improvement Project, Daly City and San Francisco, CA. *Deputy Project Manager*.** Al is Deputy Project Manager for the preparation of a joint Environmental Impact Report/Environmental Impact Statement on behalf of the City of Daly City and the National Park Service – Golden Gate National Recreation Area. The project would replace a portion of Daly City's stormwater drainage canal with a debris screening structure, box culvert, and treatment wetland, with some storm and authorized non-storm flows diverted to Lake Merced, and would enlarge the existing drainage tunnel beneath Fort Funston to mitigate flooding in the Vista Grande watershed resulting from large storms. Al also assisted with the preparation of a Water Quality Analysis based on ESA's water quality evaluation and monitoring program in Daly City's Vista Grande Canal and San Francisco's Lake Merced and prepared an alternatives analysis in support of the U.S. Army Corps of Engineers' Clean Water Act Section 404(b)(1) process.

**San Francisco Public Utilities Commission, Lake Merced Water Quality and Biological Resources, San Francisco, CA. *Project Manager*.** In connection with the proposed Vista Grande Drainage Basin Improvement Project that would provide a source of stormwater to improve and maintain water levels in Lake Merced, the SFPUC has offered to implement an aeration demonstration project to determine whether a full scale project could improve the lake's dissolved oxygen (DO) levels above 5 milligrams per liter (mg/L), while avoiding other undesireable effects. ESA is assisting in the areas of biological resources survey, wetland delineation, permitting support, and water quality sampling and analysis.

**California State Coastal Conservancy, Ballona Wetlands Restoration Environmental Impact Report/Environmental Impact Statement (EIR/EIS), Los Angeles, California. *Project Analyst*.** Al prepared the socioeconomics and environmental justice NEPA analyses for the Draft EIR/EIS. Seeking to restore wetland habitat and function within the Ballona Reserve, the California Department of Fish and Wildlife (CDFW), which manages the Ballona Reserve, and Los Angeles Department of Public Works (LADPW), which operates and maintains the improved Ballona Creek channel and levees within the Ballona Reserve, are proposing a large-scale restoration that would restore, enhance, and establish native coastal wetland and upland habitats within the Ballona Reserve and require incidental work on adjacent properties.

**California Public Utilities Commission, Lakeview Substation Project Environmental Impact Report (EIR), Riverside County, CA. *Project Analyst***. Al assisted with the preparation of an EIR on behalf of the California Public Utilities Commission by researching and preparing several sections of the EIR. The EIR evaluated a proposed electrical substation and associated subtransmission infrastructure in Lakeview and Moreno Valley, CA.

**Erler & Kalinowski, Inc., Pad D Groundwater Well Project Focused EIR, East Palo Alto, CA. *Project Analyst*.** ESA is preparing an initial study and focused EIR for a proposed new 500 gallon-per-minute municipal groundwater production well at the City of East Palo Alto-owned Pad D site. The well would be located in a commercial parking lot and bordered by the Home Depot on one side and residences on another. The focused EIR will evaluate the project's potential impacts on groundwater resources and water quality in detail. This site is also the potential location of the northeastern landing of a pedestrian bridge that will span Highway 101; the focused EIR addresses the potential cumulative impacts of these two projects.

## Publications

Alexandra Kostalas. 2011. A Local Government Policy Guide to California Climate Change Laws. Master of Arts project prepared for ICLEI USA California. UCLA Luskin School of Public Affairs, Urban Planning Department.

**Partner**

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Oakland, California 94612
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svelyvis@bwslaw.com

## PRACTICE GROUPS

Environmental, Land Use, and Natural Resources

Public Law

Litigation

Education Law

## EDUCATION

J.D., Vermont Law School, 1998

B.A., Ohio University, 1993

## ADMISSIONS

California State Bar, 1999

Colorado State Bar

# Stephen E. Velyvis

Mr. Velyvis is a well-respected land use and environmental law attorney with over 16 years of expertise advising and representing public agency and private clients in administrative proceedings and before state and federal trial and appellate courts.

Mr. Velyvis has extensive advisory and litigation experience with and works daily on projects addressing complex legal issues spanning the California Environmental Quality Act (CEQA), the National Environmental Policy Act (NEPA), the Federal Power Act, and the California Coastal Act, as well as the state and federal legal and regulatory frameworks governing clean water, clean air, endangered species and electricity generation and transmission. He also routinely represents clients in land use-related matters including local and state planning and zoning laws, the Subdivision Map Act, timber harvests/timberland conversions, and vineyard expansions.

While Mr. Velyvis has extensive advisory and litigation experience with a multitude of environmental laws, he is most experienced with CEQA, having represented parties on all three “sides” of the CEQA equation. In other words, in addition to successfully representing Burke’s many municipal and public agency clients, Mr. Velyvis has also successfully represented numerous private clients (e.g., project applicants and project opponents.) In this regard, Mr. Velyvis distinguishes himself as a leading CEQA practitioner. This deep and varied experience gives him invaluable insight into what all three sides on a given CEQA project are thinking at every step along the way. This unique perspective also enables him to develop cutting-edge legal strategies aimed at resolving conflicts and prevailing in litigation, as opposed to simply posturing or falling back on routine, "cookie cutter" advice and litigation tools. In sum, Mr. Velyvis draws on his collective experience to help Burke’s clients think outside the box and routinely provides successful, cost-effective results on myriad land use and environmental projects.

In just the past few years alone, Mr. Velyvis has worked and continues to work with numerous cities and school districts to provide advice and actively guide the preparation of a host of CEQA documents (statutory and categorical exemptions, mitigated negative declarations and environmental impact reports and addenda) and successfully defend various legal challenges thereto.

Mr. Velyvis also has experience with renewable energy projects and recently represented parties in related proceedings before the Federal Energy Regulatory Commission, the U.S. Forest Service, the State Water Resources Control Board, and the

California Public Utilities Commission with respect to a pumped-storage hydroelectricity project and related transmission line involving complex CEQA/NEPA, Clean Water Act, and Endangered Species Act issues, among others.

Finally, Mr. Velyvis also has significant experience with the Administrative Procedures Act (APA) and Regulations of the Office of Administrative Law. Most notably, Mr. Velyvis was an integral part of the legal and scientific expert team involved in successful litigation to force and advocacy to influence the Department of Pesticide Regulation's preparation of regulations covering the controversial ozone-depleting soil fumigant methyl bromide.

## Affiliations

California Bar Association, Environmental Law Section Legislation Committee (member) and Environmental Law Update publication (regular contributor)

Urban Land Institute

California Solar Energy Industries Association

USGBC Northern California Chapter (founding member, former steering committee member and emerging professionals chair of the Chapter's Diablo East Bay Branch)

California Special Districts Association: CEQA Expert Feedback Team

American Planning Association, Northern California Chapter (Board of Directors, Legislative Director)

Bay Area City Attorneys' Association

Contra Costa City Attorneys' Association

## Presentations

- Featured Speaker, Planning Fun-da-mentals, League of California Cities Planning Commissioners Academy (March 2, 2016)
- Featured Speaker "CEQA Update" at City Attorneys Association of Los Angeles County Member Luncheon (February 2016)
- Featured Speaker AB 2188 Implementation Requirements for Rooftop Solar Systems at League of California Cities City Attorneys' Spring Conference (May 2015)
- Featured Speaker on CEQA issues at County Counsels' Association Spring Land Use Conference (May 2014) "Practical Advice for Minimizing CEQA Liability in Your City" (League of California Cities' Webinar, March 2014)

## Publications

- "Identifying Baseline Conditions under CEQA – Back to the Future?" *Northern News,* March 2015
- "Big Changes on Horizon for Traffic Impact Analysis Under CEQA," *Northern News*, October 2014
- "Practical Advice for Minimizing CEQA Liability in Your City" (League of California Cities' *Western City* magazine, February 2014)

# Eric Zigas

## Principal Managing Associate, Northern California Water Group

EDUCATION

B.A., Geography, State University of New York at Buffalo

35+ YEARS EXPERIENCE

Eric has served as project director or project manager on numerous water resources planning assignments over the past 35+ years and he has prepared a considerable amount of environmental documentation to meet CEQA, NEPA and FERC requirements.

### Relevant Experience

**California American Water Company's Monterey Peninsula Water Supply Project (MPWSP) CEQA/NEPA Review.** *Project Director*. Eric managed the preparation of CEQA documentation for the California Public Utilities Commission (CPUC) on the California American Water Company's (CalAm's) proposed Coastal Water Project (CWP). After the CPUC certified the CWP EIR in 2009 and approved the Regional Project Settlement Agreement in 2010, CalAm withdrew its support for that desalination project and submitted a new application to the CPUC in 2012; the MPWSP incorporated many of the same elements previously analyzed in the Coastal Water Project EIR.

Eric directed the preparation of the April 2015 MPWSP Draft EIR that included an extensive analysis of a smaller desalination project that would be paired with the Pure Water Monterey Groundwater Replenishment (GWR) Project. In late 2015, the CPUC Energy Division announced that the Draft EIR would be modified and recirculated as a joint EIR/EIS in coordination with Monterey Bay National Marine Sanctuary (MBNMS) as the NEPA Lead Agency. Eric directed the preparation of the 4-volume MPWSP Draft EIR/EIS; it underwent extensive review by the CPUC and NOAA, and was published on Friday January 13, 2017. The Final EIR/EIS was published in early 2018.

**Uncommon Dialogue: Marine and Coastal Impacts of Ocean Desalination in California.** *Invited Participant.* In January 2016, the Stanford Woods Institute for the Environment, through its Water in the West Program and the Center for Ocean Solutions, collaborated with The Nature Conservancy and the Monterey Bay Aquarium to organize and facilitate an "uncommon dialogue" on the coastal and marine impacts of ocean desalination among leading experts from non-governmental organizations, private industry, government agencies and academia. Eric was one of 30 people invited to participate in the dialogue that had two primary objectives: i) to promote information exchange and open discussion regarding the best available science, technology and policy related to marine and coastal impacts of desalination projects in California and beyond; and ii) to identify key issues and knowledge gaps for future research and policy development with respect to marine and coastal impacts of ocean desalination in California.

**Technical Advisory Panel for the City of Santa Barbara's Subsurface Desalination Intake and Potable Reuse Feasibility Studies.** In 2015, the National Water Research Institute (NWRI) appointed Eric and three other water industry experts to a Technical Advisory Panel (Panel) to provide peer review of the technical and scientific aspects of both the Subsurface Desalination Intake Feasibility Study and the Potable Reuse Feasibility Study being undertaken by the Public Works Department of the City of Santa Barbara, California. Specifically, the Panel reviewed the work products (e.g., draft Work Plans, technical memoranda, and reports) for both feasibility studies and considered public comments on these proposed efforts. Findings and recommendations were documented in Panel reports.

**Bay Area Regional Desalination Pilot Project (BARDPP).** *Project Director.* The Bay Area's four largest water agencies -- Contra Costa Water District, East Bay Municipal Utility District, San Francisco Public Utilities Commission, and Santa Clara Valley Water District -- proposed to construct and operate a pilot desalination plant at CCWD's existing Mallard Slough Pump Station near Pittsburg, CA. The pilot plant study (PPS) was used to obtain additional data and help determine the optimal operations for a full-scale plant to be located in the SF Bay Area. Eric directed the preparation of the CEQA document and oversaw the preparation of the necessary permits for the intake and discharge systems.

**Bay Area Regional Desalination Project CEQA and Permitting.** *Project Director*. The Bay Area's six largest water agencies -- Contra Costa Water District, East Bay Municipal Utility District, San Francisco Public Utilities Commission, Santa Clara Valley Water District, Alameda County Water Agency and Zone 7 Water Agency – wanted to explore scope, budget and schedule to complete environmental documentation and permitting for a full scale regional desalination project. Eric worked with the water agencies and AECOM (under separate contract to the Agencies) to define the project and reasonable alternatives, and then developed a draft scope of work, budget and schedule to prepare an Environmental Impact Report under CEQA and to secure all necessary permits including water rights. Staff presented the results to the agencies' general managers for consideration.

**CPUC Monterey Peninsula Long-term Water Supply Contingency Plan (Plan B) as an Alternative to the Carmel River Dam**. *Project Manager*. Prior to joining ESA, Eric was responsible for the development of a long-term water supply contingency strategy for the Monterey Peninsula, as directed by AB1182 (Keeley). He led the planning team through an alternatives development and evaluation process which included working with CPUC staff in: the development of objectives and screening criteria; the identification and evaluation of potential water supply components; and the development and evaluation of alternative water resource strategies to meet the intent of the SWRCB Order 95-10. The strategies ranged from desalination (at multiple sites including Moss Landing, Marina and Sand City) to reclamation to Aquifer Storage and Recovery within the Seaside basin. There was a comprehensive public participation element to the assignment, and Eric worked with water Division staff, the advisor to the assigned commissioner, and the ALJ in the planning and facilitation of the public sessions. The recommended alternative from the Plan B study became the Coastal Water Project.

**Salinas River Basin Management Plan.** *Project Manager.* Eric evaluated the alternative supply solutions, including the development of spillway modifications at Nacimiento Reservoir, river conveyance, a river diversion and north Valley storage/recharge, in addition to increased conservation and reclamation opportunities for the Monterey County Water Resources Agency. He compiled the Basin Management Plan alternatives and screened them against the screening criteria, leading to the selection of a preferred alternative. The study addressed the issue of saltwater intrusion as a result of groundwater overdraft.

# APPENDIX O
# Agency Coordination and Consultation

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Monterey Bay National Marine Sanctuary
99 Pacific Street, Bldg 455a
Monterey, CA 93940

September 28, 2016

Department of the Army
US Army Garrison, Presidio of Monterey
1759 Lewis Road, Suite 210
Monterey, CA 93944-3223
ATTN: Hugh H. Hardin

Re: Invitation to Become a Cooperating/Participating Agency
Monterey Peninsula Water Supply Project (MPWSP)
Monterey Bay National Marine Sanctuary

Dear Mr. Hardin:

Thank you for your letter dated September 19, 2016 requesting early review of the MPWSP joint Environmental Impact Report (EIR)/Environmental Impact Statement (EIS). In response, we would like to formally invite your agency to be a Cooperating Agency/Participating Agency under the section 1508.5 of the National Environmental Policy Act (NEPA) for this project.

The National Oceanic and Atmospheric Administration's (NOAA) Monterey Bay National Marine Sanctuary (MBNMS or Sanctuary), in partnership with the California Public Utilities Commission (CPUC), is preparing a joint EIR/EIS for the Monterey Peninsula Water Supply Project (MPWSP or project) proposed by the California-American Water Company (CalAm) (Notice of Intent, published August 26, 2015 (80 FR 51787)). The EIR/EIS will address the environmental impacts resulting from the proposed construction, operation, and associated permitting actions related to the project.

As you are aware from our past informal communications, CalAm is proposing to construct and operate a desalination plant in the Monterey Bay Peninsula to develop water supplies for CalAm's Monterey District service area (Monterey District). Part of the project's implementation includes obtaining permits and authorizations from various federal, state, regional, and local agencies. CPUC previously circulated an Environmental Impact Report (EIR) in 2012. Given that a portion of the project is proposed to occur within MBNMS, we are considering authorizing MPWSP activities that would occur within MBNMS, as the lead federal agency for NEPA compliance. Please see the attached project description for the latest information on the project.

Your involvement as a Cooperating/Participating Agency is important because the project has the potential to affect water quality, biological and terrestrial resources (including protected species and sensitive habitat), physical resources, cultural resources, and socio-economic resources and your agency has special expertise and/or jurisdiction for determination of effect and/or issuance of permits.

Your involvement will be valuable to:

- Help establish purpose and need
- Help identify the range of alternatives and their impacts
- Identify issues vital to develop alternatives that avoid or minimize impacts
- Identify important issues to be addressed in the Environmental Impact Statement
- Identify other environmental review and consultation requirements or opportunities

Your participation in the project activities may include the following:

1. Participation in public meetings and coordination meetings
2. Consultation on any technical studies required for the project
3. Review relevant sections of drafts the EIS prior to its release for comment by the public and other agencies
4. Express your perspective on areas within your jurisdiction or expertise, and identify any issues that could substantially delay or prevent the granting of a permit or other approval

We will include information in the project environmental documents that your agency needs to discharge its responsibilities under NEPA as well as other requirements regarding jurisdictional approvals, permits, licenses, and/or clearances. We will provide your agency a draft of the EIS/EIR for review prior to publication, in the near future.

Your jurisdictional responsibilities will not be affected or compromised by your participation. Designation as a Cooperating/Participating Agency does not imply that your agency supports the proposed project. We expect that the EIS and our public involvement process will satisfy NEPA and CEQA requirements such as those related to project alternatives, environmental consequences, and avoidance, minimization and mitigation. In addition, we will utilize the EIS/EIR, record of decision (ROD) as our decision-making documents and as the basis for the permit application.

Please respond by November 1, 2016 to confirm that you will serve as a Cooperating/Participating Agency. Please contact Karen Grimmer at (831) 647-4253 or Karen.grimmer@noaa.gov if you have any questions.

We look forward to your continued involvement.

Sincerely,

Paul Michel

Paul Michel
Superintendent

DEPARTMENT OF THE ARMY
UNITED STATES ARMY INSTALLATION MANAGEMENT COMMAND
HEADQUARTERS, US ARMY GARRISON, PRESIDIO OF MONTEREY
1759 LEWIS ROAD, SUITE 210
MONTEREY, CA 93944-3223

REPLY TO
ATTENTION OF

Office of the Deputy to the Garrison Commander

OCT 25 2016

Monterey Bay National Marine Sanctuary
Attn: Paul E. Michel, Superintendent
99 Pacific Street, Bldg. 455a
Monterey, CA 93940

Dear Mr. Michel,

Thank you for your letter dated September 28, 2016 regarding an invitation to become a cooperating/participating agency for the Monterey Peninsula Water Supply Project (MPWSP) Environmental Impact Statement (EIS)/Environmental Impact Report (EIR). The U.S. Army (Army) accepts this invitation.

The Army recognizes your organization as the lead Federal agency, in partnership with the California Public Utilities Commission (CPUC) as the lead State agency, in preparing a joint EIS/EIR for the MPWSP as proposed by the California-American Water Company (CalAm) (Notice of Intent, published August 26, 2015 (80 FR 51787)). The EIS/EIR will address the environmental impacts resulting from this proposed project.

Given that a portion of the MPWSP, including some wells and pipelines, are proposed to be installed and operated on Army owned property, the Army will be making a determination to authorize use of its land. The Army's National Environmental Policy Act (NEPA) implementing regulations, 32 CFR 651.14.h. require the Army to coordinate with the lead agency to ensure that all proposed actions which would affect the Army are thoroughly analyzed. Per these regulations and your invitation, the Army agrees to act as a cooperating/participating agency on the EIS/EIR, including the following participation and responsibilities:

1. The Army will review and provide comment on relevant sections of drafts of the EIS/EIR prior to its release for public review, and prior to completion of the EIS/EIR and issuance of the Record of Decision (ROD). Relevant sections refer to those sections of the EIS/EIR related to areas within the Army's jurisdiction.
2. The Army will identify any issues associated with areas within the Army's jurisdiction that could potentially, substantially delay or prevent project approval on Army property.
3. The Army will provide consultation on technical studies relevant to areas within the Army's jurisdiction.

4. The Army will participate in public meetings and coordination meetings, as required.

The Army reiterates that designation as a cooperating/participating agency does not imply the Army's support of the proposed project but fulfills its legal obligations under NEPA and federal implementing regulations.

Thank you for the opportunity to participate and we look forward continued involvement. The point of contact for this correspondence is Joelle Lobo at 831-242-7829.

Sincerely,

HUGH H. HARDIN
Deputy to the Garrison Commander

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Monterey Bay National Marine Sanctuary
99 Pacific Street, Bldg 455a
Monterey, CA 93940

October 7, 2016

Katerina Galacatos
South Branch Chief, Regulatory Division
US Army Corps of Engineers, San Francisco District
1455 Market Street, 16th Floor
San Francisco, CA 94103

Re: Invitation to Become a Cooperating/Participating Agency
Monterey Peninsula Water Supply Project (MPWSP)
Monterey Bay National Marine Sanctuary

Dear Ms. Galacatos:

The National Oceanic and Atmospheric Administration's (NOAA) Monterey Bay National Marine Sanctuary (MBNMS or Sanctuary), in partnership with the California Public Utilities Commission (CPUC), is preparing a joint EIR/EIS for the Monterey Peninsula Water Supply Project (MPWSP or project) proposed by the California-American Water Company (CalAm) (Notice of Intent, published August 26, 2015 (80 FR 51787)). The EIR/EIS will address the environmental impacts resulting from the proposed construction, operation, and associated permitting actions related to the project.

We would like to formally invite your agency to be a Cooperating Agency/Participating Agency under the section 1508.5 of the National Environmental Policy Act (NEPA) for this project. As you are aware from our past informal communications, CalAm is proposing to construct and operate a desalination plant in the Monterey Bay Peninsula to develop water supplies for CalAm's Monterey District service area (Monterey District). Part of the project's implementation includes obtaining permits and authorizations from various federal, state, regional, and local agencies. CPUC previously circulated an Environmental Impact Report (EIR) in 2012. Given that a portion of the project is proposed to occur within MBNMS, we are considering authorizing MPWSP activities that would occur within MBNMS, as the lead federal agency for NEPA compliance. Please see the attached project description for the latest information on the project.

Your involvement as a Cooperating/Participating Agency is important because the project has the potential to affect water quality, biological and terrestrial resources (including protected species and sensitive habitat), physical resources, cultural resources, and socio-economic resources and your agency has special expertise and/or jurisdiction for determination of effect and/or issuance of permits.

Your involvement will be valuable to:

- Help establish purpose and need
- Help identify the range of alternatives and their impacts

- Identify issues vital to develop alternatives that avoid or minimize impacts
- Identify important issues to be addressed in the Environmental Impact Statement
- Identify other environmental review and consultation requirements or opportunities

Your participation in the project activities may include the following:

1. Participation in public meetings and coordination meetings
2. Consultation on any technical studies required for the project
3. Review relevant sections of drafts the EIS prior to its release for comment by the public and other agencies
4. Express your perspective on areas within your jurisdiction or expertise, and identify any issues that could substantially delay or prevent the granting of a permit or other approval

We will include information in the project environmental documents that your agency needs to discharge its responsibilities under NEPA as well as other requirements regarding jurisdictional approvals, permits, licenses, and/or clearances. We will provide your agency a draft of the EIS/EIR for review prior to publication, in the near future.

Your jurisdictional responsibilities will not be affected or compromised by your participation. Designation as a Cooperating/Participating Agency does not imply that your agency supports the proposed project. We expect that the EIS and our public involvement process will satisfy NEPA and CEQA requirements such as those related to project alternatives, environmental consequences, and avoidance, minimization and mitigation. In addition, we will utilize the EIS/EIR, record of decision (ROD) as our decision-making documents and as the basis for the permit application.

Please respond by November 1, 2016 to confirm that you will serve as a Cooperating/Participating Agency. Please contact Karen Grimmer at (831) 647-4253 or Karen.grimmer@noaa.gov if you have any questions.

We look forward to your continued involvement.

Sincerely,

Paul Michel

Paul Michel
Superintendent

CC: Greg Brown, US Army Corps of Engineers

**DEPARTMENT OF THE ARMY**
**SAN FRANCISCO DISTRICT, U.S. ARMY CORPS OF ENGINEERS**
**1455 MARKET STREET**
**SAN FRANCISCO, CALIFORNIA 94103-1398**

NOV 14 2016

Regulatory Division

SUBJECT: File Number 2013-00111S

Mr. Paul Michel, Superintendent
National Oceanic and Atmospheric Administration
National Ocean Service/Monterey Bay National Marine Sanctuary
99 Pacific Street, Building 455a
Monterey, California 93940

Dear Mr. Michel:

This letter is written in response to your letter dated October 7, 2016, requesting the participation of the U.S. Army Corps of Engineers, San Francisco District Regulatory Division (Corps) as a cooperating agency in the development of a joint Environmental Impact Report/Statement (EIR/EIS) for the proposed Monterey Peninsula Water Supply Project (Project).

The Corps understands that the National Oceanic and Atmospheric Administration (NOAA) Monterey Bay National Marine Sanctuary (MBNM) as the federal lead agency, working in partnership with the California Public Utilities Commission (CPUC), will prepare a joint EIR/EIS, in accordance with the National Environmental Policy Act (NEPA) and the Council on Environmental Quality's (CEQ) implementing regulations at 40 C.F.R. Parts 1500-1508.

With this letter, the Corps hereby agrees to coordinate with the MBNMS as a cooperating agency pursuant to 40 C.F.R. Section 1501.6(b) and 1508.5, 33 C.F.R. Part 325, Appendix B, paragraph 8(c), and 33 C.F.R. Section 230.16 to ensure that MBNMS's resulting EIR/EIS may be adopted by the Corps to meet our regulatory authority under Section 404 of the Clean Water Act (33 U.S.C. Section 1344) and Section 10 of the Rivers and Harbors Act (33 U.S.C. Section 403). The Corps agrees to assist MBNMS in preparing the EIR/EIS due to our jurisdiction over areas that could be affected by the proposed project and our expertise in the following:

- Identifying and delineating aquatic resources;
- Corps Regulatory Program regulations at 33 CFR Parts 320-332;
- Compliance with the Environmental Protection Agency's (EPA) CWA Section 404(b)(1) Guidelines (40 C.F.R. Part 230); and
- Assessing the functions and services of aquatic resources and identifying appropriate methods to conduct such assessments.

Subject to availability of resources and in accordance with applicable laws and regulations, the Corps agrees to:

- Assist in identifying interest groups;
- Attend coordination meetings and joint field reviews;
- Raise concerns about any relevant technical studies that may be needed in EIR/EIS;
- Assist in developing the range of alternatives, including the "practicability" of such alternatives and evaluation criteria;
- Assist in identifying appropriate and practicable mitigation, including appropriate and practicable steps to first avoid and then minimize adverse impacts to aquatic resources, and then compensate for unavoidable adverse impacts remaining after all appropriate and practicable minimization has been incorporated;
- Identify issues, concerns, and any technical studies that the EIR/EIS should address to support the Corps in fulfilling its NEPA or other responsibilities and any other requirements per CWA Section 404; and
- Review administrative draft and final EIR/EIS

We look forward to continued dialogue and coordination with the MBNMS on this proposed project. Should you have any questions regarding this matter, please call Frances Malamud-Roam of our Regulatory Division at 415-503-6792, or email Frances.P.Malamud-Roam@usace.army.mil. Please address all correspondence to the Regulatory Division and refer to the File Number at the head of this letter.

Sincerely,

John C. Morrow
Lieutenant Colonel, U.S. Army
Commander and District Engineer

Copies Furnished:

US CG, Monterey, CA
US EPA, San Francisco, CA
US FWS, Ventura, CA
US NMFS, Santa Rosa, CA
CA CC, Santa Cruz, CA
CA DFW, Monterey, CA
CA RWQCB, San Luis Obispo, CA

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Monterey Bay National Marine Sanctuary
99 Pacific Street, Bldg 455a
Monterey, CA 93940

June 8, 2016

Julianne Polanco
State Historic Preservation Officer
Attn: Anmarie Medin
Office of Historic Preservation
1725 23rd Street #100
Sacramento, California 95816

RE: Initiating National Historic Preservation Act Section 106 Consultation for the Monterey Peninsula Water Supply Project

Dear Ms. Polanco:

In accordance with the regulations at 36 CFR 800, the U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Monterey Bay National Marine Sanctuary (MBNMS), is initiating National Historic Preservation Act (NHPA) Section 106 consultation with the California State Historic Preservation Officer (SHPO) regarding the Monterey Peninsula Water Supply Project (MPWSP or proposed project) in Monterey County (Figure 1). The California-American Water Company (CalAm) is proposing the project. As the project requires authorization by the MBNMS's superintendent due to activities within the Sanctuary, the project is required to comply with the NHPA of 1966, as amended. MBNMS is the federal lead agency that oversees compliance with the National Environmental Policy Act (NEPA) and NHPA. The California Public Utilities Commission (CPUC) is the lead agency for ensuring compliance with the California Environmental Quality Act (CEQA).

<u>Proposed Project</u>

The proposed project extends approximately 18 miles, from Castroville in the north to the city of Carmel in the south. The MPWSP would include construction of up to nine subsurface slant wells, the conversion of an existing test slant well into a permanent well, and the construction of a desalination plant to produce approximately 8,744 acre-feet per year (afy) to meet service area demand and approximately 1,891 afy to return to the Salinas Valley Groundwater Basin, for a total of 10,635 afy of desalinated water. The proposed MPWSP Desalination Plant, which would have a rated capacity of 9.6 million gallons per day (mgd), would be operated to produce 9.5 mgd to meet, with other supply sources, the estimated annual demand.

The MPWSP would be comprised of the following facilities:

1. The seawater intake system, which would consist of 10 subsurface slant wells (eight active and two on standby) extending offshore into Monterey Bay, and a Source Water Pipeline

2. A 9.6 mgd desalination plant, which would be operated to produce on average of 9.5 mgd of desalinated water supplies, and appurtenant facilities, including pretreatment, reverse osmosis (RO), and post-treatment systems; backwash supply and filtered water equalization tanks; chemical feed and storage facilities; brine storage and conveyance facilities; and other associated non-process facilities

3. Desalinated water conveyance facilities, including pipelines, two stand-alone pump stations, and a Terminal Reservoir

4. An expanded aquifer storage and recovery (ASR) system, including two additional injection/extraction wells (ASR-5 and ASR-6 Wells) and three parallel pipelines (ASR Conveyance Pipeline, ASR Pump-to-Waste Pipeline, and ASR Recirculation Pipeline) to convey water to and from the new ASR injection/extraction wells and backwash effluent from the wells to an existing settling basin

Archaeological Area of Potential Effects (APE):
The archaeological APE (or the direct APE) is identical to the lateral extent of the project area boundary. Like the project area boundary, the archaeological APE represents all areas where construction-related ground disturbance could occur, including open excavations, construction work areas, staging areas, and access routes.

The horizontal APE for nonlinear facilities (i.e., the MPWSP Desalination Plant, subsurface slant wells, Terminal Reservoir, ASR-5 and ASR-6 Wells, and pump stations) is based on the anticipated footprint and construction-related disturbance associated with each facility. The vertical APE varies for each of the project components. Note that not all portions of the APE (or the project area boundary) would necessarily be disturbed. As the exact location of some of the proposed facilities cannot be confirmed until final design has been completed, the project area boundary and the APE provide some flexibility regarding the exact location of the proposed project facilities.

The horizontal APE for pipelines proposed in undeveloped areas is 200 feet; for pipelines proposed within existing roadways, the horizontal APE is equal to the width of the road right-of-way (typically 30 to 100 feet from curb to curb). Pipeline trenches would generally be no more than 6 feet wide, except in areas with sandy soils and where there are no constraints to excavating a wider trench (i.e., known resources, geography, existing utilities, or other facilities that restrict the construction area). In these areas, a trench width of up to 10 or 15 feet could potentially be used to reduce costs related to shoring the trench. For all pipelines, the length of the direct APE is equal to the length of the proposed pipeline. The vertical APE for pipelines would average 8 feet below ground surface, with some deeper excavation for trenchless technologies (i.e. jack and bore, horizontal directional drilling, etc.). Some pipeline excavations may vary in depth depending on constraints and subsurface conditions, and could extend up to 20 feet below the surface. Pipeline alignments may slightly shift during final design; the archaeological APE takes this into consideration.

Architectural Area of Potential Effects:
The architectural APE encompasses the project boundary as well as the area of indirect impact. For historic architectural resources this includes the viewshed or setting visible from a project component, as well as the area subject to construction-related vibration.

Construction activities that involve impact tools can produce significant ground borne vibration. Substantive sources of vibration during project construction would be: (1) the drill rigs used for drilling and development of the subsurface slant wells in the CEMEX active mining area; (2) the drill rigs used for drilling and development of the ASR-5 and ASR-6 Wells at the Fitch Park military housing area; (3) bulldozers used during general construction of facilities such as the MPWSP Desalination Plant; (4) jackhammers used to break up concrete during open-trench construction of pipelines; and (5) vibratory rollers used to repave streets and other previously paved areas after open-trench construction and for newly paved areas at the MPWSP Desalination Plant, ASR-5 and ASR-6 Wells, Terminal Reservoir, and Carmel Valley Pump Station and Monterey Pump Station sites.

Construction-related vibration—such as that generated by jackhammers, drill rigs, and vibratory rollers—can cause structural damage to historic-era buildings and structures (Wilson, Ihrig & Associates, 2009:40). Historic buildings in the MPWSP project vicinity include primarily older masonry structures in the City of Monterey as well as wood frame buildings and corrugated metal industrial buildings at the CEMEX sand mining facility. This analysis will use a vibration threshold for historic buildings of 0.12 inches per second (in/sec) peak particle velocity (PPV) at a distance of 25 feet (Wilson, Ihrig, & Associates et al., 2012:12). Table 1 presents the distances at which vibratory construction equipment that would be used during project construction would generate vibration levels at the 0.12-in/sec PPV damage threshold. The construction equipment that would have the greatest PPV is a vibratory roller, which has a typical PPV of 0.210 in/sec at 25 feet (New Hampshire, 2012). The Federal Transit Administration (FTA) provides an equation for estimating vibration at different distances based on a reference PPV of 25 feet for various construction equipment. Using the FTA equation, at distances greater than 45 feet the vibration generated by a vibratory roller is lower than the 0.12-in/sec PPV damage threshold. At distances greater than 25 feet, the vibration level generated by a typical drill rig is lower than the 0.12-in/sec PPV damage threshold. Beyond the distance of the damage threshold, no damage to historic buildings or structures is expected.

**TABLE 1**
**DAMAGE THRESHOLD TO HISTORIC BUILDINGS FROM CONSTRUCTION EQUIPMENT**

| Equipment Type | Typical PPV at 25 feet | Approx. Distance of Damage Threshold (0.12 PPV in/sec) |
|---|---|---|
| Vibratory roller | 0.210 in/sec | 45 feet |
| Drill rig | 0.12 in/sec | 25 feet |
| Bulldozer | 0.089 in/sec | 20 feet |
| Jackhammer | 0.035 in/sec | 15 feet |

SOURCE: Wilson, Ihrig, & Associates et al., 2012

As such, the horizontal extent of the architectural APE is inclusive of any areas that could be subject to significant vibration effects from construction equipment. For project pipelines that are proposed in road ways, the APE encompasses the width of the road right-of-way (typically 50 to 75 feet from curb to curb) as well as buildings and structures within 45 feet of the outside curb. The architectural APE for the subsurface slant wells and the ASR-5 and ASR-6 Wells encompass a 25-foot radius from the point of insertion (i.e., from the locations where the drill rigs would be operated). For project components located in unpaved areas, the architectural APE is 45 feet from the centerline of the pipeline or a 45-foot buffer from a project component.

With respect to project effects on the viewshed or setting visible from a project component, the majority of the proposed project components would be constructed below ground (i.e., pipelines) and would not affect the viewshed or setting associated of potential historic properties. For aboveground components, the viewshed and/or setting visible from a project component is included in the architectural APE.

Summary of Cultural Resources Present:
From 2009 to the present, the archaeological APE has been subject to seven cultural resource studies. Several archaeological sites are present:

- North of Reservation Road
    - P-27-001207 (CA-MNT-1154/H) – Clamshell, 2 chert flakes, glass fragments identified in 2010 adjacent to the railroad, previous site records place the site further to the east (warrants additional study)
    - P-27-002417 – Historic-era railroad grade (not relocated, presumed graded)
    - P-27-002416 – Historic-era fence line (recommended not eligible)

- South of Reservation Road
    - P-27-000377 (CA-MNT-272) – Shell midden with burial identified in 1965. ESA conducted a private utilities check. The APE nearest to this location is impacted by existing utilities and grading for road.
    - P-27-000467 (CA-MNT-372) - Shell midden identified in 1965. ESA conducted a private utilities check. The APE nearest to this location is impacted by existing utilities and grading for road.
    - P-27-000468 (CA-MNT-373) - Multicomponent site with historic-era and prehistoric artifacts identified in 1965. ESA conducted a private utilities check. The APE nearest to this location is impacted by existing utilities and grading for road.
    - P-27-001011 (CA-MNT-955) – Area of midden, incompletely defined. Houses constructed within site boundaries.
    - P-27-000988 (CA-MNT-931) - Re-deposited midden soils in Presidio used for fill during landscaping.
    - Presidio Site #1 - Re-deposited midden soils in Presidio used for fill during landscaping.
    - Presidio Site #2 - Unclear whether the sparse surface scatter in Presidio represents an intact prehistoric deposit or re-deposited midden soil (warrants additional study)

- P-27-001031 (CA-MNT-955) - Unclear whether the sparse surface scatter at High and Jefferson represents an intact prehistoric deposit or re-deposited midden soil (warrants additional study)

In addition, based on the georchaeological assessment, there is a high sensitivity for deeply buried archaeological resources at five locations. Mitigation measures 4.15-2a (Establish Archaeologically Sensitive Areas) and 4.15-2b (Inadvertent Discovery of Cultural Resources) have been recommended.

Identified architectural resources include:

- North of Reservation Road
  - P-27-002923 - Monterey Branch Line of the Southern Pacific Railroad (recommended not eligible)
  - P-27-002923 – feature, Trestle over Tembladero Slough (recommended not eligible)
  - P-27-002923 – feature, Salinas River Railroad Bridge (recommended not eligible)
  - Lapis Sand Mining Plant Historic District - (recommended eligible as a historic district, no direct adverse effect, no indirect adverse effect from vibration or visual impacts)

- South of Reservation Road
  - Spanish Royal Presidio – (National Historic Landmark, no direct adverse effect, potential indirect adverse effect from vibration)
  - Monterey Old Town Historic District - Monterey Pipeline along Madison Street passes through the southern section of the District - (National Register listed, no direct adverse effect, potential indirect adverse effect from vibration)
  - Presidio of Monterey Historic District - Pipeline would pass within 45 feet of three contributing elements (1935 Entrance Monument, 1935 Flagpole, and the 1904 Officer's Club) – (National Register listed, no direct adverse effect, potential indirect adverse effect from vibration)

Consulting Parties:
ESA contacted the Native American Heritage Commission (NAHC) on October 19, 2010 to request a database search for sacred lands or other cultural properties of significance within or adjacent to the proposed project. ESA received a response on October 27, 2010. The sacred lands file did not contain any information on the presence of cultural resources in the vicinity of the proposed project at that time. The Commission provided a list of Native American contacts that might have further knowledge of cultural resources in the vicinity of the proposed project. ESA provided an introductory letter regarding the proposed project to each contact on November 15, 2010.

Once an undertaking has been established, on behalf of the MBNMS, ESA will updated the NAHC contact and provide template letters to initiate consultation with Native American contacts provided by the NAHC.

ESA also contacted the City of Monterey Planning Department to inquire about specific requirements for pipeline installation within the road right of way in Old Town Monterey Historic District. Elizabeth Caraker, Principal Planner from the City, indicated that the City only has requirements regarding archaeological resources and that solid mitigation for any ground disturbance is in place for the event of an unanticipated discovery. The City does not have specific requirements regarding vibration effects on historic buildings.

Next Steps:
ESA is preparing a Cultural Resources Survey Report that includes both an archaeological and architectural analysis of the project's effects for CEQA and NHPA compliance. ESA's report will also assess previous recordation and evaluation efforts, and recommend treatment of resources based on analysis of effect.

As this is a large project, involving multiple governmental agencies, MBNMS would like to extend an invitation to the SHPO to review findings and comment on treatment recommendations prior to submission of the report to your office. This consultation could occur as an in-person, telephone discussion, or webinar session (or a combination).

We look forward to working with your office on this Section 106 consultation. If you have any questions please contact Karen Grimmer, MBNMS Resource Protection Coordinator, at 831-647-4253 or karen.grimmer@noaa.gov

Sincerely,

Paul Michel
Superintendent
Monterey Bay National Marine Sanctuary

Enclosures: Figure 1. Project Location
Draft Area of Potential Effect (APE) figures

cc: Advisory Council on Historic Preservation
California Public Utilities Commission
California American Water
Environmental Science Associates

STATE OF CALIFORNIA – THE NATURAL RESOURCES AGENCY EDMUND G. BROWN, JR., *Governor*

**OFFICE OF HISTORIC PRESERVATION**
**DEPARTMENT OF PARKS AND RECREATION**
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www.ohp.parks.ca.gov

May 03, 2017

In reply refer to: NOAA_2017_0403_001

Mr. Paul Michel, Superintendent
U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Ocean Service – Monterey Bay National Marine Sanctuary
99 Pacific Street, Building 455a, Monterey, CA 93940

Subject: Section 106 Consultation for the Monterey Peninsula Water Supply Project, Monterey County, CA

Dear Mr. Michel:

The Office of Historic Preservation (OHP) received on April 03, 2017 your letter initiating consultation on the above referenced undertaking under Section 106 of the NHPA (as amended), and its implementing regulations found at 36 CFR Part 800. The National Oceanic and Atmospheric Administration (NOAA) has consultation responsibilities related to approving a permit application for the proposed undertaking. Monterey Bay National Marine Sanctuary (MBNMS) will act as NOAA's agency lead for compliance with Section 106.

California American Water Company (CalAm) has proposed a project to construct and operate a water desalinization facility that provides potable water by extraction and then it is transported to users through a connected underground pipe system. The overall project, in Monterey County, is about 18 miles long, from Castroville to the Carmel Valley. Within the Monterey Bay National Marine Sanctuary boundaries, CalAm will construct, operate, maintain and decommission subsurface seawater intake facilities under the sanctuary and to allow brine discharges through an existing ocean outfall facility within the sanctuary.

This new water supply is needed to replace existing supplies constrained by legal decisions affecting the Carmel River and Seaside Groundwater Basin water resources. Specifically, the State Water Resources Control Board (SWRCB) Order Number WR 95-10 (Order 95-10) and associated Cease and Desist Order, and the Monterey Superior Court adjudication of water rights in the Seaside Groundwater Basin, reduce CalAm's use of its two primary sources of supply for the Monterey District. This provides the impetus for implementing the proposed project as the preferred project alternative (Alternative 5a in the EIR/EIS) which is partially located within federal lands of the MBNMS.

The purpose of the federal proposed actions is to authorize otherwise prohibited activities to occur within MBNMS, to ensure that the State and Federal permits and the proposed project comply with MBNMS regulations, and to ensure that MBNMS resources are protected by requiring terms and conditions that may be necessary.

NOAA is seeking comments on the adequacy of defining the Area of Potential Effects (APE), on its historic property identification efforts and on its finding of no adverse effect to historic properties that may be affected. Documents included with the submittal are:

- *Transmittal Letter, dated March 30, 2017 from Environmental Science Associates (ESA)*
- *Monterey Peninsula Water Supply Project, Monterey County: Cultural Resources Survey Report, March 2017 (ESA Project No. D205335). (By: H. Koenig and B. Brewster, ESA-Cultural Resources Group, Petaluma, CA) [For: Monterey Bay National Marine Sanctuary, Monterey, CA] [ESA 2017]*
- *Attachment A: Area of Potential Effect Maps (March 2017);*
- *Attachment B: Site Records (March 2017).*

Project description and component details are provided in the submitted report (ESA 2017: pg. 1-2). The Area of Potential Effects (APE) is identical to the lateral extent of the project area boundary and facilities development and represents all areas where construction-related ground disturbance could occur, including open excavations, construction work areas, and staging areas (Attachment A). The vertical APE depth varies for each project component. Most pipeline trench depths are about 8 feet below ground surface with a few trenchless boring locations being deeper; the Desalinization plant area will be about 12 feet deep; and the slant wells would reach a varied depth of about 190-210 feet beneath the seafloor depending on their drilling location. An indirect APE was established to assess any potential effects for view sheds and construction vibration and related concerns.

On behalf of NOAA, MBNMS contracted with ESA to conduct a records search, historical background studies and make initial contact with the Native American Heritage Commission. As part of the study, ESA surveyed portions of the APE that had not been recently surveyed according to current standards, on October 26 and 27, 2010; November 29 and 30, 2010; September 20, 2012; March 8, 2013; June 7, 2013; April 24, 2014, and June 28, 2016. Aerial photographs of the project vicinity and copies of USGS 7.5-mlnute topographic maps showing previously recorded cultural resources were used to guide the field survey effort.

Study results indicate that seven historic-era archaeological resources and four prehistoric archaeological were previously recorded in a ½-mile search radius (ESA 2017: Table 2, pg. 3-4). Two of the historic-era resources (P-27-002416 and P-27-002417) and one of the prehistoric resources (P-27 001207) are within or adjacent to the APE (Attachment B provides the site records). Two built environment resources have also been recorded and are: the Lapis Sand Mining Historic District (P-27-003386); and the Monterey Branch of the Southern Pacific Railroad (P-27-002923).

NOAA contacted the Native American Heritage Commission for information from their Sacred Lands file and to obtain a list of Native American Tribes and Native American groups and organizations who might have information related to historic properties with religious and cultural significance that may be in the area. NOAA sent letters and several responses were received expressing concerns with project areas and components and recommending that monitoring occur and treatment plans be developed for inadvertent discoveries during project implementation. There are requests to be kept informed as the project progresses. Should subsequent concerns arise NOAA will need to continue with consultation and make notifications as required, pursuant to 36 CFR 800.2(c)(2) and 36 CFR 800.4(a)(4).

ESA evaluated the recorded cultural resources that might be affected by the undertaking (ESA 2017: pp. 5-3 to 5-7; 6-1 Table 4; ff: Figures 4 and 5). Results are summarized in Table 4 as below:

**TABLE 4: SUMMARY OF CULTURAL RESOURCES IN OR ADJACENT TO THE MPWSP APE**

| Designation | Name | Within Direct APE | Within Indirect APE | Eligibility Recommendation | Finding of Effect |
|---|---|---|---|---|---|
| P-27-001207 | Prehistoric site | No | N/A | N/A | Not in APE |
| P-27-002416 | Fence line | Yes | Yes | Not eligible | Not a Historic Property |
| P-27-002417 | Monterey-Salinas Valley Railroad grade | Yes | Yes | Not eligible | Not a Historic Property |
| P-27-002923 | Monterey Branch Line of the Southern Pacific Railroad | Yes | Yes | Not eligible [Cf; Herbert 2010] | Not a Historic Property |
| P-27-003386 | Lapis Sand Mining Plant Historic District | No | Yes | Eligible as a Historic District [Cf: SWCA 2014] | No Historic Property Affected |

Initially, there was a potential to impact some of the contributing buildings of the previously determined-eligible Lapis Sand Mining Plant Historic District, but the project was able to be redesigned to avoid those possible impacts by moving the proposed pipeline alignment. Although trenching will occur, the ground surface will be returned to pre-project condition.

NOAA and MBNMS staff agree with ESA's evaluations and significance of the cultural resources as listed above and in the report (ESA 2017). Based on the documentation, project scope and definition of the APE, MBNMS has determined that there will be no adverse effects to historic properties within the APE and is requesting comments on the delineation of the APE, its historic property identification efforts, and is requesting concurrence for its finding of no adverse effects to historic properties.

After OHP staff review of the documentation, the following comments are offered:

- Pursuant to 36 CFR 800.4(a)(1), there are no objections to the APE as defined;
- Pursuant to 36 CFR 800.4(b), NOAA has documented a reasonable and good faith effort to identify historic properties within the area of potential effects.
- NOAA has determined that the proposed undertaking will result in no adverse effect to historic properties. Pursuant to 36 CFR 800.5(b), **I concur**.

Please be advised that under certain circumstances, such as unanticipated discovery or a change in project description, NOAA may have additional future responsibilities for this undertaking under 36 CFR Part 800 (as amended). Should you require further information, please contact Jeanette Schulz at Jeanette.Schulz@parks.ca.gov or (916) 445-7031.

Sincerely,

Julianne Polanco
State Historic Preservation Officer

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Monterey Bay National Marine Sanctuary
99 Pacific Street, Bldg 455a
Monterey, CA 93940

June 30, 2017

Sent Via Electronic Email Only

Mr. Barry A. Thom
Regional Administrator
National Marine Fisheries Service, West Coast Region
c/o Amanda Morrison
North Central Coast Regional Office
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-4731

SUBJECT: Request for consultation under the Endangered Species Act (ESA) Section 7 and Essential Fish Habitat (EFH) determination under the Magnuson-Stevens Fishery Conservation and Management Act (MSA).

PROJECT: California American Water Company's Monterey Peninsula Water Supply Project (MPWSP); NOAA/MBNMS-2015-022

Dear Mr. Thom:

The California American Water Company (CalAm) proposes to build a desalinization plant, Monterey Peninsula Water Supply Project (MPWSP), which would drill slant wells into the submerged lands of the Monterey Bay National Marine Sanctuary (MBNMS) and discharge concentrated brine through an existing outfall into MBNMS. Their action must be authorized or permitted by several federal agencies, including authorizations by the U.S. Army Corp of Engineers pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. The U.S. Army may issue a land use permit (Army Regulation (AR) 405-80, 200-1). NOAA, through MBNMS, has been designated as the lead federal agency for the purposes of the Endangered Species Act and Essential Fish Habitat (EFH) determination under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). This letter serves to request concurrence with MBNMS' determination under Section 7 of the Endangered Species Act (ESA), Essential Fish Habitat (EFH) under the Magnuson-Stevens Fishery Conservation and Management Act (MSA) for the Proposed Project/Action.

A Biological Assessment (BA) was prepared by CalAm and submitted to MBNMS on June 27, 2017 titled *Monterey Peninsula Water Supply Project, Biological Assessment for National Marine Fisheries Service Consultation.* It analyzes potential effects of CalAm's Monterey Peninsula Water Supply Project (MPWSP; Proposed Action) on listed species and designated critical habitat (DCH) that are regulated by NOAA's National Marine Fisheries Service (NMFS) under the Endangered Species Act, and on Essential Fish Habitat (EFH). This BA has been prepared to meet the Section 7 and EFH requirements identified in 50 Code of Federal Regulations (CFR) §402.12(f) and 50 CFR §600.920, respectively. CalAm is proposing the

MPWSP as a means of developing water supplies for CalAm's Monterey District service area. The Proposed Action would be to issue permits for the CalAm project that include a subsurface seawater intake system, a 6.4 million-gallon-per-day (mgd) seawater reverse osmosis (RO) desalination plant, a brine discharge system, product water conveyance pipelines, one pump station, storage facilities, and improvements to the existing Seaside Groundwater Basin's aquifer storage and recovery system. The purpose of the MPWSP is to replace existing water supplies for CalAm's Monterey District service area, with a focus on reducing water diversions from the Carmel River.

Action Area

The Action Area encompasses the area associated with those project components that have the potential to result in direct or indirect effects on species under NMFS jurisdiction, as identified in 50 CFR §17.11. These species include marine mammals, sea turtles and other marine reptiles, fish (marine and anadromous), and marine invertebrates and plants. For the Proposed Project, there are two Action Areas: 1) one associated with the combined discharge in MBNMS, within Monterey Bay; and 2) one associated with the Castroville Pipeline crossing of the Salinas River.

The **Combined Discharge Action Area (CDAA)** is approximately 1.5 miles (2.4 kilometers [km]) offshore of Marina, California, about 2.5 miles (4.0 km) southwest of the mouth of the Salinas River. The underwater diffuser is 1,100 feet (335 meters) long and sits on ballast rock in approximately 100 feet (30 meters) of water. The CDAA is 162.57 acres (65 hectares) and extends beyond the project footprint; its size varies depending on ocean climate and water chemistry; and the area includes the zone of initial dissolution (ZID), the brine mixing zone (BMZ), and the far-field dilution area. The orientation of area of potential effects of the CDAA would vary depending on ocean climate and water chemistry, but would not be expected to exceed the area associated with the far field dilution of salinity. Based on modeling of the combined discharge, the ZID extends up to 42 feet (12.8 meters), the BMZ extends out 328 feet (100 meters), and the far-field dilution area, in which salinity may increase by 0.5 ppt or more, may extend out as much as 1,148 feet (350 meters) from the diffusers.

The **Salinas River Action Area** is associated with project construction and includes the Castroville Pipeline attached to the underside of the Monte Road Bridge as it crosses the Salinas River. There would be no physical disturbance of the wetted portion of the Salinas River, but limited trimming of vegetation and excavation would be required in the riparian zone to install the pipeline. The Salinas River Action Area is approximately 800 feet (244 meters) long and includes the project footprint required for construction. This area includes the limits of vegetation clearing and removal of riparian vegetation, plus a 50 foot (15 meter) buffer up and downstream of the crossing. The area totals 3.37 acres (1.4 hectares).

Summary of Findings

Based on review of the *Monterey Peninsula Water Supply Project, Biological Assessment for National Marine Fisheries Service Consultation* –provided by CalAm, MBNMS has determined that the Proposed Action, including the proposed terms and conditions, would not reach the scale where take would occur due to loss of migration opportunities or reduction in habitat quantity or quality. As such, MBNMS has determined the following:

1. With implementation of the proposed avoidance and minimization measures, the Proposed Action associated with the Combined Discharge Action Area may affect, but is not likely to adversely affect, the following species:
    - Steelhead trout *(Oncorhynchus mykiss)*– South-Central California Coast (CCC) and CCC Distinct Population Segment (DPS);
    - Chinook salmon *(Oncorhynchus tshawytscha)* – Sacramento River winter-run, Central Valley spring-run, California Coastal ESUs, and various other ESUs;
    - Green Sturgeon (*Acipenser medirostris)* – Southern DPS;
    - Leatherback sea turtle *(Dermochelys coriacea)*
    - Killer whale *(Orcinus orca)*– Southern resident DPS

2. With implementation of the proposed avoidance and minimization measures, the Proposed Action associated with the Salinas River Action Area may affect, but is not likely to adversely affect Steelhead – South-CCC and CCC DPSs.

3. With implementation of the proposed avoidance and minimization measures, the Proposed Action associated with the Combined Discharge Action Area may affect, but is not likely to result in destruction or adverse modification of Designated Critical Habitat (DCH) for Green Sturgeon – Southern DPS and leatherback sea turtle.

4. With implementation of the proposed avoidance and minimization measures, the Proposed Action associated with the Salinas River Action Area may affect, but is not likely to result in destruction or adverse modification of DCH for Steelhead – South-CCC DPS.

5. Although the Proposed Action may result in adverse effects on EFH designated by the Pacific Salmon, Pacific Groundfish, Coastal Pelagic, or Highly Migratory Species Fishery Management Plans (FMPs), such effects would be insignificant and would not preclude use of the Combined Discharge or Salinas River Action Areas by commercially managed species. Additionally, proposed avoidance and minimization measures will be implemented to avoid, reduce, rectify, and mitigate for potential effects on EFH, such as hazardous material spill prevention, minimization of sedimentation and turbidity, and protocols to avoid exceeding water quality objectives from the combined discharge.

<u>Project Description</u>

CalAm proposed to build a desalination plant with the capacity to produce up to 9.6 mgd of desalinated product water (proposed project in MPWSP DEIR/EIS Jan 2017). However, the Monterey Regional Water Pollution Control Agency (MRWPCA) in October 2015, and the California Public Utility Commission (CPUC) in September 2016 approved the Pure Water Monterey Groundwater Replenishment project (GWR), which authorized CalAm to purchase 3,500 afy of the GWR supply for extraction from the Seaside Groundwater Basin. The GWR Project was considered in the MPWSP DEIR/EIS as a project in the cumulative scenario for several of the alternatives, including Alternative 5a, which was determined to be the Environmentally Preferred project by MBNMS. Alternative 5a represents a reduced-capacity project compared to the original proposed desalination facility and is analyzed as the Preferred Alternative for the Biological Assessment. An Endangered Species Act Section 7(a)(2)

Concurrence Letter and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the GWR project was issued by your office on December 5, 2016 (WCR-2016-5540) and is therefore not included in this consultation.

Under the Preferred Alternative (Alternative 5a), approximately 15.5 mgd of raw seawater would be needed to produce 6.4 mgd of desalinated product water. The reverse osmosis (RO) process would generate approximately 8.99 mgd of brine containing salts and other seawater constituents removed from the product water. The salinity of the brine is expected to range between 57 and 58 parts per thousand (ppt), which is roughly 71 to 74 percent higher than seawater. The brine from the desalination plant would be combined RO concentrate from the GWR Project, and a varying amount of treated wastewater. The mixture of brine, RO concentrate, and treated wastewater is referred to as the combined discharge. The combined discharge would be released into Monterey Bay within MBNMS via the existing MRWPCA ocean outfall and diffuser.

The project area extends approximately 18 miles from the town of Castroville in the north to the City of Carmel in the south. The MPWSP would include:

- A seawater intake system, which would consist of seven subsurface slant wells (five active and two on standby; these would consist of the converted test slant well and six new wells) located at the CEMEX site extending seaward of the mean high water line (MHWL) into MBNMS, and a source water pipeline. The six new permanent slant wells would be approximately 900 to 1,000 feet (274 to 305 meters) long and drilled at approximately 19 degrees below horizontal, extending offshore 161 to 356 feet (49 to 111 meters) seaward of the mean high water (MHW) line, to a depth of 190 to 210 feet (58 to 64 meters) beneath the seafloor. All construction activities and ground disturbance would occur above mean sea level, landward of the MHW line. However, the well casings would extend seaward and subsurface of the MHW line, below the seafloor within MBNMS.

- A 6.4 mgd desalination plant and appurtenant facilities, including source water receiving tanks; pretreatment, reverse osmosis (RO), and post-treatment systems; chemical feed and storage facilities; brine storage and facilities; and other associated non-process facilities. The desalination plant would be located on approximately 25 acres (10 hectares) of a vacant, 46-acre (18.6-hectare), parcel of land located along Charles Benson Road in unincorporated Monterey County.

- Desalinated water conveyance facilities, including pipelines, pump stations, clearwells, and Terminal Reservoir. Important to this consultation is the 4.5 mile-long (7.2 km), 12 inch- (30 cm-) diameter Castroville Pipeline that would convey desalinated Salinas Valley return water from the MPWSP Desalination Plant to the Castroville Seawater Intrusion Project (CSIP) distribution system and the Castroville Community Services District (CCSD) Well #3. The Castroville Pipeline would branch off from the Desalinated Pipeline approximately 240 feet (73 meters) south of the intersection of Del Monte Boulevard and Lapis Road. The pipeline would follow Lapis Road north, within the Transportation Agency for Monterey County right-of-way, and would cross over the Salinas River at Monte Road by being attached to the underside of the Monte Road Bridge.

- The brine storage and disposal system would have an uncovered 3 million-gallon brine storage basin with two impermeable liners; two 6 mgd, 40 horsepower brine discharge pumps; and a brine aeration system to maintain dissolved oxygen (DO) concentrations in the brine at 5 milligrams per liter (mg/L). The RO process would generate approximately 8.99 mgd of brine, including decanted backwash water. Brine from the RO system would be conveyed through the 3,900 foot- (1,188–meter-) long, 36 inch- (91–cm-) diameter Brine Discharge Pipeline to a proposed Brine Mixing Facility at the existing

MRWPCA waste water treatment plant and then convey the combined discharge to the existing MRWPCA ocean outfall that discharges into the waters of MBNMS. The existing MRWPCA ocean outfall pipeline is 2.1 miles-long (3.8 km) and ends with a 1,100 foot- (335 meter-) long, underwater diffuser that rests on rock ballast. The diffuser ports are approximately 6 inches (15 cm) above the rock ballast and nominally 54 inches (137 cm) above the seafloor, although this height varies due to unevenness in the sea floor topography. For the dilution calculations, the ports are assumed to be 4 feet (1.2 meters) above the seafloor at approximately 90 to 110 feet (27 to 34 meters) below sea level. The diffuser is equipped with 172 ports (129 open and 43 closed), each 2 inches (5 cm) in diameter and spaced 8 feet (2.4 meters) apart.

- An expanded Aquifer Storage and Recovery (ASR) system, including two additional injection/extraction wells (ASR-5 and ASR-6 Wells), two parallel ASR Conveyance Pipelines to convey water to and from the ASR-5 and ASR-6 Wells, and an ASR Pump-to-Waste System.

Project Operations

The only aspect of operations that may affect listed species is the use of the existing wastewater outfall to discharge brine in combination with other treated discharges.

The MPWSP Desalination Plant would operate at an overall recovery rate of 42 percent. Approximately 15.5 mgd of raw seawater would be needed to produce 6.4 mgd of desalinated product water. The salinity of the brine is expected to range between 57 and 58 ppt, which is roughly 71 to 74 percent higher than seawater. The brine stream would be discharged to Monterey Bay via the existing MRWPCA ocean outfall and diffuser.

Brine would be mixed with treated wastewater from the MRWPCA Regional Wastewater Treatment Plant during some times of the year before being discharged through the ocean outfall. During the agricultural irrigation season, April through October, the treated wastewater is diverted to the Salinas Valley Reclamation Project's tertiary treatment facility for additional advanced treatment and then used to irrigate crops as part of the Castroville Seawater Intrusion Project (CSIP). During irrigation season, the project's brine stream would be discharged to Monterey Bay without wastewater dilution if the MRWPCA treated wastewater flows are equal to or less than the CSIP demand for irrigation water. During the non-irrigation season (November through March), when the CSIP is not operating, the brine stream would be mixed with treated wastewater from the MRWPCA Regional Wastewater Treatment Plant before being discharged to the ocean.

Year-round, the brine would be blended with 0.94 mgd of RO concentrate from the Pure Water Monterey Groundwater Replenishment (GWR) Project. Together, the brine from the Proposed Action, GWR concentrate, and treated wastewater effluent are referred to as the "combined discharge." The MRWPCA's diffuser would disperse the combined discharge along its multiport length, increasing the initial dilution and thereby minimizing salinity differences between the discharges and the surrounding seawater. Multiple scenarios have been modeled in regard to compliance with California Ocean Plan objectives based on three different oceanic conditions and varying quantities of the three waste streams identified above. The specific information is included in the DEIR/EIS and the *Monterey Peninsula Water Supply Project, Biological Assessment for National Marine Fisheries Service Consultation.*

Construction Schedule

Construction is expected to start July 2018 and continue through June 2020 (24 months total).

The slant well installation would be conducted in two phases: (1) well drilling and (2) well development. All construction activities for the subsurface slant wells would occur inland of the year 2020 MHW line and in previously disturbed areas, landward of the dunes. Surface construction activities would occur outside of MBNMS. Slant well construction would take approximately 10 to 12 months to complete, and could take place anytime throughout the overall 24 month construction duration for the Proposed Action.

Pipeline installation would occur at a rate of approximately 150 to 250 feet per day over the 24 month construction period. The Castroville Pipeline is expected to take 4 months for construction.

Critical Habitat for Species with Potential to Occur

**Combined Discharge Action Area:**

DCH is **not** present in the Combined Discharge Action Area for the following Species:

- Steelhead – South Central California Coast DPS and Central California Coast DPS
- Coho Salmon - Central California Evolutionary Significant Unit (ESU)
- Chinook Salmon *(Oncorhynchus kisutch)*– Sacramento River Winter Run; Central Valley Spring-Run; California Coastal ESUs
- Humpback Whale *(Megaptera novaeangliae)* – Mexico, Central America DPS
- Killer Whale – Southern Resident DPS
- Eulachon *(Thaleichthys pacificus)* – Southern DPS
- Green sea turtle *(Chelonia mydas)* - East Pacific DPS
- Olive Ridley sea turtle *(Lepidochelys olivacea)*
- Loggerhead sea turtle *(Caretta caretta)*– North Pacific DPS
- Blue whale *(Balaenoptera musculus)*
- Fin whale *(Balaenoptera physalus)*
- North Pacific right whale *(Eubalaena japonica)*
- Sperm whale *(Physeter macrocephalus)*
- Guadalupe fur seal *(Arctocephalus townsendi)*

DCH for Green Sturgeon – Southern DPS is present in the Combined Discharge Action Area. The designation includes the coastal marine habitat off California from Monterey Bay, north and east to include waters in the Strait of Juan de Fuca, Washington, and extends from mean higher high water to a depth of 358 feet (109 meters) (74 FR 52300). The primary consistent elements essential for the species in coastal marine areas include migratory corridors, water quality, and food resources. The designation includes the entirety of the Action Area, including the vertical water column associated with the combined discharge.

DCH for Leatherback Sea Turtle includes the portion of the Combined Discharge Action Area. The Action Area is in Area 1, which includes the species' principal foraging areas, characterized by high densities of primary prey species (brown sea nettle [*C. fuscenscens*]) during upwelling shadows that create retention areas (77 FR 4170). Critical habitat extends from the shoreline (extreme low water line) out to a water depth of 262 feet (80 meters).

**Salinas River Action Area:**
Designated Critical Habitat (DCH) is **not** present in the Salinas River Action Area for the following Species:

- Coho Salmon - Central California ESU
- Chinook Salmon – Sacramento River Winter Run; Central Valley Spring-Run; California Coastal ESUs

Designated Critical Habitat for Steelhead – South Central California Coast DPS and Central California Coast DPS, is associated with the Salinas River Action Area. The Action Area overlaps 0.47 acres (0.19 hectares) of DCH, based on the delineation of ordinary high water mark, Project activities would occur from above the water surface from the bridge deck, from a barge, or adjacent to the DCH. No vegetation trimming would occur within DCH.

<u>Essential Fish Habitat (EFH)</u>
Pacific Coast Salmon Fishery Management Plan - EFH is present in the Combined Discharge Action Area for two of the species: Chinook and coho salmon. The areas of EFH include all marine waters north of Point Conception and the areas off Alaska extending to the exclusive economic zone (EEZ). Freshwater and estuarine EFH habitat components are not present in the Action Area associated with either the combined discharge or the pipeline crossing of the Salinas River. Habitat elements for the Chinook salmon and coho salmon in the marine EFH include estuarine rearing, ocean rearing, and juvenile and adult migration. Features that are important to the species include good/adequate water quality; adequate/cool water temperatures; adequate/abundant prey species and forage base; and adequate depth and habitat complexity, including vegetation and algae. Specific elements for Chinook salmon also include connectivity with terrestrial ecosystems.

Habitat Areas of Particular Concern (HAPC) are generally identified based on definitions of complex channel and floodplain habitat, thermal refugia, spawning habitat, estuaries, and marine and estuarine submerged aquatic vegetation. None of these HAPCs or other areas of interest are located in the Combined Discharge Action Area. However, the Salinas River lagoon is an estuary, and considered an HAPC, although Chinook and coho salmon are not known to originate from the Salinas River watershed.

Pacific Coast Groundfish (PCG) Fishery Management Plan - Due to the large number of species and the lack of data for all species life histories, EFH has been designated for the assemblage of groundfish species. Furthermore, a Habitat Suitability Probability model confirmed that these areas are particularly suitable groundfish habitat. The overall existing groundfish EFH includes all waters and substrate in depths of less than 11,483 feet (3,500 meters) to the mean higher high water level or the upriver extent of saltwater intrusion; and seamounts in depths greater than 11,483 feet (3,500 meters) and any areas designated as a HAPC.

The Combined Discharge Action Area is within the identified limits of the PCG EFH, and many of the Habitat Suitability Probability model results identify groundfish species in various life stages in this Action Area (PFMC 2016a).

The Salinas River Action Area is also located in the PCG EFH, because the average salinity is above 0.5 ppt (0.94 ppt geometric mean) (RWQCB 2016).

Several types of HAPCs are identified in the PCG FMP; these include estuaries, canopy kelp, seagrass, and rocky reefs. None of these HAPCs or other areas of interest are located in the Combined Discharge Action Area. However, the Salinas River lagoon is mapped as an estuary, and considered a HAPC that is present in the Salinas River Action Area.

Consultation Summary

With regard to Federal Endangered Species Act (ESA) consultation for the Proposed Action, MBNMS was involved in the following agency coordination meetings:

- Meeting with U.S. Fish and Wildlife Service (USFWS) on November 12, 2015: USFWS, AECOM, Environmental Science Associates, California Department of Fish and Wildlife (CDFW), CalAm, Point Reyes Bird Observatory (now Point Blue), and MBNMS discussed federal consultation requirements, coordination of whole project for consultation, timing of BAs and environmental review, and state needs.
- Meeting with USFWS on April 20, 2016: USFWS, AECOM, CDFW, MBNMS, and other consultants.
- US Army and US Army Corp of Engineers participated as Cooperating Agencies/Participating Agencies under the section 1508.5 of the National Environmental Policy Act (NEPA).

Mitigation Commitments by CalAm

CalAm will retain a lead biologist to oversee implementation of Avoidance and Minimization Measures to protect special-status species and sensitive natural communities during construction and periodic maintenance activities. In the event that construction-related activities have the potential to violate the prescribed special-status species and habitat protection measures, the project Lead Biologist, or other appointed qualified biological monitors will report to construction or operational site supervisors with authority to stop work to prevent any violations. Work will proceed only after the construction-related hazards to special-status species and habitats are removed and the species is no longer at risk. Avoidance and Minimization Measures include:

1) Implement general best management practices (BMPs) (See *Monterey Peninsula Water Supply Project, Biological Assessment* for *National Marine Fisheries Service Consultation*–Section 6.2 for list of 15 BMPs.
2) Environmental Awareness Training will be provided to all construction workers prior to starting work.

3) A Storm Water Pollution Prevention Plan and Hazardous Materials Spill Prevention Plan will be developed and implemented.
4) Contractors will implement a dust control plan on construction sites.
5) Water quality monitoring prior to any discharge resulting from the desalination plant will ensure no exceedance of the California Ocean Plan water quality objectives (WQO). If WQOs cannot be met, additional design features, engineering controls, or operational measures will be required. These might include:
    a. Additional pre-treatment at desalination plant.
    b. Additional treatment prior to discharge such as, use of granulated activated carbon, advanced oxidation with UV light and concurrent addition of hydrogen peroxide.
    c. Biological active filtration downstream of ozone treatment.
    d. Retrofitting the existing outfall to increase dilution by positioning the diffuser jets at an angle that will optimize maximum dilution.
    e. Flow augmentation, which will add up to 5 MGD of brackish water to the discharge to increase the dilution of the brine.
6) A Habitat Mitigation and Monitoring Plan (HMMP) will be developed and submitted to appropriate resource agencies for approval prior to project construction. The HMMP will be implemented at all areas where special-status species habitat or sensitive natural communities will be restored, created, or enhanced to mitigate for project impacts either prior to, concurrently with, or following project construction, as specified in the HMMP. The HMMP will outline measures to be implemented to, depending on the mitigation requirements, restore, improve, or reestablish special-status species habitat, sensitive natural communities, and critical habitat on the site.

In summary, we request your concurrence with our 'not likely to adversely affect' determinations, and hereby request informal consultation under Section 7 of the ESA and EFH under MSA. If you have any questions, please contact Bridget Hoover, of my staff, at 831-647-4217 or by email at bridget.hoover@noaa.gov.

Sincerely,

Paul Michel
Superintendent
Monterey Bay National Marine Sanctuary

Enclosure: MPWSP BA for NMFS Consultation

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Prepared by
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300 Lakeside Drive, Suite 400
Oakland, CA 94612
June 2017

# Monterey Peninsula Water Supply Project

# Biological Assessment for National Marine Fisheries Service Consultation

*Photo: Copyright © 2015 Kenneth and Gabrielle Adelman, California Coastal Records Project, www.californiacoastline.org*

**Prepared for:**
**Monterey Bay National Marine Sanctuary**
**99 Pacific Street, Bldg. 455A**
**Monterey, California 93940**

**June 2017**

# Table of Contents

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# List of Acronyms

| | |
|---|---|
| afy | acre-feet per year |
| ASR | aquifer storage and recovery |
| BA | Biological Assessment |
| BIRP | Begonia Iron Removal Plant |
| BMP | best management practice |
| BMZ | brine mixing zone |
| °C | degrees Celsius |
| CalAm | California American Water |
| CCC | Central California Coast |
| CCLEAN | Central Coast Long-Term Environmental Assessment Network |
| CCSD | Castroville Community Services District |
| CDFW | California Department of Fish and Wildlife |
| CEQA | California Environmental Quality Act |
| CESA | California Endangered Species Act |
| CFR | Code of Federal Regulations |
| cm | centimeter |
| cm/s | centimeters per second |
| CNDDB | California Natural Diversity Database |
| CPS | Coastal Pelagic Species |
| CPUC | California Public Utilities Commission |
| CSIP | Castroville Seawater Intrusion Project |
| DCH | Designated Critical Habitat |
| DDT | dichloro-diphenyl-trichloroethane |
| DO | dissolved oxygen |
| DPS | Distinct Population Segment |
| EEZ | exclusive economic zone |
| EFH | Essential Fish Habitat |
| EIR | Environmental Impact Report |
| EIS | Environmental Impact Statement |
| ESA | Endangered Species Act |
| ESU | Evolutionarily Significant Unit |
| °F | degrees Fahrenheit |
| FMP | Fishery Management Plan |
| FR | Federal Register |
| GAC | granular activated carbon |
| gpm | gallons per minute |
| GWR | Pure Water Monterey Groundwater Replenishment Project |
| HAPC | Habitat Area of Particular Concern |
| HMMP | Habitat Mitigation and Monitoring Plan |
| HMS | Highly Migratory Species |
| hp | horsepower |
| $kg/m^3$ | kilograms-per-cubic meter |
| KLI | Kinnetic Laboratories, Incorporated |
| km | kilometer |
| LC50 | the lethal concentration at which 50 percent of the population is killed |
| $m^3$ | cubic meter |
| MBNMS | Monterey Bay National Marine Sanctuary |
| MCWD | Marina Coast Water District |
| MCWRA | Monterey County Water Resources Agency |
| mgd | million gallons per day |
| mg/g | milligrams per gram |
| µg/L | micrograms per liter |

| | |
|---|---|
| mg/L | milligram per liter |
| MHW | mean high water |
| Monterey District | Monterey District service area |
| mm | millimeter |
| MPWMD | Monterey Peninsula Water Management District |
| MPWSP | Monterey Peninsula Water Supply Project |
| MRWPCA | Monterey Regional Water Pollution Control Agency |
| MSA | Magnuson-Stevens Fishery Conservation and Management Act |
| NCCOS | National Oceanic Atmospheric Administration National Centers for Coastal Ocean Science |
| NEPA | National Environmental Policy Act |
| NPDES | National Pollutant Discharge Elimination System |
| NMFS | National Marine Fisheries Service |
| NOAA | National Oceanic and Atmospheric Administration |
| NOS | National Ocean Service |
| ONMS | Office of National Marine Sanctuaries |
| PAH | polynuclear aromatic hydrocarbon |
| PCB | polychlorinated biphenyl |
| PCDD | polychlorinated dipenzo-p-dioxin |
| PCFM | Pacific Fishery Management Council |
| PCG | Pacific Coast Groundfish |
| PCS | Pacific Coast Salmon |
| PFMC | Pacific Fishery Management Council |
| pH | potential of hydrogen |
| ppt | part per thousand |
| RO | reverse osmosis |
| ROW | right-of-way |
| RUWAP | Regional Urban Water Augmentation Project |
| RWQCB | Regional Water Quality Control Board |
| SIMoN | Sanctuary Integrated Monitoring Network |
| South-CCC | South-Central California Coast |
| SWPPP | Storm Water Pollution Prevention Plan |
| SWRCB | State Water Resources Control Board |
| TAMC | Transportation Agency for Monterey County |
| TCDD | tetrachlorodibenzo-p-dioxin |
| U.S. EPA | Environmental Protection Agency |
| USFWS | U.S. Fish and Wildlife Service |
| ZID | zone of initial dilution |

# Executive Summary

As the lead federal agency, the Monterey Bay National Marine Sanctuary (MBNMS) is responsible for compliance with the Endangered Species Act (ESA). This Biological Assessment (BA) analyzes the potential effects of the proposed federal actions including MBNMS issuing authorizations and a permit to the California American Water (CalAm) Company's Monterey Peninsula Water Supply Project (MPWSP) on listed species and designated critical habitat (DCH) that are regulated by the National Marine Fisheries Service (NMFS) under the ESA, and on Essential Fish Habitat (EFH). This BA has been prepared to meet the ESA and EFH requirements identified in 50 Code of Federal Regulations (CFR) §402.12(f) and 50 CFR §600.920, respectively. The Proposed Action would include a subsurface seawater intake system, a 6.4-million-gallon-per-day (mgd) seawater reverse osmosis (RO) desalination plant, a brine discharge system, product water conveyance pipelines, one pump station, storage facilities, and improvements to the existing Seaside Groundwater Basin's aquifer storage and recovery system. The purpose of the Proposed Action is to replace existing water supplies for CalAm's Monterey District service area, with a focus on reducing water diversions from the Carmel River and extractions from the Seaside Groundwater Basin.

The draft Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) for the Proposed Action was published on January 13, 2017. This BA analyzes the effects on listed species regulated by NMFS that are associated with the Proposed Action and the various project components described in the January 2017 Draft EIR/EIS (identified as the environmental preferred alternative, Alternative 5a)[1], except where noted.

Because a portion of the Proposed Action occurs within MBNMS and is subject to MBNMS review and approval, the National Oceanic and Atmospheric Administration's ONMS is reviewing the MPWSP activities. Three federal actions are associated with the MPWSP, including (1) authorization of a Coastal Development Permit; (2) authorization of a Central Coast Regional Water Quality Control Board-issued National Pollutant Discharge Elimination System permit or other discharge authorization; and (3) issuance of a currently-proposed special use permit to CalAm for the continued presence of a pipeline conveying seawater to a desalination facility.

Implementation of the Proposed Action would produce, transfer, and store desalinated water to convey it to CalAm customers via the existing distribution system, and increase use of existing storage capacity in the Seaside Groundwater Basin. Construction is expected to start July 2018 and continue through June 2020 (24 months total).

The MPWSP Desalination Plant would operate at an overall recovery rate of 42 percent. Approximately 15.5 mgd of raw seawater would be needed to produce 6.4 mgd of desalinated product water. The reverse osmosis (RO) process would generate approximately 8.99 mgd of brine containing salts and other seawater constituents removed from the product water. The salinity of the brine is expected to range between 57 and 58 parts per thousand (ppt), which is roughly 71 to 74 percent higher than seawater (Flow Science Inc. 2014). The brine would usually be combined with RO concentrate from the Pure Water Monterey Groundwater Replenishment Project, and with varying amounts of secondary treated wastewater. The mixture of brine, RO concentrate, and treated wastewater is referred to as the combined discharge, which would be discharged into Monterey Bay within MBNMS via the existing Monterey Regional Water Pollution Control Agency (MRWPCA) ocean outfall and diffuser.

The Castroville Pipeline would cross over the Salinas River at Monte Road by being attached to the underside of the Monte Road Bridge. Limited trimming of vegetation and excavation would be required in the riparian zone to install the pipeline.

[1] The Proposed Project or Action in the DEIR/EIS is a larger version of the project, with the same components and at the same location; the Proposed Action in this BA is the reduced-size project analyzed as Alternative 5a in the DEIR/EIS.

**For this marine resources BA, the Action Area encompasses the area associated with those project components that have the potential to result in direct or indirect effects on species under NMFS jurisdiction, as identified in 50 CFR §17.11. These species include marine mammals, sea turtles and other marine reptiles, fish (marine and anadromous), and marine invertebrates and plants. For the Proposed Action, there are three Action Areas: 1) one associated with the brine discharge in MBNMS, within Monterey Bay; 2) one associated with construction of the Castroville Pipeline crossing of the Salinas River; and 3) the drilling of the slant wells underneath the intertidal and subtidal waters of Monterey Bay. The latter would have no potential effects on resources under NMFS jurisdiction, because the drilling would not generate detectable noise or have other effects in the water column.**

**The Action Area associated with the combined brine discharge is approximately 1.5 miles (2.4 kilometers [km]) offshore of Marina, California, and about 2.5 miles (4.0 km) southwest of the mouth of the Salinas River. The existing underwater diffuser is 1,100 feet (335 meters) long and sits on ballast rock in about 100 feet (30 meters) of water. The combined discharge Action Area is 162.57 acres (65 hectares) and extends beyond the underwater diffuser; its size varies depending on ocean climate and water chemistry; and includes the zone of initial dilution (ZID), the brine mixing zone (BMZ), and the far-field dilution area. The orientation of area of potential effects of the combined discharge Action Area would vary depending on ocean climate and water chemistry, but would not be expected to exceed the area associated with the far field dilution of salinity. Based on modeling of the combined discharge (Roberts 2016, Appendix B), the ZID extends up to 42 feet (12.8 meters), and the far-field dilution area, in which salinity may increase by 0.5 ppt or more, may extend out as much as 1,148 feet (350 meters) from the diffusers. The BMZ, as defined by the California Ocean Plan (SWRCB 2015, revised and effective January 28, 2016), extends out 328 feet (100 meters), a distance at which certain water quality requirements must be met.**

**The Action Area associated with the Salinas River crossing is approximately 1,081 feet (330 meters) long and includes the project footprint required for construction. This area includes the limits of vegetation clearing and removal of riparian vegetation, plus a 50-foot (15-meter) buffer up and downstream of the crossing; it totals 3.37 acres (1.4 hectares).**

**A separate BA for potential project-related effects on species that are under the jurisdiction of the U.S. Fish and Wildlife Service has been prepared.**

**A review of literature was used to compile information on current, and proposed, threatened or endangered species, proposed and current DCH, species occurrence records, and EFH in the Action Area. Based on the background review and a subsequent field review of the Salinas River crossing, it was determined that the Action Area provides habitat suitable to support the following federally listed species that are regulated by NMFS under the Endangered Species Act:**

- **Steelhead – South-Central California Coast (South-CCC) Distinct Population Segment (DPS) and Central California Coast (CCC) DPS (*Oncorhynchus mykiss*) -- Threatened;**
- **Coho salmon – South-Central California Evolutionarily Significant Unit (ESU) (*Oncorhynchus kisutch*) -- Threatened;**
- **Chinook salmon – Sacramento River winter-run, Central Valley spring-run, California Coastal ESUs (*Oncorhynchus tshawytscha*) -- Endangered, Threatened, and Threatened, respectively**
- **Green Sturgeon – Southern DPS (*Acipenser medirostris*) -- Threatened;**
- **Leatherback Sea Turtle (*Dermochelys coriacea*) -- Endangered;**
- **Humpback Whale Mexico DPS; Central America DPS (*Magaptera novaeangliae*) – Threatened and Endangered, respectively; and**
- **Killer Whale – Southern Resident DPS (*Orcinus orca*) -- Endangered.**

**The Action Area is also in an area identified as EFH for various life stages of fish species that are managed in accordance with Fishery Management Plans (FMPs) under the Magnuson-Stevens Fishery Conservation and Management Act, including:**

- **Pacific Coast Salmon (PCS) FMP,**
- **Pacific Coast Groundfish (PCG) FMP,**
- **Coastal Pelagic Species (CPS) FMP, and**
- **FMP for U.S. West Coast Fisheries for Highly Migratory Species (HMS).**

**Additionally, there is DCH in the Action Area for the Steelhead – South-CCC DPS and the Green Sturgeon – Southern DPS.**

**Installation of the overwater pipeline crossing at the Salinas River Lagoon has the potential to injure or kill, and temporarily harm or harass the Steelhead – South-CCC DPS. Although the Proposed Action would result in pipeline being installed above the mean high water line and outside of the DCH, construction activities would result in the trimming of 0.86 acre (0.35 hectare) and removal of 0.05 acres (0.02 hectare) of riparian vegetation adjacent to DCH; and the use of a barge during construction may cause minor and temporary disturbance of the substrates within the Salinas River Lagoon. These effects would be minimized through implementation of avoidance and minimization measures, including measures to reduce siltation and erosion, measures to prevent the spread of invasive plant species, and the implementation of a mitigation and monitoring plan to ensure that temporary impacts on natural vegetation are properly restored, and to provide compensation for permanent impacts, if any.**

**Potential effects on the marine environment within MBNMS are limited to the release of the combined discharge at the existing wastewater outfall, which may have effects in the area associated with the ZID, BMZ, and far-field dilution. The operation impacts of the Proposed Action associated with the combined discharge into Monterey Bay include mortality of a very small proportion of plankton due to shear stress caused by entrainment into turbulent flows at the diffuser, and minor changes to benthic community structure in the area affected by increased salinity or ammonia. Such changes are expected to have an insignificant and discountable effect on steelhead (South-CCC DPS and CCC DPS), coho salmon (Central California ESU), Chinook salmon (Sacramento River winter run ESU, Central Valley spring-run ESU, California Coastal ESU), green sturgeon (Southern DPS), leatherback sea turtle, humpback whale, and killer whale (southern DPS). The Proposed Action will not cause a meaningful increase in bioaccumulation of contaminants due to the combined discharge.**

**Similarly, the combined discharge resulting from the Proposed Action may cause changes to the benthic community due to elevated ammonia or salinity within DCH for the Green Sturgeon – Southern DPS. However, overall productivity of benthic organisms is not expected to be reduced as a result of the combined discharge.**

**Potential effects on EFH for Pacific salmon may result from minor changes to the benthic habitat in the area affected by the combined discharge, primarily affecting habitat that may be used by Chinook salmon. Plankton smaller than 1mm , which may serve as forage for coho salmon, may experience mortality due to turbulence-induced shear stress. The EFH for Pacific groundfish, which include benthic species, may be affected by the Proposed Action. The potential effects include a reduction in the forage quality for some groundfish species, and improvement of the forage quality for others. Potential effects of the combined discharge on EFH for CPS and HMS are not expected to occur because the combined discharge may only exceed water quality objectives under negatively buoyant discharge scenarios, where the discharge would not interact with pelagic waters that support CPS. However, all such effects on the EFH are expected to be insignificant and discountable in relation to the volume of Monterey Bay. For all potential effects on EFH resulting from the combined discharge, implementation of the protocols to avoid exceeding water quality objectives will ensure that established water quality objectives that are defined at the edge of the BMZ (100 meters/328 feet), are not exceeded outside of the ZID (12.8 meters/42 feet); this would greatly limit the area of EFH potentially affected by the Proposed Action.**

**MBNMS has identified avoidance and minimization measures that will be implemented to avoid, reduce, rectify, and mitigate potential effects on the listed species and their suitable habitats. These**

**measures include best management practices, environmental awareness training, biological monitoring and surveys, hazardous material spill prevention, minimization of sedimentation and turbidity, minimization of noise, development and implementation of a mitigation and monitoring plan, and protocols to avoid exceeding water quality objectives from the combined discharge.**

**With implementation of the proposed avoidance and minimization measures, MBNMS has determined that the Proposed Action associated with the combined discharge *may affect, but is not likely to adversely affect*, the following species:**

- **Steelhead – South-CCC and CCC DPS;**
- **Chinook salmon – Sacramento River winter-run, Central Valley spring-run, California Coastal ESUs, and various other ESUs;**
- **Green Sturgeon – Southern DPS;**
- **Leatherback sea turtle; and**
- **Killer whale – Southern resident DPS.**

**With implementation of the proposed avoidance and minimization measures, MBNMS has determined the Proposed Action associated with the Salinas River crossing *may affect, but is not likely to adversely affect*, steelhead – South-CCC and CCC DPSs.**

**With implementation of the proposed avoidance and minimization measures, MBNMS has determined the Proposed Actions associated with the combined discharge *may affect, but are not likely to result in destruction or adverse modification* of DCH for the Green Sturgeon – Southern DPS and leatherback sea turtle.**

**With implementation of the proposed avoidance and minimization measures, MBNMS has determined the Proposed Actions associated with the Salinas River crossing *may affect, but are not likely to result in destruction or adverse modification* of DCH for the Steelhead – South-CCC DPS.**

**MBNMS has determined that although the Proposed Action *may result in adverse effects* on EFH designated for the Pacific salmon, Pacific groundfish, coastal pelagic, or HMS FMPs, such effects would be insignificant and would not preclude use of the combined discharge or Salinas River Action Areas by commercially managed species. Additionally, proposed avoidance and minimization measures will be implemented to avoid, reduce, rectify, and mitigate for potential effects on EFH, such as hazardous material spill prevention, minimization of sedimentation and turbidity, development and implementation of a mitigation and monitoring plan, and protocols to avoid exceeding water quality objectives from the combined discharge.**

# 1 Introduction

As the lead federal agency, Monterey Bay National Marine Sanctuary (MBNMS) is responsible for compliance with the Endangered Species Act (ESA). This Biological Assessment (BA) analyzes the potential effects of the proposed federal actions including MBNMS issuing authorizations and a permit to the California American Water (CalAm) Company's Monterey Peninsula Water Supply Project (MPWSP; Proposed Action[2]) on listed species and designated critical habitat (DCH) that are regulated by the National Marine Fisheries Service (NMFS) under the ESA, and on Essential Fish Habitat (EFH). This BA has been prepared to meet the ESA and EFH requirements identified in 50 Code of Federal Regulations (CFR) §402.12(f) and 50 CFR §600.920, respectively. The MPWSP would include a subsurface seawater intake system, a 6.4-million-gallon-per-day (mgd) seawater reverse osmosis (RO) desalination plant, a brine discharge system, product water conveyance pipelines, one pump station, storage facilities, and improvements to the existing Seaside Groundwater Basin's aquifer storage and recovery (ASR) system. The purpose of the Proposed Action is to replace existing water supplies for CalAm's Monterey District, with a focus on reducing surface water diversions from the Carmel River and extractions from the Seaside Groundwater Basin.

The public draft of the Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) was prepared for the Proposed Action by MBNMS, the National Environmental Policy Act (NEPA) lead federal agency, in coordination with the California Public Utilities Commission (CPUC), the lead agency for the California Environmental Quality Act (CEQA); and was published on January 13, 2017. This BA analyzes the effects on listed species regulated by NMFS associated with the Proposed Action and the various project components described in the January 2017 Draft EIR/EIS (identified as the environmentally preferred alternative, Alternative 5a), except where noted.

CalAm and the MPWSP are constrained by legal decisions affecting the Carmel River and Seaside Groundwater Basin water resources. The State Water Resources Control Board (SWRCB) directed CalAm to reduce and eventually terminate unlawful diversion of water from the Carmel River in excess of its legal entitlement of 3,376 acre-feet per year (afy) (SWRCB Order 95-10 and subsequent Cease and Desist Order 2009-0060). Order 95-10 directed CalAm to maximize use of the Seaside Groundwater Basin, among other requirements.

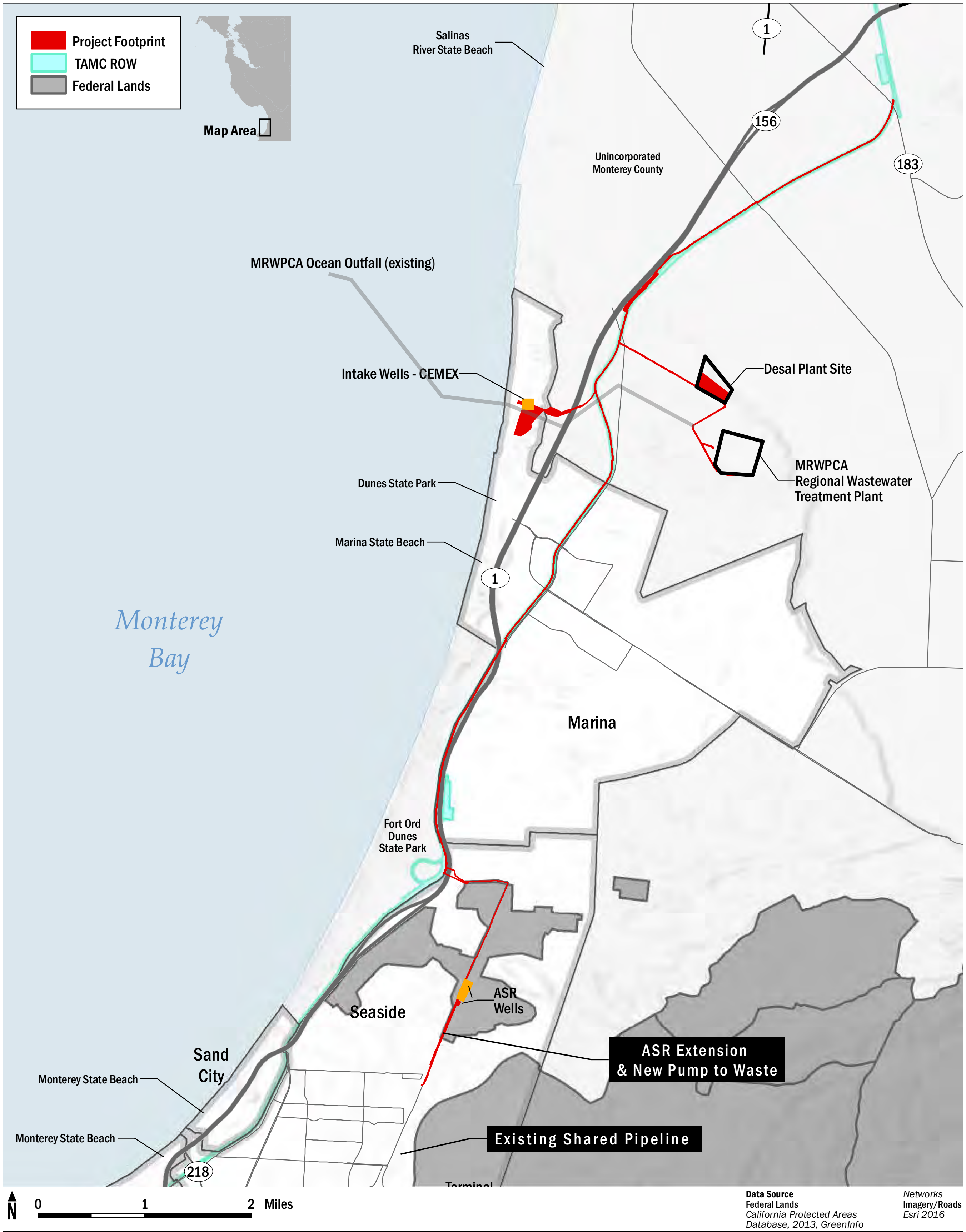
In 2006, the Monterey County Superior Court adjudicated the waters right of all users of the Seaside Groundwater basin for the purpose of avoiding long-term damage to the basin. The adjudication substantially reduced the amount of groundwater available to CalAm (from approximately 4,000 afy to 1,474 afy).

On July 19, 2016, the SWRCB adopted Order WR 2016-0016 amending Order WR 2009-0060 to require that unauthorized diversions from the Carmel River end by December 31, 2021. CalAm must replace this reduction in source water with a consistent and reliable water supply to maintain existing service to its Monterey District customers. In response, CalAm has proposed the MPWSP to the CPUC and MBNMS. The MPWSP (the Proposed Action) and several feasible alternatives are analyzed in the EIR/EIS.

The Proposed Action would consist of an infrastructure expansion that would include the construction of a subsurface seawater intake system, a 6.4-mgd desalination plant and attached or auxiliary facilities, desalinated water conveyance facilities (e.g., pipelines, pump stations, and tanks), and an expanded ASR system (injection and extraction wells, pipelines). The project vicinity is shown in Figure 1. The primary objectives of the Proposed Action are to:

1. Develop water supplies for CalAm Monterey District service area to replace existing Carmel River water, in accordance with SWRCB Orders 95-10 and 2016-0016;

[2] The Proposed Project or Action in the DEIR/EIS is a larger version of the project, with the same components and at the same location; the Proposed Action in this BA is the reduced-size project analyzed as Alternative 5a in the DEIR/EIS.




**California American Water**

*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 1**

*Project* Location

2. Develop water supplies to enable CalAm to reduce pumping from the Seaside Groundwater Basin consistent with the adjudication of the groundwater basin, with natural yield and improvement of groundwater quality;
3. Provide water supplies to allow CalAm to meet its obligation to pay back the Seaside Groundwater Basin by approximately 700 afy over 25 years, as established by the Seaside Groundwater Basin Watermaster;
4. Develop a reliable water supply for the CalAm Monterey District service area, accounting for the peak month demand of existing customers;
5. Develop a reliable water supply that meets fire flow requirements for public safety;
6. Provide sufficient water supplies to serve existing vacant legal lots of record;
7. Accommodate tourism demand under recovered economic conditions;
8. Minimize energy requirements and greenhouse gas emissions per unit of water delivered; and
9. Minimize project cost and associated water rate increases (CPUC and MBNMS 2017).

The secondary objectives of the Proposed Action are to:

1. Locate key project facilities in areas that are protected against predicted future sea-level rise in a manner that maximizes efficiency for construction and operation, and minimizes environmental impacts;
2. Provide sufficient conveyance capacity to accommodate supplemental water supplies that may be developed at some point in the future to meet build-out demand in accordance with adopted General Plans; and
3. Improve the ability to convey water to the Monterey Peninsula cities by eliminating the hydraulic lowpoint in front of the Naval Postgraduate School, improving the existing interconnections at satellite water systems, and providing additional pressure to move water over the Segunda Grade.

Three MBNMS actions are associated with the MPWSP; they include:

1. Authorization of a Coastal Development Permit for CalAm to drill into the submerged lands of MBNMS to install a subsurface seawater intake system;
2. Authorization of a Central Coast Regional Water Quality Control Board issued National Pollutant Discharge Elimination System (NPDES) permit or other discharge authorization to allow for the discharge of brine into the Pacific Ocean and MBNMS via an existing ocean outfall pipe;
3. Issuance of a currently-proposed special use permit to CalAm for the continued presence of a pipeline conveying seawater to a desalination facility; and

## 1.1 Consultation History

With regard to ESA consultation for the Proposed Action, MBNMS was involved in the following agency coordination meetings:

- Meeting with U.S. Fish and Wildlife Service (USFWS) on November 12, 2015: USFWS, AECOM, Environmental Science Associates, California Department of Fish and Wildlife (CDFW), CalAm, Point Reyes Bird Observatory (now Point Blue), and MBNMS discussed federal consultation requirements, coordination of whole project for consultation, timing of BAs and environmental review, and state needs.
- Meeting with USFWS on April 20, 2016: USFWS, AECOM, CDFW, the National Oceanic and Atmospheric Administration (NOAA), MBNMS, and other consultants.

# 2 Project Description

The Proposed Action involves construction of pipelines and facilities to be placed in unincorporated areas of Monterey County, the town (census-designated place) of Castroville, and in the cities of Marina and Seaside. It consists of several distinct physical components which are described below (see Figure 2, Project Overview). Most of the project components are on land and do not contain listed species or habitats under the jurisdiction of the NMFS. However, some of the project components occur in aquatic systems that may contain or support listed species, or their habitat, that are under the jurisdiction of the NMFS. Table 1 identifies all of the components associated with the MPWSP, and which components have the potential to affect listed species and their habitat, DCH, and/or EFH under the jurisdiction of the NMFS.

## 2.1 Project Components

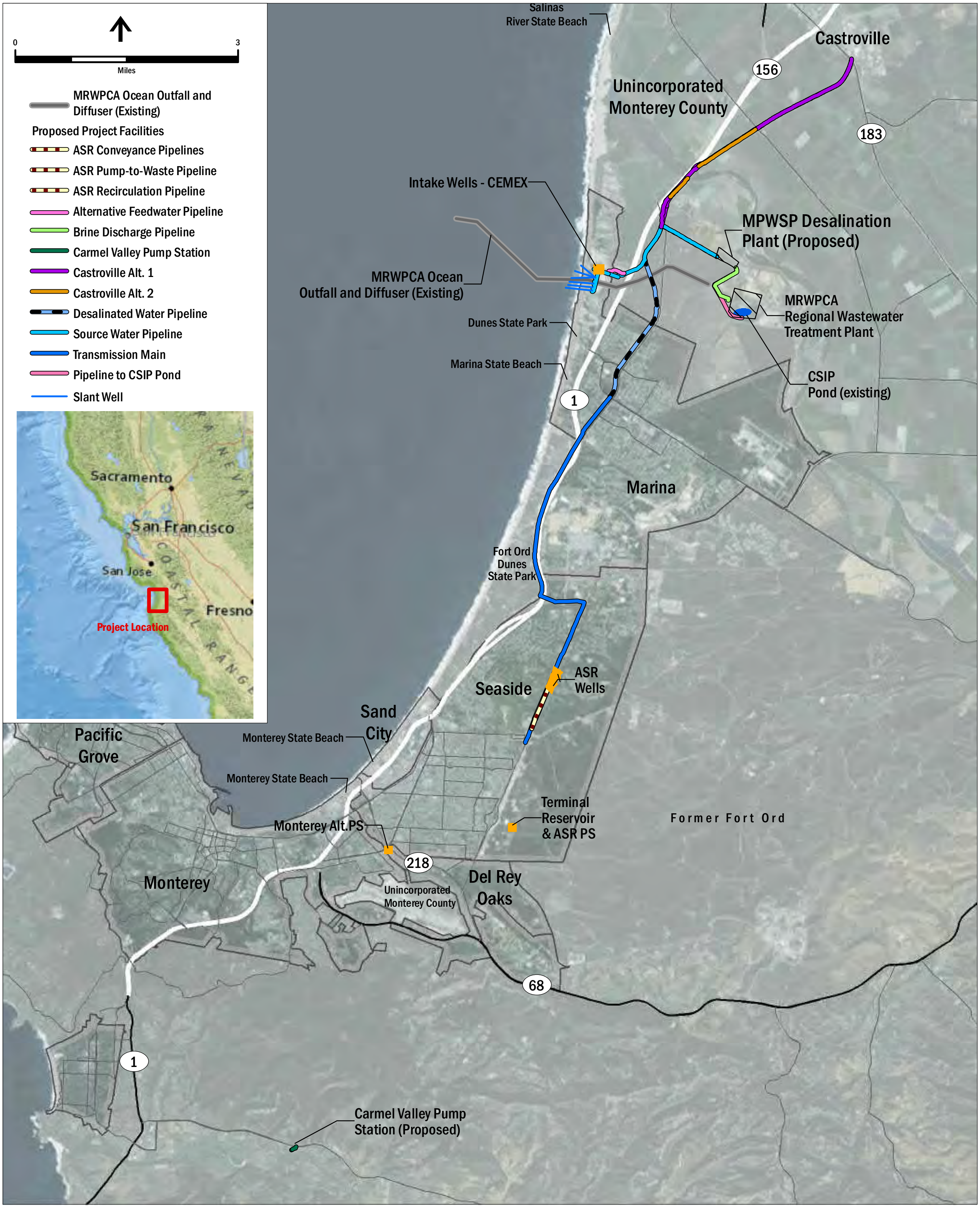
The proposed MPWSP comprises the following facilities (see Figure 2):

- A seawater intake system, which would have seven subsurface slant wells (the existing test slant well plus 6 new wells) at the CEMEX Lapis Plant site (these wells would extend offshore into the submerged lands of MBNMS and a Source Water Pipeline would convey the combined source water from the slant wells to the desalination plant);
- A 6.4-mgd desalination plant and associated auxiliary facilities, including: source water receiving tanks; pretreatment, RO, and post-treatment systems; chemical feed and storage facilities; and other associated non-process/administrative facilities;
- Desalinated water conveyance facilities, including pipelines, a pump station, and treated water storage tanks;
- Brine storage and disposal system including an uncovered 3 million-gallon brine storage basin with two impermeable liners, brine discharge pipeline to a proposed Brine Mixing Facility at the MRWPCA waste water treatment plant and a combined discharge to the existing MRWPCA ocean outfall that discharges into MBNMS, and
- An expanded ASR system, including two additional injection/extraction wells (ASR-5 and ASR-6 wells) and three parallel ASR pipelines: ASR Recirculation Pipeline, ASR Conveyance Pipeline, and ASR Pump-to-Waste Pipeline. These pipelines would convey water to and from the new ASR injection/extraction wells, and backwash effluent, from the wells to an existing settling basin.

### 2.1.1 Seawater Intake System (USFWS and NMFS Jurisdiction)

#### *2.1.1.1 Slant Wells*

The seawater intake system would include seven subsurface slant wells at the CEMEX Lapis Plant site (five active at any given time and two on standby; these would consist of the converted existing test slant well and six new wells at five new well sites). These wells would draw seawater from groundwater aquifers that extend beneath the ocean floor for use as source water for the MPWSP Desalination Plant. The well heads for the slant wells would be in the City of Marina, about 2 miles (3.2 kilometers [km]) south of the Salinas River, in the retired mining area section of the CEMEX sand mining facility (see Figure 2). The slant wells would be drilled on the landward side of the dunes (onshore), south of the existing CEMEX access road, and extend down below the surf zone of the adjacent MBNMS (under the seafloor) (see Figure 3). Installation of the permanent subsurface slant wells would include the use of a 22- to 36-inch- (55- to 91-centimeter- [cm]) diameter steel casing (see Figure 3). The completed pump columns and wellheads would be 10 inches (25 cm) in diameter.




NOTE:
*The ASR Pipelines are ASR Conveyance Pipeline, the ASR Pump-to-Waste Pipeline, and the ASR Recirculation Pipeline. See Figure 3-9a for the individual pipeline alignments.

Source: CPUC/MBNMS 2017

Monterey Peninsula Water Supply Project

Figure 2
Monterey Peninsula Water Supply Project Overview

The six new permanent slant wells would be approximately 900 to 1,000 feet (274 to 305 meters) long and drilled at approximately 14 degrees below horizontal, extending offshore 161 to 356 feet (49 to 111 meters) seaward of the year 2020 mean high water[3] (MHW) line, to a depth of 190 to 210 feet (58 to 64 meters) beneath the seafloor. All construction activities and ground disturbance would occur above mean sea level, landward of the 2020 MHW line. However, the well casings would extend seaward and subsurface of the 2020 MHW line, below the seafloor within MBNMS.

The seven slant wells would be located at five new wellhead sites plus the one existing test slant well site, all of which would be located along the back (inland side) of the dunes. The well sites are numbered sequentially, with Site 1 being the northernmost site and Site 6 the southernmost site. The test slant well site (Site 1) and four new sites (Sites 3 through 6) would each have one slant well, and one site (Site 2) would have two slant wells (see Figure 3). Site 2 would be located about 650 feet (198 meters) south of Site 1. Sites 2 through 6 would be drilled over a total distance of about 975 feet (297 meters). Sites 3, 4, and 5 would be spaced approximately 250 feet (76 meters) apart.

The well sites would include the following facilities per well: above ground wellhead(s); a below ground mechanical piping vault (12 feet x 6 feet x 6 feet) for meters, valves, and gauges, etc.; an electrical enclosure; and a pump-to-waste basin (see Figure 3). Each wellhead would be located aboveground for ease of maintenance. Each slant well would be equipped with a 2,500 gallons per minute (gpm), 300 horsepower (hp) submersible well pump. The electrical controls for operation of the slant wells would be housed in a single-story, 17-foot-long, by 10-foot-wide, 10-foot-high (5.2-meter-long by 3-meter-wide by 3-meter-high) fiberglass enclosure located at each of the six well sites. Each site would also have a pump-to-waste basin for the percolation of turbid water produced during slant well startup and shutdown. The pump-to-waste basin would be constructed of rip rap material, approximately 1 to 2 feet deep, 12-foot-long, and 8-foot-wide (0.3 to 0.6 meters deep, 3.6-meter-long, and 2.4-meter-wide). The new permanent slant wells and associated infrastructure at Sites 2 through 6 would be constructed on a 5,250 – to 6,025-square-foot graded pad located above the maximum high tide elevation on the inland side of the dunes. A 750-foot-long, 42-inch-diameter (228-meter-long, 107–cm-diameter) buried NSF/ANSI 61-certified pipe would collect the seawater pumped from Sites 2 through 6 and convey it to the proposed buried Source Water Pipeline located at the existing CEMEX access road.

### *2.1.1.2 Test Slant Well and Long-Term Aquifer Pump Test*

CalAm built a test slant well at the CEMEX Lapis Plant retired sand mining area. The test slant well is currently operating as a pilot program to collect data. The environmental effects associated with construction and operation of the test slant well were evaluated in November 2014 under CEQA/NEPA requirements by the City of Marina/California Coastal Commission and NOAA MBNMS, respectively. The test well is permitted through February 2018; therefore, construction and operation of the test slant well are not evaluated in this document. The data from the pilot program would inform the final design of the subsurface slant wells, the overall seawater intake system, and the MPWSP Desalination Plant treatment system. The test slant well facilities include the test well, a submersible well pump, a wellhead vault, electrical facilities and controls, temporary flow measurement and sampling equipment, monitoring wells, and a temporary pipeline connection to the adjacent MRWPCA ocean outfall pipeline for discharges of the test water. The test slant well was drilled at 19 degrees below horizontal and is approximately 720 feet (220 meters) long.

CalAm proposes to convert the test slant well into a permanent well after testing is done and operate it as part of the MPWSP seawater intake system. The construction of the additional conveyance and treatment facilities needed to convert the test slant well to a permanent well is evaluated in this document. The conveyance and treatment facilities for the source water produced from the subsurface slant wells are described below.

[3] The 2020 MHW at the Monterey Tide Gauge NOAA#9413450 equals 1.53 m (5.02 ft.) NAVD88, considering a high sea level rise scenario of 8.1 cm (3.2 in) by 2020 (5.46 ft. by 2100).

**TABLE 1 SUMMARY OF PROPOSED FACILITIES**

| Facility | Description | Potential to Affect Resources under the USFWS/NMFS Jurisdiction |
|---|---|---|
| **Seawater Intake System** | | |
| **Subsurface Slant Wells**<br>Approximately 15.5 mgd of seawater (i.e. source water) drawn from beneath the ocean floor in MBNMS for use as source water for the desalination plant | • Seven slant wells at the CEMEX plant site extending offshore beneath Monterey Bay into MBNMS (the conversion of an existing test slant well into a permanent well plus six new wells at five new sites), with up to five wells operating at any given time and two wells maintained on standby<br>• The six new slant wells would be grouped into five new sites: four with one well each and with two wells; each well would have a wellhead, mechanical piping vault (meter, valves, and gauges); one electrical control enclosure, and one pump-to-waste basin | USFWS |
| **Source Water Pipeline**<br>Conveys the combined source water from the slant wells to the desalination plant | • 2.7-mile-long, 42-inch-diameter pipeline<br>• Two hydraulic surge tanks would be located near the collector pipe/Source Water Pipeline connection point, south of the CEMEX access road and inland of the dunes. | USFWS |
| **Desalination Facilities** | | |
| **Pretreatment System**<br>Treat source water to remove suspended solids and dissolved contaminants | • Pressure filters or multimedia gravity filters would be housed within a 6,000-square-foot pretreatment building<br>• Two 300,000-gallon backwash supply and filtered water equalization tanks<br>• Two 0.25-acre, 6-foot-deep, lined backwash settling basins with decanting system | USFWS |
| **Reverse Osmosis System**<br>Remove salts and other minerals from pretreated source water | • Dual-pass RO system consisting of four active modules and one standby module, with each module producing 1.6 mgd of “permeate” (the purified water produced through the RO membrane)<br>• Ultraviolet light disinfection system (if required)<br>• The RO, post-treatment systems, and chemical storage tanks would be housed within a 30,000-square-foot process and electrical building | USFWS |
| **Post-Treatment System**<br>Adjust the hardness, pH, and alkalinity of the desalinated product water, and disinfect the water in accordance with drinking water requirements | • Chemical feed lines and injection stations (for carbon dioxide, lime, sodium hydroxide, phosphate-based corrosion inhibitor, and sodium hypochlorite) | USFWS |

### TABLE 1 SUMMARY OF PROPOSED FACILITIES

| Facility | Description | Potential to Affect Resources under the USFWS/NMFS Jurisdiction |
|---|---|---|
| **Chemical Storage**<br>The capacity would range from less than 5,000 gallons to 20,000 gallons, depending on the treatment chemical | • Chemical storage tanks with secondary containment<br>• Sumps and sump pumps | USFWS |
| **Administrative Building**<br>House restrooms, locker rooms, break rooms, conference rooms, electrical controls, laboratory facilities, equipment storage and maintenance, and electrical service equipment | • 4,000- to 6,000-square-foot building | USFWS |
| **Brine Storage and Disposal Facilities** | | |
| **Brine Storage and Disposal**<br>Brine (seawater concentrate) produced during the RO process would be conveyed to the brine storage basin at the MPWSP Desalination Plant before it is conveyed to the wastewater treatment plant for disposal into waters of MBNMS | • 3-million-gallon brine storage basin<br>• 1-mile-long, 30-inch-diameter Brine Discharge Pipeline | USFWS |
| **MRWPCA Ocean Outfall Pipeline and Diffuser (existing)**<br>Convey 8.99 mgd of brine from the wastewater treatment plant to the existing ocean outfall pipeline in MBNMS, which terminates at a diffuser located offshore that would discharge the concentrate into Monterey Bay | • Existing 2.3-mile long, 60-inch-diameter pipe (onshore portion)<br>• Existing 2.1-mile-long, 60-inch-diameter pipe (offshore portion)<br>• Existing 1,100-foot-long existing diffuser with 172 ports (129 ports are open and 43 are closed), each 2 inches in diameter and spaced 8 feet apart on alternating sides | NMFS (Offshore, and Diffuser) and USFWS |
| **Desalinated Water Conveyance and Storage Facilities** | | |
| **Clearwells (Water Storage Tanks) and Clearwell Pump Station**<br>Pump water from the post-treatment process to the clearwells, which serve as holding tanks | • 6.4-mgd capacity, 120-hp pump<br>• Two 100-foot-diameter, 1,750,000-gallon aboveground storage tanks (providing a total combined storage volume of 3.5 million gallons) | USFWS |
| **Desalinated Water Pump Station**<br>Pump desalinated product water to either 1) the CalAm water system; or 2) the CCSD and/or CSIP as Salinas Valley return flows | • 6.4-mgd capacity, 800-hp pump to pump water through the Desalinated Water Pipeline to the CalAm water system<br>• 1.4-mgd, 20-hp pump to pump water through the Salinas Valley Return Pipeline to CSIP Pond or the Castroville Pipeline to CCSD | USFWS |
| **Desalinated Water Pipeline**<br>Convey desalinated product water from the clearwells at the MPWSP | • 3.3-mile-long, 36-inch-diameter pipeline | USFWS |

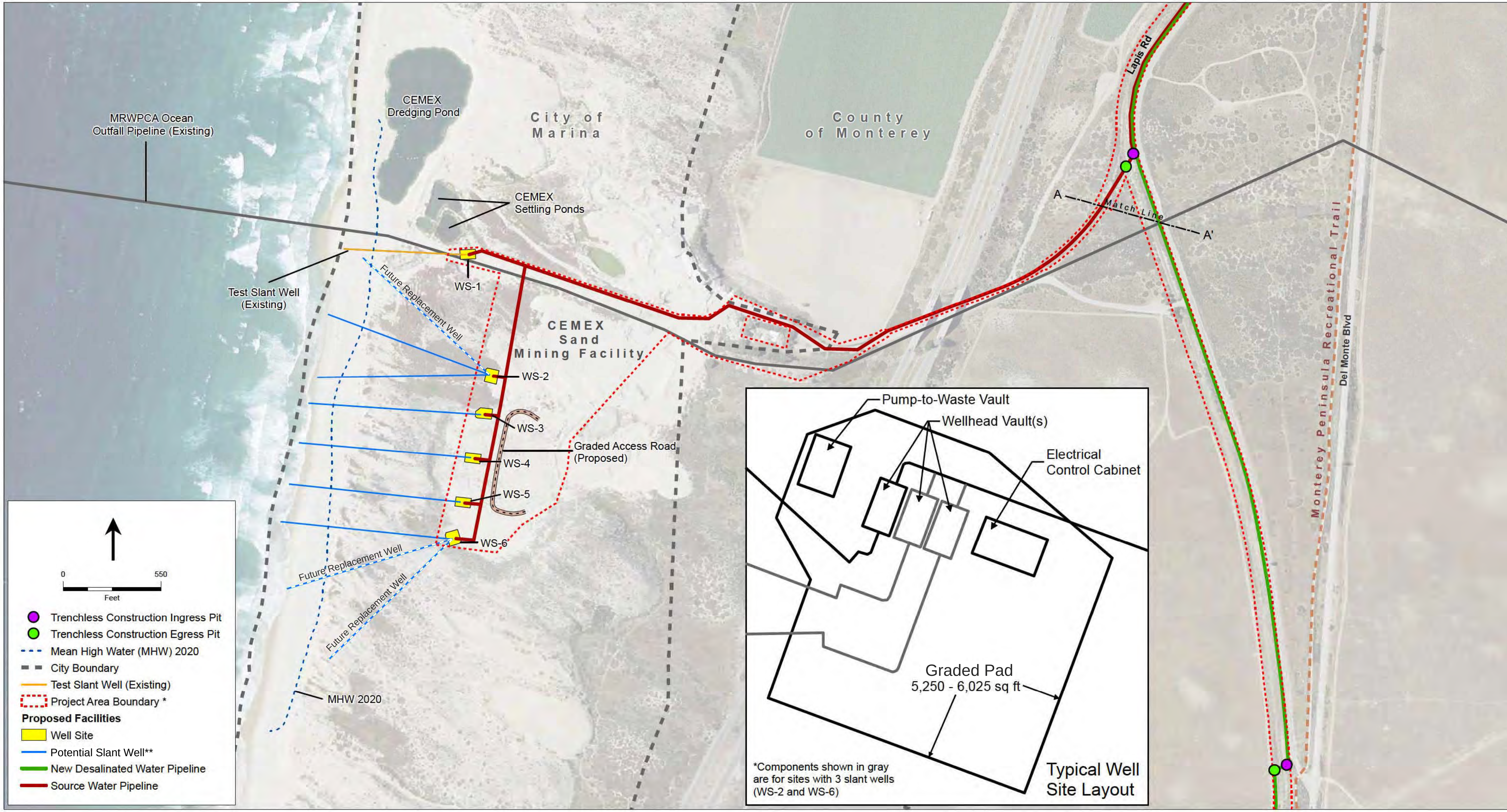
**TABLE 1 SUMMARY OF PROPOSED FACILITIES**

| Facility | Description | Potential to Affect Resources under the USFWS/NMFS Jurisdiction |
|---|---|---|
| Desalination Plant to the Transmission Main at Reservation Road | | |
| **New Transmission Main**<br>Convey desalinated product water between the Desalinated Water Pipeline at Reservation Road and ASR facilities at General Jim Moore Boulevard | • 6-mile-long, 36-inch-diameter force main | USFWS |
| **Carmel Valley Pump Station**<br>500-square-foot facility that would provide the additional pressure needed to pump water uphill through the existing Segunda Pipeline into Segunda Reservoir | • 3 mgd, 100-hp pump station | USFWS |
| **Castroville Pipeline**<br>Convey desalinated product water from the MPWSP Desalination Plant to the CSIP distribution system and the CCSD Well #3<br>• Product water to be delivered to the CSIP system via a new connection point located approximately halfway along the pipeline alignment at Nashua Road and Monte Road<br>• At the northern pipeline terminus, product water to be delivered to the CCSD at Del Monte Ave & Merritt St | 4.5-mile-long, 12-inch-diameter pipeline extending from MPWSP Desalination Plant to Castroville | NMFS and USFWS |
| **Pipeline to CSIP Pond**<br>Convey desalinated product water from the MPWSP Desalination Plant to the CSIP pond for subsequent delivery to agricultural users in the Salinas Valley | 1.2-mile-long, 12-inch-diameter pipeline | USFWS |
| **ASR System** | | |
| **Six ASR Injection/Extraction Wells (four existing wells and two proposed):**<br>• ASR-1 and ASR-2 wells (existing)<br>• ASR-3 and ASR-4 wells (existing)<br>• ASR-5 and ASR-6 wells (proposed)<br>Used to inject Carmel River water and desalinated product water into the Seaside Groundwater Basin for storage; during periods of peak demand, would be used to extract stored water for | • Two proposed 1,000-foot-deep injection/ extraction wells (ASR-5 and ASR-6 wells) with a combined injection capacity of 2.2 mgd and extraction capacity of 4.3 mgd<br>• Four existing injection/extraction wells (Phase I and II wells) | USFWS |

**TABLE 1 SUMMARY OF PROPOSED FACILITIES**

| Facility | Description | Potential to Affect Resources under the USFWS/NMFS Jurisdiction |
|---|---|---|
| **delivery to customers** | | |
| **ASR Pipelines:**<br>**1. ASR Recirculation Pipeline**<br>**2. ASR Conveyance Pipeline**<br>**3. ASR Pump-to-Waste Pipeline**<br>**4. Transmission Main to ASR Well Pipeline**<br>**ASR Recirculation pipeline would be used to convey water from existing conveyance pipelines and infrastructure at Coe Avenue and General Jim Moore Boulevard to the new ASR-5 and ASR-6 wells for injection**<br>**ASR Conveyance Pipeline would be used to convey extracted ASR water supplies to the existing infrastructure at Coe Avenue/General Jim Moore Boulevard**<br>**ASR Pump-to-Waste Pipeline would convey backflush effluent produced during routine maintenance of the ASR-5 and ASR-6 wells to the existing Phase I ASR settling basin.**<br>**Transmission Main to ASR Well Pipeline would convey desalinated water to ASR-5 and ASR-6 for injection** | • **ASR Recirculation, Conveyance and Pump-to-Waste Pipelines: Three parallel 0.9-mile-long, 16-inch-diameter pipelines**<br>• **Transmission Main to ASR Well Pipeline: 150-foot-long, 16-inch-diameter pipeline connection from the Transmission Main to proposed ASR-5 and ASR-6, with one connection per well** | **USFWS** |

Notes:
ASR = aquifer storage and recovery
CalAm = California American Water
CCSD = **Castroville Community Services District**
CSIP = Castroville Seawater Intrusion Project
hp = horsepower
MBNMS = Monterey Bay National Marine Sanctuary
mgd = million gallons per day
MPWSP = Monterey Peninsula Water Supply Project
MRWPCA = Monterey Regional Water Pollution Control Agency
NMFS = National Marine Fisheries Service
RO = reverse osmosis
USFWS = U.S. Fish and Wildlife Service




NOTE:
*Project area boundary refers to the area within which all construction related disturbance would occur.
**Future replacement wells are not part of the Proposed Action.

Source: CPUC/MBNMS 2017

Monterey Peninsula Water Supply Project

**Figure 3**

MPWSP Seawater Intake System (Slant Wells)

#### *2.1.1.3 Source Water Pipeline*

The Source Water Pipeline is an approximately 2.2-mile-long (3.5 km), 42-inch- (107 cm-) diameter buried pipeline that would convey water from the well clusters to the MPWSP Desalination Plant at Charles Benson Road. From the slant wells, it would generally follow the CEMEX access road and would run parallel to MRWPCA's existing outfall pipeline for approximately 0.7 mile (1.1 km) (see Figure 2). The Source Water Pipeline would turn northeast approximately 500 feet (152 meters) east of Highway 1 and follow a dirt path for roughly 1,000 feet (305 meters) to Lapis Road. A jack and bore method would be used to install the pipeline under the existing railroad tracks. The alignment would continue north about 0.5 mile (0.8 km) within the Transportation Agency for Monterey County (TAMC) right-of-way (ROW) along Lapis Road. The pipeline would turn east across Del Monte Boulevard south of the intersection with Lapis Road and continue east for 0.8 mile (1.3 km) to the MPWSP Desalination Plant site at the east end of Charles Benson Road. This segment of pipeline would parallel the north side of Charles Benson Road, outside of the paved road. The pipeline would be installed east-to-west along the north side of the row of mature Monterey cypress and eucalyptus trees that form a boundary between the agricultural land to the north and Charles Benson Road. CalAm is negotiating with landowners for an easement for this alignment.

### 2.1.2 MPWSP Desalination Facilities (USFWS Jurisdiction)

The desalination plant is located on approximately 25 acres (10 hectares) of a vacant, 46-acre (18.6-hectare), parcel of land located along Charles Benson Road in unincorporated Monterey County. The plant would house the seawater desalination infrastructure used to create potable water and would have a 6.4-mgd production capacity. The desalination plant would also include a pretreatment system, a RO system, a post-treatment system, and a multi-purpose pump station near the center of the plant to divert waste effluent to the brine waste stream to be discharged by the existing MRWPCA outfall and diffuser. An administrative building would house visitor reception, offices, restrooms, locker rooms, break rooms, conference rooms, a control room, a laboratory, equipment storage and maintenance area, and monitoring and control systems for the RO system, post-treatment system, chemical feed systems, and related facilities (see Figure 4).

### 2.1.3 Brine Storage and Disposal Facilities (USFWS and NMFS Jurisdiction)

The brine storage and disposal system would have an uncovered 3-million-gallon brine storage basin with two impermeable liners; two 6 mgd, 40 horsepower brine discharge pumps; and a brine aeration system to maintain dissolved oxygen (DO) concentrations in the brine at 5 milligrams per liter (mg/L) (see Figure 4). The RO process would generate approximately 9 mgd of brine, including decanted backwash water. Brine from the RO system would be conveyed through the 3,900-foot- (1,188–meter-) long, 36-inch- (91–cm-) diameter Brine Discharge Pipeline to a proposed Brine Mixing Facility at the MRWPCA waste water treatment plant and then convey the combined discharge to the existing MRWPCA ocean outfall that discharges into the waters of MBNMS. When temporary storage is needed, brine would be directed to the brine storage basin where it can be stored for up to 5 hours, then pumped to the Brine Discharge Pipeline.

The existing MRWPCA ocean outfall pipeline is 2.1-mile-long (3.8 km) and ends with a 1,100-foot- (335-meter-) long, underwater diffuser that rests on rock ballast (see Figure 2). The diffuser ports are approximately 6 inches (15 cm) above the rock ballast and nominally 54 inches (137 cm) above the seafloor, although this height varies due to unevenness in the sea floor topography (see Figure 5). For the dilution calculations, the ports are assumed to be 4 feet (1.2 meters) above the seafloor at approximately 90 to 110 feet (27 to 34 meters) below mean sea level. The diffuser is equipped with 172 ports (129 open and 43 closed), each 2 inches (5 cm) in diameter and spaced 8 feet (2.4 meters) apart on alternating sides of the pipe.

### 2.1.4 Desalinated Water Conveyance (USFWS and NMFS Jurisdiction)

Desalinated, post-treatment product water would flow to two covered, aboveground treated-water storage tanks (clearwells). Each tank would provide 1,750,000 gallons of storage, for a total storage volume of 3.5 million gallons. Desalinated product water from the MPWSP Desalination Plant would flow south through a series of proposed pipelines into the CalAm system. Water would flow from the Desalinated Water Pipeline to the Transmission Main at Reservation Road; it would then continue south along the west side of the Monterey Peninsula Recreational Trail and TAMC ROW before turning inland at Lightfighter Drive. These pipelines would include surface equipment such as valves and blowoffs. Salinas Valley return flow pumps would pump desalinated product water (i.e., Salinas Valley return flows) to water distribution systems as needed.

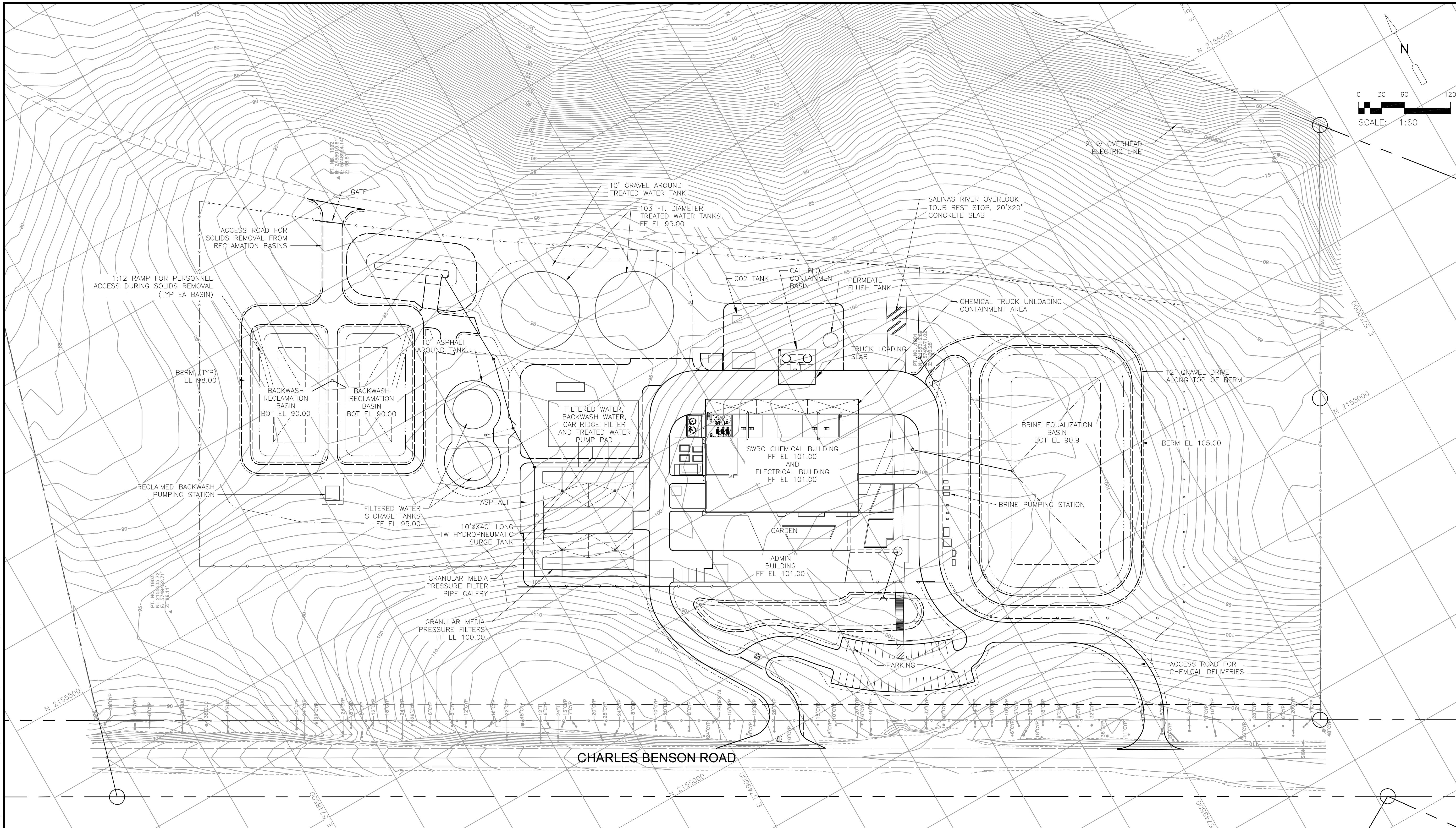
#### *2.1.4.1 Carmel Valley Pump Station (USFWS Jurisdiction)*

The Carmel Valley Pump Station, at 26530 Rancho San Carlos Road in unincorporated Monterey County, would be connected to existing water mains located in Carmel Valley Road. These mains are part of the Begonia Iron Removal Plant (BIRP) operation and, when operating, would convey water to both the Forest Lake Reservoir to the west, and the Segunda Tank to the north, through the existing interconnecting mains. Additionally, the Carmel Valley Pump Station would provide fire flow indirectly to the Desalination Plant through Crest Tank which is filled via the existing Segunda Pump Station and Tank when BIRP is offline. The mechanical equipment would be housed and raised above the 100-year flood elevation. The Carmel Valley Pump Station would require supply and discharge pipeline connections to an existing water main in Carmel Valley Road. Three new manual valves would be installed in areas of existing infrastructure. Additionally, three new actuated valves would be installed on the CalAm owned parcel.

#### *2.1.4.2 Castroville Pipeline (USFWS, with portions under NMFS Jurisdiction)*

The 4.5-mile-long (7.2 km), 12-inch- (30 cm-) diameter Castroville Pipeline would convey desalinated Salinas Valley return water from the MPWSP Desalination Plant to the Castroville Seawater Intrusion Project (CSIP) distribution system and the Castroville Community Services District (CCSD) Well #3. The Castroville Pipeline would branch off from the Desalinated Pipeline approximately 240 feet (73 meters) south of the intersection of Del Monte Boulevard and Lapis Road. The pipeline would follow Lapis Road north, within the TAMC ROW, and would cross over the Salinas River at Monte Road by being attached to the underside of the Monte Road Bridge (see Figure 6).[4]

[4] The January 2017 Draft EIR/EIS analyzed the installation of the pipeline under the Salinas River via horizontal directional drilling techniques. The final EIR/EIS will include an analysis of the project effects associated with the construction method described here.

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CALIFORNIA AMERICAN WATER

| REVISIONS | REVISIONS |
|---|---|
| | |

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Walnut Creek, CA 94596
Tel: (925) 933-2900

####

## LICENSED PROFESSIONAL ENGINEER NO. ####

CDM SMITH
100 PRINGLE AVE., STE 300
WALNUT CREEK, CA

DRAWN BY G. RODRIGUEZ
PROJECT ENG'R D. BROWN

DATE OCTOBER 2014

PROJECT 154001-0191

MPWSP DESALINATION INFRASTRUCTURE PROJECT
CIVIL
SITE PLAN

Figure 4

| CALIFORNIA AMERICAN WATER CO. | COASTAL DIVISION | USE DIMENSIONS ONLY SCALE AS NOTED |
|---|---|---|
| USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES | 60% SUBMITTAL | 154001-0191-C6 |

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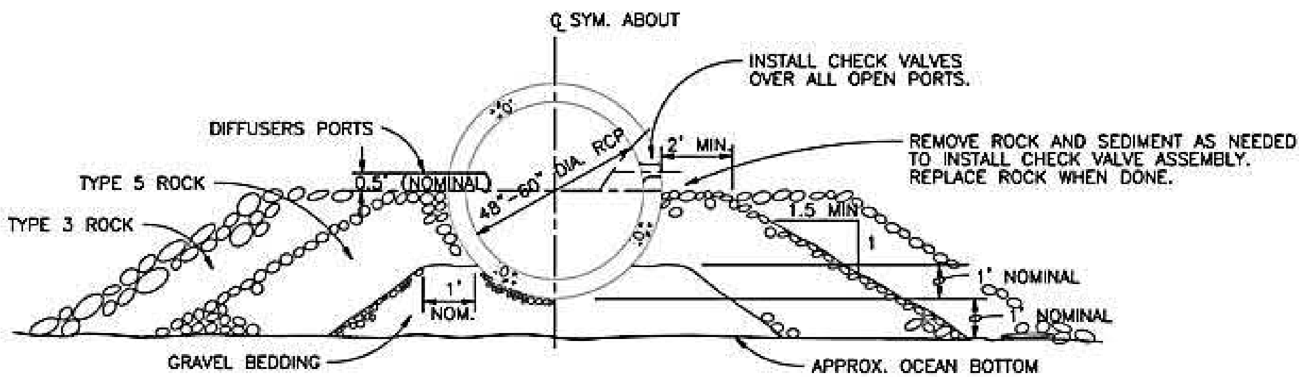
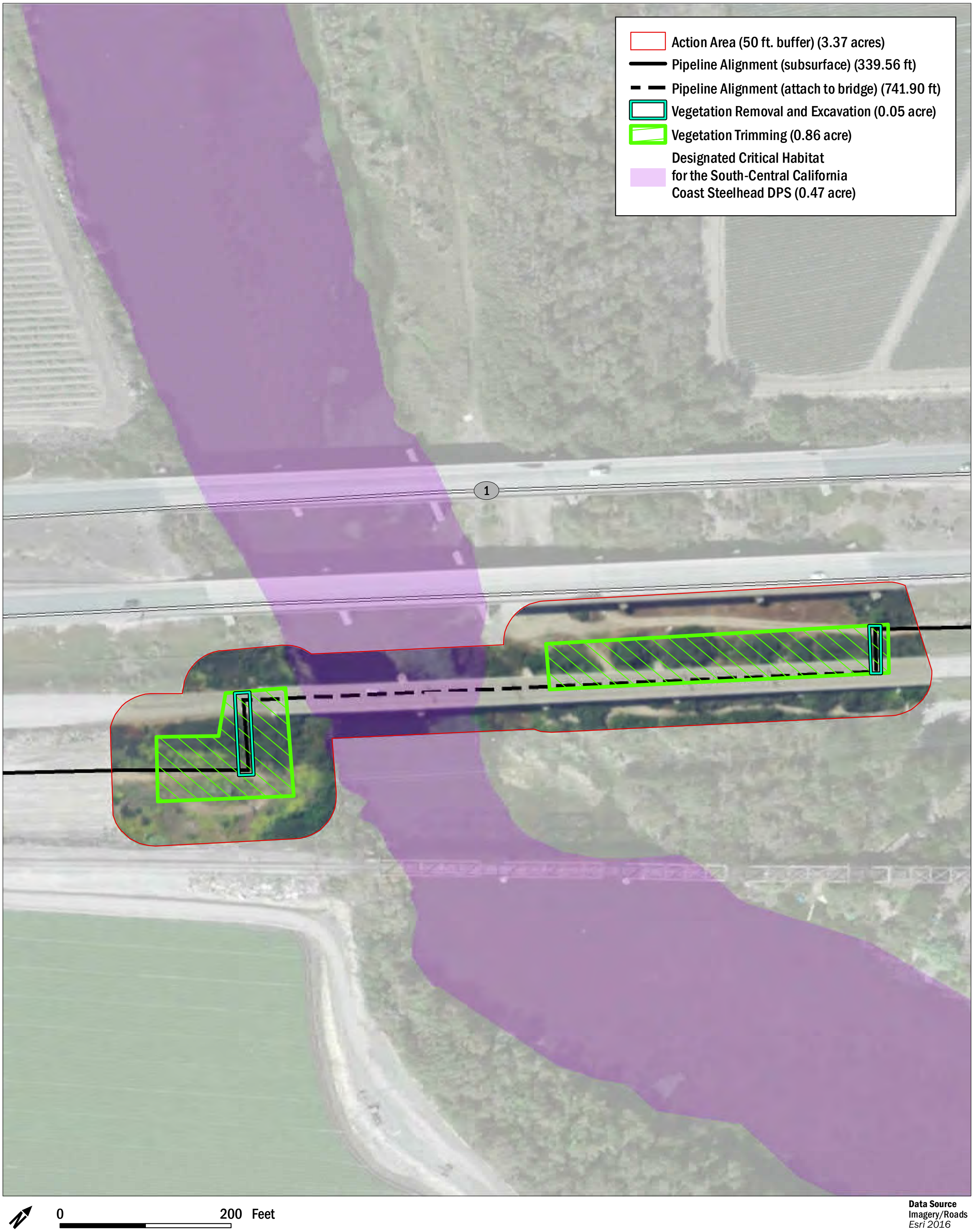
# Figure 5 Cross Section of Existing MRWPCA Ocean Outfall






California American Water
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 6**

*Salinas River Crossing Plan*

To construct the Pipeline crossing at the Salinas River, some vegetation clearing would be required. The majority of excavation and ground disturbance would be within the dirt roadways on the north side of the Monte Road Bridge. Grubbing (removal) and excavation of vegetated areas would be required at two small areas on both the north and south end of the elevated pipeline (a total of 0.05 acre [0.02 hectare]) to bring the underground pipeline from the dirt road to underneath the bridge. On both the north and south sides of the channel, trimming of riparian vegetation would also be required to position and affix the pipeline to the underside of the bridge (see Figure 6). The total required area of riparian vegetation trimming would be 0.86 acre (0.35 hectare). To install the pipe over the wetted portion of the Salinas River Channel, a barge may be used. This barge would remain in the lagoon for at most, 1 month. During this time, the barge would be moved incrementally during construction and would not remain in one location for an extended period.

The pipeline would continue northeast from the Salinas River, along the TAMC ROW and Monte Road, to Nashua Road. A new pipe connection to the CSIP distribution system would be built at the northern end of Monte Road, where it meets Nashua Road. The Castroville Pipeline would continue north along the TAMC ROW, crossing under Tembladero Slough to Highway 183 (Salinas Road). From Highway 183, the pipeline would continue north between Del Monte Avenue and Union Pacific Railroad, turn west across Del Monte Avenue and connect to CCSD Well #3 at the north corner of Del Monte Avenue and Merritt Street.

#### *2.1.4.3 Pipeline to CSIP Pond (USFWS Jurisdiction)*

Salinas Valley return flow to be delivered to the CSIP pond would be conveyed through a new 1.2-mile-long (1.9 km), 12-inch- (30 cm-) diameter pipeline that would connect the MPWSP desalination plant on Charles Benson Road to the existing CSIP pond at the southern end of the MRWPCA Regional Wastewater Treatment Plant. From the CSIP pond, water would be delivered to agricultural users in the Salinas Valley through existing infrastructure.

#### *2.1.4.4 Proposed ASR Facilities (USFWS Jurisdiction)*

CalAm proposes to expand the existing Seaside Groundwater Basin ASR system to provide additional injection/extraction capacity for both desalinated product water and Carmel River water supplies. The proposed improvements to the ASR system would include two additional injection/extraction wells (ASR-5 and ASR-6) and three parallel, 0.9-mile-long (1.4 km), ASR pipelines. CalAm would build the two additional injection/extraction wells (ASR-5 and ASR-6 wells) on two U.S. Army-owned parcels located east of General Jim Moore Boulevard, south of its intersection with Ardennes Circle, in the Fitch Park Monterey Bay Military Housing area. The ASR-5 and ASR-6 wells would operate in conjunction with the existing ASR-1, ASR-2, ASR-3, and ASR-4 wells. Any of the six ASR injection/extraction wells could be used to inject/extract desalinated product water and Carmel River water supplies, or to extract Seaside Groundwater Basin water or Pure Water Monterey GWR water supplies.

Three parallel 0.9-mile-long (1.4 km), 16-inch- (40 cm-) diameter ASR pipelines (the ASR Recirculation Pipeline, the ASR Conveyance Pipeline, and the ASR Pump-to-Waste Pipeline), would extend along General Jim Moore Boulevard between the proposed ASR-5 and ASR-6 wells and Coe Avenue. In addition, a 150-foot- (45-meter-) long, 16-inch- (40–cm-) diameter pipeline would connect the Transmission Main to each of the ASR wells. These pipelines would convey desalinated water to ASR-5 and ASR-6 wells for injection.

## 2.2 Project Construction

### 2.2.1 Site Preparation and Construction Staging

#### *2.2.1.1 Site Clearing and Preparation*

Construction workers would clear and prepare the construction work areas in stages, as construction progresses. The contractor would clear and grade the portions of the project area to be worked in before construction starts, removing vegetation and debris, as necessary, to provide a relatively level surface for the movement of construction equipment. The contractor would recontour and restore the temporary construction work areas to their original profile upon completion of construction, and would hydroseed or pave the areas, as appropriate.

#### *2.2.1.2 Staging Areas*

Construction equipment and materials would be stored within the construction work areas to the extent feasible. Construction staging for the subsurface slant wells at the CEMEX site, the MPWSP Desalination Plant, and the ASR-5 and ASR-6 wells would be contained within the project area boundaries associated with that feature. For construction of all other facilities and pipelines, construction workers would use eight staging areas in the vicinity of the project area that are primarily paved parking lots located in highly disturbed areas, except the sandy lot proposed as the staging area near Seaside Middle School. Table 2 summarizes the staging area locations and current site conditions.

TABLE 2 CONSTRUCTION STAGING AREAS

| Location | Site Description |
| --- | --- |
| Monte Road/Neponset Road in unincorporated Monterey County | Paved parking lot (semi-trucks) at Dole Vegetable Processing Plant |
| Beach Road in Marina | Paved parking lot at Walmart |
| Highway 1/1st Street in Marina | Gated paved parking lot |
| 2nd Avenue, between Lightfighter Drive and Divarty Street, in Seaside | Paved parking lot at the Cal State University at Monterey Bay Athletic Fields |
| 2nd Avenue/Lightfighter Drive in Seaside | Paved parking lot |
| West side of General Jim Moore Boulevard, near Gigling Road, in Seaside | Paved parking lot |
| East side of General Jim Moore Boulevard, near Gigling Road, in Seaside | Paved parking lot |
| West side of General Jim Moore Boulevard, near Seaside Middle School, in Seaside | Sandy area |

Because all of the proposed staging areas are paved or sand, CalAm's contractors would not need to remove vegetation to prepare the staging sites. Heavy machinery would not be operated at the staging areas unless it is used to move lighter-duty machinery in and out of the staging area, or to load and unload material onto transportation vehicles for delivery to the construction sites. Only temporary motion-sensored nighttime lighting would be installed at staging areas.

### 2.2.2 Well Drilling and Development and Related Site Improvements

#### *2.2.2.1 Subsurface Slant Wells*

Well installation would be done in two phases: (1) well drilling and (2) well development. All construction activities for the subsurface slant wells would occur inland of the year 2020 MHW line and in previously disturbed areas, landward of the dunes. Surface construction activities would occur outside of MBNMS. Slant well construction would take approximately 10 to 12 months to complete, and could take place anytime throughout the overall 24-month construction duration for the Proposed Action. Construction activities associated with installation of the six additional subsurface slant wells, including staging, materials storage, and stockpiling, would temporarily disturb approximately 6 acres (2.4 hectares) of land (approximately 1 acre (0.4 hectare) of disturbance per slant well) within the project area boundary shown on Figure 3. Construction activities would occur

24 hours per day, 7 days per week, with multiple slant wells being built simultaneously. Construction-related trucks and vehicles would access the slant well site via Del Monte Boulevard, Lapis Road, and the existing access roads in the CEMEX active mining area. The construction contractor would use a temporary field office (mobile trailer) in the southern portion of the CEMEX project area throughout slant well construction activities. The field office and materials receiving and storage would be contained within the 6-acre construction disturbance area.

The proposed slant wells would be built using a dual rotary drilling rig, pipe trailers, portable drilling fluid tanks, Baker tanks (portable holding tanks), haul trucks, flatbed trucks, pumps, and air compressors. The slant wells would be drilled at approximately 14 degrees below horizontal.

Drilling fluids, such as water, bentonite mud, or environmentally inert biodegradable additives, would be used to drill through the first 100 feet (30 meters) of the dry dune sands to prevent the sand from locking up the drill bit inside the conductor casing. The fluid would be recirculated using a mud tank located next to the drill rig. Once the drill bit reaches groundwater, the construction contractor would pump out all of the sand-bentonite mud slurry and put it in a storage container for off-site disposal. The elevation of the groundwater surface would be determined from the existing monitoring wells.

The remaining 900 feet (274 meters) of borehole below the top of the groundwater table would be drilled using water already present in the sand and some potable water. No bentonite mud or other additives would be used to drill this segment of the slant well. The water and sediment mixture generated during drilling of the lower portion of slant well would be placed in settling tanks, as necessary, to allow sediment to settle out. The volume of water produced during this drilling phase would be small, allowing the construction contractor to dispose of the clarified effluent by percolating it into the ground at the CEMEX mining area. Drilling spoils generated while drilling the lower portion of slant well would not contain bentonite mud or other additives; they would be spread within the construction disturbance area and would not require offsite disposal.

To develop the slant wells, a submersible pump would be lowered several hundred feet (a few hundred meters) into each well and would be pumped for 2 to 6 weeks during slant well completion and initial well testing. The groundwater pumped from the wells during well development would be discharged to the ocean, within the waters of MBNMS, through the test slant well discharge pipe and the existing MRWPCA ocean outfall. The wellheads would include 12-inch- (30 cm-) diameter mechanical discharge piping (i.e., flow meter, isolation valve, check valve, pump control valve, air release valve, and pressure gauge). The discharge mechanical piping would be located in a below ground vault (12 foot by 6 foot [3.6 by 1.8 meters]). The discharge piping would then connect to the buried source water pipeline. The wellheads would be accessible at grade level.

#### *2.2.2.2 ASR Injection/Extraction Wells*

Construction activities for new ASR injection/extraction wells would include grading, installation and removal of temporary sound walls; well drilling, installation of pipeline connections to the proposed ASR Conveyance Pipelines along General Jim Moore Boulevard, and installation of electrical equipment, pumps, and an access road from General Jim Moore Boulevard. Construction equipment would include drill rigs, water tanks, pipe trucks, flatbed trucks, and several service vehicles. The new ASR injection/extraction wells would be drilled using the reverse rotary drilling method. Bentonite drilling fluids would not be used during well drilling, but noncorrosive, environmentally inert, biodegradable additives may be used to keep the borehole open if necessary. Most construction activities would extend from 7 a.m. to 7 p.m., 5 days per week; however, continuous 24-hour construction would be necessary for approximately 4 weeks, per well, of the initial well drilling until final depth is reached and the borehole is stabilized. Construction of both wells is expected to take 12 months.

The well development water would be disposed of in accordance with Central Coast Regional Water Quality Control Board (RWQCB) Resolution No. R3-2008-0010, General Waiver for Specific Types of

Discharges (RWQCB 2008). Any waste material generated during construction of the proposed ASR facilities that requires off-site disposal would be transported to an approved landfill facility.

### 2.2.3 Desalination Plant Construction

Construction activities would include grading and general site preparations, pouring concrete footings for foundations, tanks, and other support equipment; constructing walls and roofs; cutting, laying, and welding pipelines and pipe connections; assembling and installing major desalination process components; installing piping, pumps, storage tanks, and electrical equipment; testing and commissioning facilities; and finish work such as paving, landscaping, and fencing the perimeter of the site.

Construction workers would access the MPWSP Desalination Plant site by Charles Benson Road and existing access roads. Construction equipment would include excavators, backhoes, graders, pavers, rollers, bulldozers, concrete trucks, flatbed trucks, boom trucks or cranes, forklifts, welding equipment, dump trucks, air compressors, and generators. Pretreatment, RO, and post-treatment facilities would be prefabricated and delivered to the site for installation. Approximately 25 acres (10 hectares) of the 46-acre (18.6-hectare) site would be disturbed during construction. Construction activities at the desalination plant site are expected to occur over 24 months.

### 2.2.4 Brine Discharge

Continuously recording automated water quality monitoring devices will be installed at least one year prior to implementing operational discharges to the receiving waters of Monterey Bay. The devices will monitor salinity and dissolved oxygen to ensure that the operational discharges from the MPWSP are in compliance with the 2 ppt receiving water salinity limitation as required by the California Ocean Plan. A Monitoring and Reporting Plan, consistent with the standard monitoring procedures in Appendix III of the Ocean Plan, will be implemented as described in Section 6.6.1, Water Quality Monitoring.

### 2.2.5 Pipeline Installation

Approximately 21 miles (33.8 km) of pipelines would be installed within paved roadways, or adjacent to roads and the Monterey Peninsula Recreational Trail. Most pipeline segments would be installed using conventional open-trench technology; however, where it is not feasible or desirable to perform open-cut trenching, trenchless methods would be used.

Typical construction equipment for pipeline installation would include flatbed trucks, backhoes, excavators, pipe cutting and welding equipment, haul trucks for spoils transport, trucks for materials delivery, compaction equipment, Baker tanks, pickup trucks, arc-welding machines, generators, air compressors, cranes, drill rigs, and skip loaders. Pipeline segments would typically be delivered and installed in 6- to 40-foot-long (1.8- to 12-meter) sections. Soil removed from trenches and pits would be stockpiled and reused, to the extent feasible, or hauled away for offsite disposal. Topsoil would be stockpiled separately and replaced last. Under typical circumstances, the width of the disturbance corridor for pipeline construction would vary from 50 to 100 feet (15 to 30 meters), depending on the size of the pipe being installed. Multiple pipelines would be built simultaneously. Although most pipeline construction would occur over a 15-month period, pipeline construction could occur any time throughout the entire 24-month construction period. The construction duration for most individual pipelines would be much shorter than 15 months. Pipeline installation would be sequenced to minimize land use disturbance and traffic disruption to the extent possible.

#### *2.2.5.1 Open-Trench Construction*

The construction sequence for pipeline installed using open-trench methods would typically include:

- Clearing and grading the ground surface along the pipeline alignments;

- Excavating the trench;
- Preparing and installing pipeline sections;
- Installing vaults, manhole risers, manifolds, and other pipeline components;
- Backfilling the trench with nonexpansive fills;
- Restoring preconstruction contours; and
- Revegetating or paving the pipeline alignments, as appropriate.

A conventional backhoe, excavator, or other mechanized equipment would be used to excavate trenches. The typical trench width would be 6 feet (1.8 meters); however, vaults, manhole risers, and other pipeline components could require wider excavations. Work crews would install trench boxes or shoring, or would lay back and bench the slopes, to stabilize the pipeline trenches and prevent the walls from collapsing during construction. After excavating the trenches, the contractor would line the trench with pipe bedding; that is, sand or other appropriate material shaped to support the pipeline. Construction workers would then place pipe sections (and pipeline components, where applicable) into the trench, weld the sections together as trenching proceeds, and then backfill the trench. Most pipeline segments would have 4 to 5 feet (1.2 to 1.5 meters) of cover. Open-trench construction would generally proceed at a rate of about 150 to 250 feet (45 to 76 meters) per day. Steel plates would be placed over trenches to maintain access to private driveways. Some pipeline installation would require construction in existing roadways and could result in temporary lane closures or detours.

#### *2.2.5.2 Trenchless Technologies*

Where it is not feasible or desirable to perform open-cut trenching, workers would use trenchless methods such as jack-and-bore, drill-and-burst, horizontal directional drilling, or microtunneling. Pipeline segments in heavily congested underground utility areas or in sensitive habitat areas would likely be installed using horizontal directional drilling or microtunneling. Jack-and-bore methods would likely be used beneath railroad crossings. Horizontal directional drilling would likely be used for pipeline segments that cross beneath Highway 1 (Transmission Main) and beneath drainages (Castroville Pipeline). Trenchless methods of pipeline installation would be required at five identified locations (additional locations may be identified during final pipeline design):

1. Installation of the Source Water Pipeline beneath the TAMC ROW at Lapis Road, just north of the CEMEX Plant access road
2. Installation of the Desalinated Water Pipeline beneath the TAMC ROW near the southern intersection of Lapis Road and Del Monte Boulevard
3. Installation of the Transmission Main beneath the TAMC ROW near Marina Drive, Del Monte Boulevard, and Reindollar Avenue in the City of Marina.
4. Installation of the Transmission Main at Highway 1 and Lightfighter Drive
5. Installation of the Castroville Pipeline under Tembladero Slough

##### Jack-and-Bore and Microtunneling Methods

The jack-and-bore and microtunneling methods entail excavating an entry pit and an egress pit at either end of the pipe segment. A horizontal auger is used to drill a hole, and a hydraulic jack is used to push a casing through the hole to the egress pit. As the boring proceeds, a steel casing is jacked into the hole and pipe is installed in the casing.

##### Drill-and-Burst Method

The drill-and-burst method involves drilling a small pilot hole at the desired depth through a substrate, and then pulling increasingly larger reamers through the pilot hole until the hole reaches the desired diameter.

### Horizontal Directional Drilling

Horizontal directional drilling requires the excavation of a pit on either end of the pipe segment. A surface-launched drilling rig is used to drill a small horizontal boring at the desired depth between the two pits. The boring is filled with drilling fluid and enlarged by a back-reamer to the required diameter. The pipeline is then pulled into position through the boring. Entry and receiving pits range in size depending on the length of the crossing, but typically have dimensions of approximately 50 by 50 feet (15 by 50 meters).

## 2.2.6 Disinfection of Existing and Newly Installed Pipelines

Before connecting existing and new pipelines, CalAm would drain and disinfect the existing pipeline segments. Similarly, upon completing construction activities, facility operators would disinfect the newly installed pipelines and pipeline connections before bringing the pipelines into service. Effluent produced during the pipeline disinfection process would be discharged to the local stormwater drainage system in accordance with the Central Coast RWQCB *General Waste Discharge Requirements for Discharges with Low Threat to Water Quality* (Order No. R3-2011-0223, NPDES Permit No. CAG993001) (RWQCB, 2011).

### *2.2.6.1 Carmel Valley Pump Station*

The contractors would clear and grade the construction areas prior to the onset of construction activities, including temporary staging areas, as necessary. Construction activities would include the following: clearing, excavation and cutting, laying, and welding of pipelines and pipe connections; pouring concrete footings for foundations, tanks, and other support equipment; constructing walls and roofs; assembling and installing major components; installing piping, pumps, storage tanks, and electrical equipment; testing and commissioning facilities; and finish work such as paving, landscaping, and fencing the perimeter of the site.

Typical construction equipment would include excavators, backhoes, graders, pavers, rollers, bulldozers, concrete trucks, flatbed trucks, boom trucks and/or cranes, forklifts, welding equipment, dump trucks, air compressors, and generators. Access to the site would be provided from Carmel Valley Road. Construction-related best management practices (BMPs) would be implemented to minimize soil erosion, soil loss from construction sites, and prevent stormwater and other pollutants from leaving the construction sites. Construction is estimated to begin in June 2018 and conclude by September 2018. Construction would occur 8 hours per day, 5 days a week over the 4-month construction period.

### *2.2.6.2 Installation of Powerlines*

New powerlines would be built underground and aboveground between the existing powerlines in the area and the proposed facilities. Installation of overhead powerlines would be done in two phases: (1) installing the poles, and (2) installing and tensioning the powerline. Power poles would be installed approximately 300 feet (91 meters) apart. The poles would be set by digging a hole 10 feet (3 meters) deep, placing the pole in the hole, and backfilling. An area approximately of 50 by 50 feet (15.2 by 15.2 meters) would be needed at each of the pole locations for laydown and assembly. A limited amount of vegetation may be removed, but grading would not be needed. Construction workers would use standard rubber-tired line trucks to access the alignment, and to install and tension the new overhead powerlines. The puller/tensioner would be mounted on a utility truck or on a double-axle trailer. Workers may need to trim or remove some vegetation along the alignment to keep vegetation away from the overhead powerlines.

Installation of the new underground powerlines would require excavation of a trench approximately 1 foot wide by 3 feet deep (0.3 to 0.9 meter) along their alignments. Construction workers would backfill the trench and restore the ground surface after installation of the underground powerline is completed.

#### *2.2.6.3 Construction Schedule*

Construction is expected to start July 2018 and continue through June 2020 (24 months total).

## 2.3 Project Operations

The only aspect of operations that may affect listed species under NMFS jurisdiction are the operation of the source water intake system (the slant wells), and use of the existing wastewater outfall to discharge produced brine in combination with other treated discharges.

### 2.3.1 Source Water Intake and Processing

CalAm would operate the subsurface slant wells and MPWSP Desalination Plant 24 hours a day, 365 days per year. Up to five subsurface slant wells would run at any given time, with each well producing approximately 3 mgd of source water for the MPWSP Desalination Plant, for a combined total of up to 15.5 mgd of source water. At least two wells would stay on standby. Approximately 25 to 30 facility operators and support personnel would be on site 24 hours a day to operate the desalination facilities.

The slant wells would require maintenance every 5 years. During maintenance, workers would access the well from the wellhead, and would lower mechanical brushes into the wells to clean the screens. If chemical cleaning products are needed for maintenance, only environmentally inert products would be used. The disturbance area associated with periodic maintenance of the subsurface slant wells would be roughly 2 acres (0.8 hectares) total. All disturbances would occur on the back side of the dunes at the wellheads. Accounting for all of the slant wells, maintenance activities within the beach area would last between 9 and 18 weeks every 5 years.

Water drawn from the slant wells, which is predominantly seawater, would be pumped to the Desalination Plant. From there, it would undergo a pretreatment process before going to the RO system. The pretreatment requirements for seawater collected by the proposed slant wells would be determined through the operation of the test slant well and pilot program, but could include coagulation of dissolved solids, flocculation to promote the settlement of solids, or membrane filtration.

RO is an ion separation process that uses semipermeable membranes to remove salts and other compounds from water. Pretreated source water is forced at very high pressures through RO membranes. Water molecules, which are smaller than salt and many other impurities, are able to pass through the membranes. A portion of the source water passes through the RO membranes to produce “permeate,” or desalinated water; the source water that does not pass through the membranes increases in salt concentration and is discharged as brine. This brine also contains a concentration of all other seawater constituents that were not removed in the pretreatment process.

### 2.3.2 Combined Discharge

The MPWSP Desalination Plant would operate at an overall recovery rate of 42 percent. Approximately 15.5 mgd of raw seawater would be needed to produce 6.4 mgd of desalinated product water. The RO process would generate approximately 8.99 mgd of brine. The salinity of the brine is expected to range between 57 and 58 ppt, which is roughly 71 to 74 percent higher than seawater (Flow Science Inc. 2014). The brine stream would be discharged to Monterey Bay via the existing MRWPCA ocean outfall and diffuser.

Brine would be mixed with treated wastewater from the MRWPCA Regional Wastewater Treatment Plant during some times of the year before being discharged through the ocean outfall. During the agricultural irrigation season, April through October, the treated wastewater is diverted to the Salinas Valley Reclamation Project’s tertiary treatment facility for additional advanced treatment and then used to irrigate crops as part of the CSIP. During irrigation season, the project’s brine stream would be discharged to Monterey Bay without dilution if the MRWPCA treated wastewater flows are equal to or less than the CSIP demand for irrigation water. During the nonirrigation season (November through March), when the CSIP is not operating, the brine stream would be mixed with treated wastewater from the MRWPCA Regional Wastewater Treatment Plant before being discharged to the ocean.

Year-round, the brine would be blended with 0.94 mgd of RO concentrate from the Pure Water Monterey Groundwater Replenishment (GWR) Project. Together, the brine from the Proposed Action, GWR concentrate, and treated wastewater effluent are referred to as the "combined discharge." The MRWPCA's diffuser would disperse the combined discharge along its multiport length, increasing the initial dilution and thereby minimizing salinity differences between the discharges and the surrounding seawater.

## 2.4 Action Area

As defined under the ESA, the Action Area includes all areas that may be affected directly or indirectly by the Proposed Action and not merely the immediate area involved in the Action. It encompasses the geographic extent of environmental changes (i.e., the physical, chemical, and biotic effects) that will result directly and indirectly from the Action. For the Proposed Action, the Action Area includes the project footprint, which comprises the boundaries of all permanent infrastructure (e.g., slant well sites, the Proposed Desalination Plant, pipelines, and pump stations); and all work areas, access routes, and staging areas necessary for construction. For this BA, the Action Area is limited to those project components that have the potential to result in direct or indirect effects on species under NMFS jurisdiction. For the Proposed Action, there are three Action Areas: 1) the marine areas that may be affected by the combined discharge in MBNMS from the existing MRWPCA ocean outfall; 2) the area associated with the Castroville Pipeline crossing of the Salinas River; and 3) the drilling of the slant wells underneath the intertidal and subtidal waters of Monterey Bay. The latter would have no potential effects on resources under NMFS jurisdiction, because the drilling would not generate detectable noise or have other effects in the water column.

The Action Area associated with the combined discharge is approximately 1.5 miles (2.4 km) offshore of Marina, California, about 2.5 miles (4.0 km) southwest of the mouth of the Salinas River. The underwater diffuser is 1,100 feet (335 meters) long and sits on ballast rock in about 100 feet (30 meters) of water. The combined discharge Action Area is 162.57 acres (65 hectares) in size, includes the entire water column, and extends beyond the project footprint; it also includes the zone of initial dilution (ZID), the brine mixing zone (BMZ), and the area over which salinity may be increased above ambient by 0.5 ppt or more (i.e., far-field dilution zone). The orientation of the potential effects of the combined discharge Action Area would vary depending on ocean climate and water chemistry but would not be expected to exceed the area associated with the far field dilution zone. Based on modeling of the combined discharge (See January 2017 Draft EIR/EIS Appendix D1, Scenario V9), the ZID would extend up to 42 feet (12.8 meters) from the diffusers and the area far-field dilution zone may extend out as much as 1,148 feet (350 meters) from the diffusers. The BMZ, as defined by the California Ocean Plan (SWRCB 2015, revised and effective January 28, 2016), extends out 328 feet (100 meters).

The Action Area associated with the Salinas River crossing is approximately 1,081 feet (330 meters) long and includes the project footprint required for construction, the limits of vegetation clearing and removal, and a 50-foot (15-meter) buffer up and downstream of the crossing and totals 3.37 acres (1.4 hectares) (see Figure 6).

# 3 Affected Environment

This section describes the habitat and species present, and the affected environment. The information presented in this section is focused on the marine environment and the Salinas River in the Action Area. These areas correspond to the project components that could affect resources under the jurisdiction of the NMFS and include the combined discharge into Monterey Bay within MBNMS, and the pipeline crossing of the Salinas River.

The jurisdictional responsibilities and listing procedures for federally listed species were established in 1974 through a Memorandum of Understanding between the USFWS and the NMFS. Specifically, the NMFS has jurisdictional responsibilities for "all species of the order *Cetacea*; all species of the order *Pinnipedia*, other than walruses; all commercially harvested species of the phylum *Mollusca* and the class *Crustacea* which spend all of their lifetimes in estuarine waters; and all other non-mammalian species (except members of the classes *Aves*, *Amphibia*, and *Reptilia*) which either (i) reside the major portion of their lifetimes in marine waters; or (ii) are species which spend part of their lifetimes in estuarine waters, if the major portion of the remaining time (the time which is not spent in estuarine water ) is spent in marine waters" (NMFS and USFWS 1974).

A separate BA for potential project-related effects on species that are under the jurisdiction of the USFWS has been prepared. The USFWS BA contains a summary of the affected environment, potential adverse effects on federally listed species under USFWS jurisdiction, proposed avoidance and minimization measures, and meets requirements for a BA identified in 50 CFR §402.12(f).

Some of the species covered in this NMFS BA are jointly managed with the USFWS. The NMFS and USFWS share jurisdiction over marine sea turtles in the *Cheloniidae* and *Dermochelyidae* families (NMFS and USFWS 1974). NMFS has lead responsibility in the marine environment, while USFWS has responsibility for sea turtles on land. Because marine sea turtles do not nest on terrestrial areas in Monterey County, these species are not discussed in the USFWS BA and are included only in this NMFS BA.

Section 3.1 describes the methods used to assess the Action Area. Section 3.2 describes the affected environment in the Action Area. Section 3.3 presents the life history of each of the federally listed, proposed, and candidate species, and evaluates the potential for the species to occur in the Action Area. Section 3.4 discusses those species that have low potential to occur in the Action Area. Section 3.5 describes the EFH identified in the various Fishery Management Plans (FMPs).

## 3.1 Methods

The following sources were used to compile information on current and proposed threatened or endangered species, current and proposed DCH, species occurrence records, and EFH in the Action Area and vicinity:

- NMFS Californian Species List Tools for the Marina U.S. Geological Survey topographic quadrangle (Quad Number 36121-F) (NMFS 2016a, September) (Appendix A);
- NOAA NMFS Habitat Conservation EFH Mapper (including Habitat Areas of Particular Concern [HAPCs]) (NMFS 2016f);
- FMPs; and
- A California Natural Diversity Database RareFind 5 query for records of federally listed species within a 5-mile (8 km) radius of the Action Area (CNDDB 2016).

Of the species identified from the sources above, some have no potential to occur in the Action Area, while others are known to occur or the suitable habitat required to complete their life history requirements is present (Table 3). Those species with no potential to occur include those species whose geographic range occurs outside of the Action Area or those species with no suitable habitats in the Action Area. For species with a low potential to occur, suitable habitat may be present, but it may have less than ideal conditions for the species or may be near the current extent of the species range. For species with moderate potential to occur, suitable foraging or breeding/spawning habitat is present and the species are believed to, or are known to, occur in or near the Action Area. However, they may not occur every year or only seasonally in such few numbers that they may not overlap the Action Area. Species with high potential to occur include those species that have been well documented in Monterey Bay, species for which the Action Area has suitable and appropriate habitat, and species that likely occur in the Action Area on a regular or seasonal basis. Table 3 lists the species identified in the background research and provides a justification for the potential to occur status, including those species with no potential to occur.

Based on the background review and field surveys of the Salinas River crossing performed in 2015 and 2016, the Action Area provides habitat suitable to support the following federally listed species that are regulated by NMFS under the ESA:

- Steelhead – South-CCC Distinct Population Segment (DPS) (*Oncorhynchus mykiss*);
- Coho salmon – South Central California Evolutionarily Significant Unit (ESU) (*Oncorhynchus kisutch*);
- Chinook salmon – Sacramento River winter-run, Central Valley spring-run, California Coastal ESUs (*Oncorhynchus tshawytscha*);
- Green Sturgeon – Southern DPS (*Acipenser medirostris*);
- Leatherback Sea Turtle (*Dermochelys coriacea*);
- Humpback Whale Mexico DPS; Central America DPS (*Magaptera novaeangliae*); and
- Killer Whale – Southern Resident DPS (*Orcinus orca*).

## TABLE 3 FEDERAL LISTED SPECIES WITH THE POTENTIAL TO OCCUR IN THE ACTION AREA

| Common Name *Scientific Name* | Status [1] | Habitat | Range | Potential to Occur, per Action Area (Combined Discharge Action Area/Salinas River Action Area) |
|---|---|---|---|---|
| Fish | | | | |
| Steelhead – South-CCC DPS<br>CCC DPS<br>*Oncorhynchus mykiss* | T, CH<br>T | Anadromous. Spawn in coastal watersheds; reared in freshwater and estuarine habitats (1 to 3 years) prior to migrating to sea (1 to 4 years). | The South-CCC DPS spawns in waterways from the Pajaro River (at the border between Santa Cruz and Monterey Counties) south to (but not including) the Santa Maria River (at the border of San Luis Obispo and Santa Barbara Counties). Sub-adults of both the South-CCC and CCC DPS travel and forage widely in marine waters of the north and central Pacific Ocean. | High Potential to Occur/High Potential to Occur. South-CCC DPS spawns in the Salinas River. Migrates through the Salinas River Action Area to suitable spawning habitat well upstream of the Action Area. Adults of the South-CCC and CCC DPS units may occur in the marine waters of the combined discharge Action Area. DCH (3309) present for South-CCC DPS in the Action Area associated with Salinas River. |
| Eulachon– Southern DPS<br>*Thaleichthys pacificus* | T, CH | Anadromous. Nearshore ocean water and to 1,000 feet (300 meters) in depth. Spawn in natal freshwater streams of lower reaches of larger snowmelt-fed rivers over sand or coarse gravel substrates. | Endemic to eastern Pacific Ocean, ranging from North California to southwest Alaska and the southeastern Bering Sea. Documented as far south as the Sacramento River, with major spawning runs occurring from the Columbia River Basin. Known to spawn as far south as the Mad River. | Low Potential to Occur/No Potential to Occur. Suitable spawning habitat is not present in the Salinas River Action Area. Nearshore habitats may be suitable for the species, but the species is not known from Monterey Bay or the combined discharge Action Area. Critical habitat is not located near the Action Area. |
| Coho Salmon – Central California ESU<br>*Oncorhynchus kisutch* | T | Anadromous. Spawn in small to moderately sized coastal streams characterized by heavily forested watersheds and cold water, and perennially flowing waterways. Juveniles rear in freshwater for less than a year and return to spawn during their third year. | Spawn in watersheds outside of the Action Area. Sub-adults travel widely in coastal waters and feed on crustaceans, squid, and fish. | High Potential to Occur/No Potential to Occur. Suitable marine habitat is present in the marine waters of the combined discharge Action Area. Species is most abundant in the upper 10 meters of coastal waters and is associated with areas of pronounced coastal upwelling (PFMC 2014). Historically spawned in the Pajaro and Salinas River, but not since the 1990s. |
| Chinook Salmon-<br>Sacramento River winter run Chinook salmon ESU<br>Central Valley spring-run Chinook | E<br>T | Anadromous. Prefer streams that are deeper and larger than those used by other Pacific salmon species. Juveniles may spend from 3 months to 2 years in freshwater before migrating to estuarine areas as smolts and then into the ocean to | All ESUs spawn in watersheds outside of the Action Area. Sub-adults of all ESUs travel widely in coastal waters and feed on crustaceans, squid, and fish. | High Potential to Occur/No Potential to Occur. Suitable marine habitat is present in the combined discharge Action Area. Species is most abundant in deeper water depths of 30 to 70 meters, and is associated with areas of pronounced coastal upwelling. Species is not known to spawn in the Salinas |

| Common Name *Scientific Name* | Status [1] | Habitat | Range | Potential to Occur, per Action Area (Combined Discharge Action Area/Salinas River Action Area) |
|---|---|---|---|---|
| salmon ESU<br>California coastal Chinook salmon ESU<br>*Oncorhynchus tshawytscha* | T | feed and mature. | | River Action Area. |
| North American Green Sturgeon – Southern DPS<br>*Acipenser medirostris* | T, CH | Anadromous. Nearshore oceanic waters, bays, and estuaries. Early life stage in freshwater, with adults returning to spawn when they are more than 15 years of age. | Ensenada, Mexico, to Bering Sea, Alaska. Forages in estuaries and bays ranging from San Francisco to British Columbia. This DPS spawns in Sacramento, lower Feather River, and lower Yuba River, and from Eel River south to Sacramento/Feather River. | High Potential to Occur/No Potential to Occur. Known from marine and coastal environmental of Monterey Bay (adults). However, no suitable freshwater spawning, rearing, or migration habitat is present in the Salinas River Action Area. DCH is present in Coastal/Marine Areas in Monterey Bay to a depth of 328 feet (100 meters) in the combined discharge Action Area. |
| Marine Invertebrate | | | | |
| Black Abalone<br>*Haliotis cracherodii* | E, CH | Crevices, cracks, and holes of intertidal and shallow subtidal rocks. Areas of moderate to high surf. | From Point Arena, California, to Bahia Tortugas and Isla Guadalupe, Mexico. Rare north of San Francisco and south of Punta Eugenia. | No Potential to Occur/No Potential to Occur. Suitable intertidal or subtidal habitats with rocky substrate do not occur in or adjacent to the Action Area. Critical habitat is not designated in or near the Action Area. |
| Marine Turtles | | | | |
| Green Sea Turtle- East Pacific DPS<br>*Chelonia mydas* | T | Beaches for nesting, open ocean convergences zone, and coastal areas for benthic feeding (seagrass and algae). | Reported in ocean habitats from Central America to southern Alaska. No nesting beaches in the U.S. Foraging grounds in U.S. are unknown; most reports are from southern California and Baja California. | Low Potential to Occur/No Potential to Occur. Suitable pelagic habitat present, although limited foraging opportunities exist in the combined discharge Action Area. No breeding habitat in the U.S. and most foraging in the U.S. is concentrated in San Diego. |
| Olive Ridley Sea Turtle<br>*Lepidochelys olivacea* | T | Pelagic sea turtle, but also inhabits coastal areas, including bays and estuaries. Breeds on beaches of Central America. Dives to depths of 500 feet, (152 meters) to forage on benthic invertebrates. | Breeding occurs in Central America. Migration occurs over great distances, and forages along the west coast of the continental U.S. and Hawaii in tropical and temperate ocean waters. | Low Potential to Occur/No Potential to Occur. The species is primarily known to forage from Southern California south to Chile. Suitable pelagic habitat is present, although limited foraging opportunities exist in the combined discharge Action Area. No breeding habitat in the U.S., and most open water |

| Common Name *Scientific Name* | Status [1] | Habitat | Range | Potential to Occur, per Action Area (Combined Discharge Action Area/Salinas River Action Area) |
|---|---|---|---|---|
| | | | | observations are from Mexico. |
| Leatherback Sea Turtle<br>*Dermochelys coriacea* | E, CH | Pelagic sea turtles, forage in coastal waters. Long migrations. Nest on tropical beaches. Eats soft bodied animals such as jellyfish and salps, and pyrosomes. | Breeding occurs in the Western Pacific Ocean. Foraging occurs in the eastern North Pacific (western U.S. Coast). | High Potential to Occur/No Potential to Occur. Suitable prey species are present in Monterey Bay combined discharge Action Area. The species is well documented in Monterey Bay, typically between July and October. DCH (Area 1) is present in the Action Area. |
| Loggerhead Sea Turtle – North Pacific DPS<br>*Caretta caretta* | E | Nests on beaches in the northwestern Pacific Ocean. Open ocean and nearshore coastal areas. Eats whelks and conch. | Nests in Japan and South China Sea. Primarily found south of Point Conception. Only four occurrences north of Point Conception between 1990 and 2012. | Low Potential to Occur/No Potential to Occur. No nesting habitat present in the Action Area. Few occurrences in the vicinity of the combined discharge Action Area. May be more likely to occur during El Niño when suitable prey may be present. |
| Marine Mammals | | | | |
| Blue Whale<br>*Balaenoptera musculus* | E | Coastal and pelagic environments. Frequently found on the continental shelf and far offshore in deep water. Primarily eats krill. | From Kamchatka to southern Japan in the west and the Gulf to Alaska and California south to at least Costa Rica in the east. | Low Potential to Occur/No Potential to Occur. Known to occur in submarine canyon in Monterey Bay and just north of MBNMS boundary. Foraging, rearing, and migration habitat occurs in Monterey Bay, but is typically in deeper water than found in the combined discharge Action Area. May be present from June through November. |
| Fin Whale<br>*Balaenoptera physalus* | E | Immediate offshore waters. Concentrations along frontal boundaries, or mixing zones between coastal and oceanic waters, corresponding to 200-meter isobaths where prey (krill) is concentrated. Also eats schooling fish and squid. | North Pacific: from central Baja California to Japan. | Low Potential to Occur/No Potential to Occur. Occurs in Monterey Bay, but is typically concentrated in areas with deeper water and high concentrations of krill than found in the Action Area. May be present in Monterey Bay year round, but mostly in summer and early fall. |
| Humpback Whale -<br>Mexico DPS<br>Central America DPS<br>*Magaptera novaeangliae* | <br><br>T<br>E | Coastal and inland waters; mainly waters 75 to 105 meters deep. Continental shelves, along their edge and around oceanic islands. Eats mostly krill, but also plankton and small fish. | Summer range: from Point Conception, north to the Gulf of Alaska and the Bering Sea. Winter range includes Baja California, Mexico, and Central America. | Moderate Potential to Occur/ No Potential to Occur. Occurs in Monterey Bay fairly close to shore over the continental shelf and in the vicinity of the continental shelf break, but is typically found in areas with deeper water than found in the combined discharge Action |

| Common Name *Scientific Name* | Status 1 | Habitat | Range | Potential to Occur, per Action Area (Combined Discharge Action Area/Salinas River Action Area) |
|---|---|---|---|---|
| | | | | Area. No wintering habitat in the Action Area. May be present in Monterey Bay from April to November, but some individuals may be present year-round. |
| Killer Whale – Southern Resident DPS *Orcinus orca* | E | Abundant in colder waters; less abundant in tropical, subtropical, and offshore waters. Inland waters. Population includes three pods- J, K, and L. Diet includes salmon, herring, cod, tuna, sharks, and rays | Spring, summer, and fall: Salish Sea (including Puget Sound), Northwest Straits, and south Georgia Strait. Winter range extents from Monterey Bay, California to Chatham Strait in southeast Alaska. | Moderate Potential to Occur/ No Potential to Occur. Species primarily occurs in Washington; however, some winter movements occur into Northern California. Resident killer whales are observed during winter months in Monterey Bay and may occasionally occur in the combined discharge Action Area. |
| North Pacific Right Whale *Eubalaena glacialis* | E | Nursery areas include shallow, coastal waters. Coastal or shelf waters (<200 meters deep), with movements to deep waters. Winter in lower latitudes and migrate to higher latitudes in the spring and summer. Feed on zooplankton, including copepods, euphausiids, and cyprids | Pacific Ocean, eastern North Pacific stock is from Baja California, Mexico, to Bering Sea. | Low Potential to Occur/No Potential to Occur. Rare along the California coast and only five individuals have been seen in MBNMS since 1900. Suitable migration and winter/spring habitat is present in the combined discharge Action Area. Historically, has never been captured in large numbers along the California coast. May be present in Monterey Bay from February to May. |
| Sei Whale *Balaenoptera borealis* | E | Subtropical to subpolar waters on the continental shelf edge and slope. Typically observed in deep water of oceanic areas far from the coastline, associated with fronts and eddies. Feed on plankton, small schooling fish and cephalopods. | Temperate waters; south of the Aleutian Islands, and range from Baja California, Mexico, to Japan and Korea in the west. | No Potential to Occur/No Potential to Occur. Rarely observed off the California coast. Typically in waters far from the coast and away from the combined discharge Action Area. |
| Sperm Whale *Physeter macrocephalus* | E | Inhabit areas with water depths of 600 meters or more and are uncommon in water less than 300 meters deep. Feed on large squid, sharks, skates, and fishes. | All oceans of the world. Close to pack ice in both hemispheres and common along the equator in the Pacific. | Low Potential to Occur/No Potential to Occur. Typically found in waters much deeper than those present in the combined discharge Action Area. There have been no observations of the species in Monterey Bay. |
| Guadalupe Fur Seal *Arctocephalus* | T | Tropical waters and coastal rocky habitat and caves. Breed on Guadalupe | Breeding on select islands of Southern California and Mexico. Nonbreeding season | Low Potential to Occur/No Potential to Occur. Species does not breed near the combined |

| Common Name *Scientific Name* | Status [1] | Habitat | Range | Potential to Occur, per Action Area (Combined Discharge Action Area/Salinas River Action Area) |
|---|---|---|---|---|
| *townsendi* | | Island, Mexico; San Benito Island, Baja California; and San Miguel Island, California. Feed on squid, mackerel, and lantern fish | range is poorly understood, but may range at least as far north as the Farallones. | discharge Action Area, but may occur in Monterey Bay during the nonbreeding season. Several strandings have been reported from Monterey Bay. |

Notes:

Low Potential to Occur indicates species that are highly unlikely to be affected by the Proposed Action; these species are discussed in Section 3.4.

CCC = Central California Coast
DCH = Designated Critical Habitat
DPS=Distinct Population Segment
ESU = Evolutionarily Significant Unit
MBNMS = Monterey Bay National Marine Sanctuary
South-CCC = South-Central California Coast

[1] Federal Status:
E=Endangered
T= Threatened
CH=Critical Habitat

**The Action Area is also in an area identified as EFH for various life stages of fish species that are managed in accordance with the following FMPs, under the Magnuson-Stevens Fishery Conservation and Management Act (MSA). EFH includes "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." EFH is mapped in the Action Area for numerous species, including:**

- **Pacific Coast Salmon (PCS) FMP:**
  - **Chinook salmon**
  - **Coho salmon**
- **Pacific Coast Groundfish (PCG) FMP:**
  - **Rockfish**
  - **Skate**
  - **Leopard shark**
  - **Soupfin shark**
  - **Spiny dogfish**
  - **Cabezon**
  - **Kelp greenling**
  - **Ling cod**
  - **Pacific cod**
  - **Pacific whiting (hake)**
  - **Arrowtooth flounder**
  - **Butter sole**
  - **Curlfin sole**
  - **Dover sole**
  - **English sole**

- Flathead sole
- Pacific sanddab
- Petrale sole
- Rex sole
- Rock sole
- Sand sole
- Starry flounder

- Coastal Pelagic Species (CPS) FMP:
  - Coastal pelagic finfish (Pacific sardine, Pacific [chub] mackerel, northern anchovy, and jack mackerel)
  - Market squid
  - Krill or Euphausiids (eight dominant species, including Krill (*Euphausia pacifica*)

- FMP for U.S. West Coast Fisheries for Highly Migratory Species (HMS):
  - Common thresher shark

Currently, there are four recognized types of HAPC: estuaries, rocky reef, kelp forest, and seagrass. Estuaries are the only HAPC in the Action Area, and they are only associated with the Salinas River Action Area. HAPCs are described in the regulations as subsets of EFH that are rare, particularly susceptible to human-induced degradation, especially ecology important, or located in an environmentally stressed area. These are high-priority areas for conservation, management, or research, and are important for healthy fish populations.

## 3.2 Environmental Setting

This subsection describes the physical and biological setting of the region and of the Action Area, as defined above.

### 3.2.1 Combined Discharge Setting

The Action Area associated with the combined discharge is in MBNMS. The sanctuary protects marine resources from Marin to Cambria, encompassing 276 linear miles (444 km) along the coast and extending an average of 30 miles (48 km) offshore. The sanctuary includes a variety of habitats, such as pristine beaches, tide pools, kelp forest, steep submarine canyons, and an offshore seamount that support extensive marine life. MBNMS was established for the purpose of research, education, public use, and resource protection. MBNMS manages the sanctuary under the National Marine Sanctuaries Act and issues permits for regulated activities (MBNMS 2016).

The discharge into Monterey Bay would occur through an existing pipeline and wastewater outfall structure. The outfall is 2.1 miles (3.4 km) long and is approximately 1.5 miles (2.4 km) offshore of Marina, California, and about 2.5 miles (5.6 km) southwest of the mouth of the Salinas River (see Figure 7). The underwater diffuser is 1,100 feet (335 meters) long and sits on ballast rock in about 100 feet (30 meters) of water. The MRWPCA owns and operates the pipeline and outfall. The outfall is used to discharge wastewater from the MRWPCA treatment plant.

The existing treatment process for wastewater includes screening, primary sedimentation, and secondary biological treatment through trickling filters, followed by a solids contactor (i.e., bioflocculation); and clarification. Much of the secondary effluent between March and October undergoes tertiary treatment (granular media filtration and disinfection) to produce recycled water used for agricultural irrigation. The unused secondary effluent is discharged to Monterey Bay

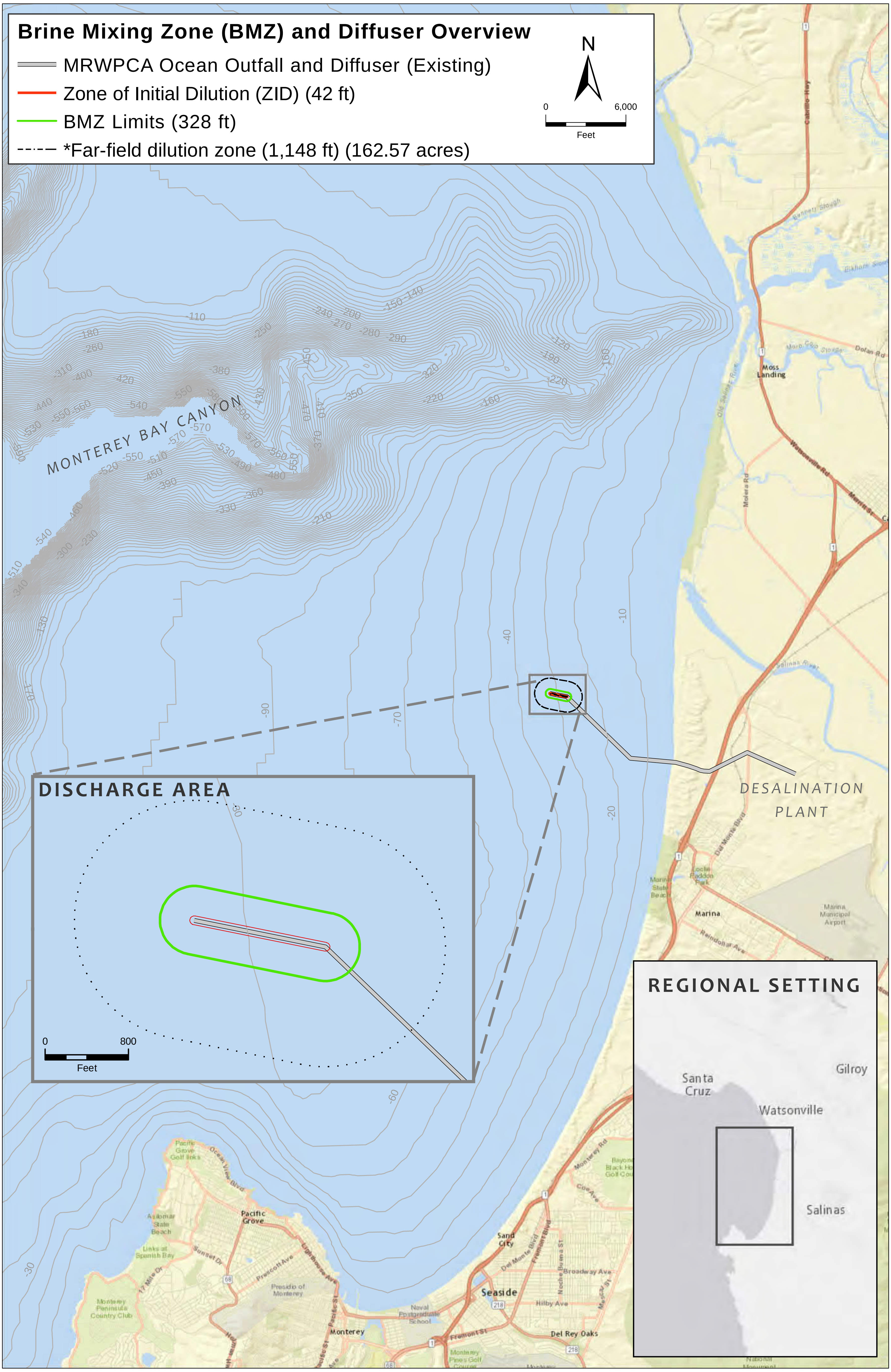
(Trussell Technologies 2016). Extensive dry-season reclamation for agricultural use reduces discharge volumes substantially.

The bathymetry in the vicinity of the Action Area is relatively flat, with an average slope of 1 percent to the west of the diffuser for 5 miles (8 km). The rim of Monterey Submarine Canyon is less than 4 miles (6.4 km) to the northwest of the Action Area (see Figure 7).

Ocean Climate and Seasons: Ocean climate refers to oceanographic conditions, including temperature, salinity, current, and wave patterns prevailing over a period of time. The ocean climate in Monterey Bay is important because the climatic conditions affect the water quality in the Action Area. In Monterey Bay, there are three oceanic climate seasons: upwelling, oceanic, and Davidson.

Upwelling typically occurs between mid-February or March and September (or November), and is characterized by higher nutrient concentrations at the surface, where sunlight and stratification of the water column often lead to high primary production and chlorophyll values. The upwelling is wind-induced and produces cooler surface water. Once the winds relax and upwelling ceases, the oceanic climate occurs, bringing warmer water typically starting in mid-August or September and continuing through mid-October or November. These warmer waters result in phytoplankton blooms that are intermittent and primarily composed of small phytoplankton. Phytoplankton productivity is lowest during the Davidson current, when waters are the coldest, which occurs in the winter between mid-October or November and mid-February or March. These three individual seasons overlap extensively and do not recur with exact consistency.

Habitats: The Action Area associated with the combined discharge is best characterized as a relatively shallow pelagic environment with soft bottom substrate (see Figure 8). Pelagic habitat is found in the water column and is inhabited by zooplankton and phytoplankton organisms that float or swim in the water, and by fish, marine birds, and marine mammals. The Action Area occurs entirely within the epipelagic zone (defined as the area between the surface to around 200 meters [660 feet] in depth), where light is available for photosynthesis, and it is subject to seasonal variations in temperature and salinity (NOS 2014). Monterey Bay has a high level of primary production due to annual seasonal upwelling, typically occurring in the spring and summer. Phytoplankton, the primary producers in the marine pelagic food web, are consumed by many species of zooplankton. In turn, the zooplankton support a variety of species, such as small schooling fish and whales. Zooplankton in the upper epipelagic zone include crustacean larvae, copepods (the most abundant), euphausiids, ctenophore, hydrozoan medusa and siphonopheres, and the chaetognaths (NOS 2014).

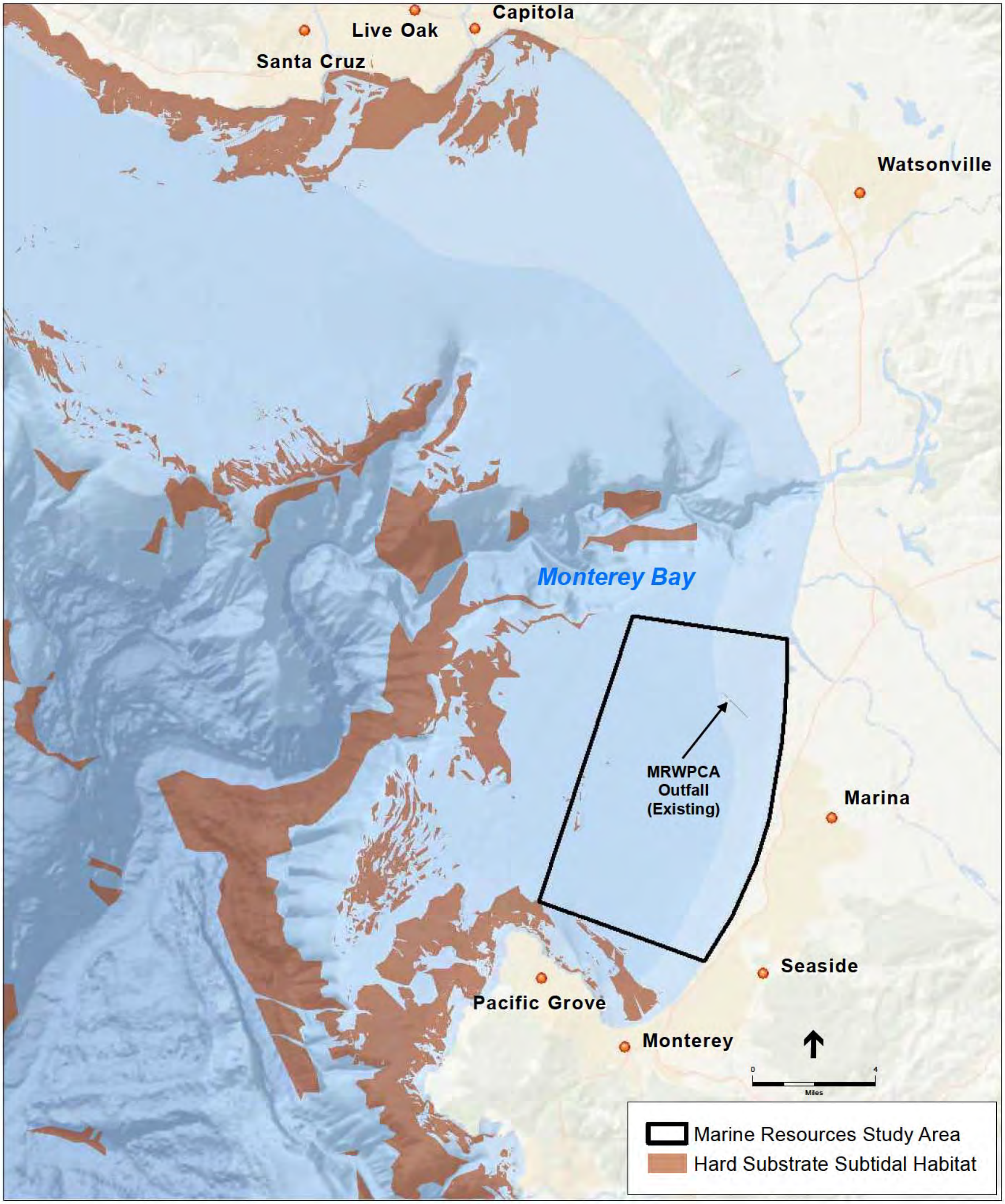



Footnote: *The shape of the far-field dilution zone will shift depending on currents.

Basemap Sources: ESRI, USGS



**Figure 7**
Brine Mixing Zone (BMZ) and Diffuser Overview




Source: NOAA, 2016 and CPUC/MBNMS 2017



**Figure 8**
Hard Substrate Subtidal Habitat in Monterey Bay

**As presented in *Modeling Brine Disposal into Monterey Bay* (Roberts 2016; Appendix B), seawater samples were taken along three towed transects in and adjacent to the discharge site in May 2016. These surveys were used to estimate planktonic levels in and adjacent to the combined discharge Action Area. The size and number of each taxonomic group are provided in Table 4.**

**TABLE 4 PLANKTON TOW RESULTS NEAR THE ACTION AREA**

| Taxonomic Group | Size (mm) | Count (#/$m^3$) |
|---|---|---|
| Copepods | | |
| Copepod (unidentified) | 0.3 to 5.0 | 33.73 |
| *Calanoid* | 1.0 to 5.0 | 3,052.72 |
| *Oithona* sp. | 0.5 to 2.0 | 369.85 |
| *Corycaeus* sp. | 0.3 to 1.5 | 64.31 |
| *Copepod nauplii* | 0.1 to 0.2 | 77.69 |
| Others | | |
| *Euphausiid nauplii* | 0.35 to 0.5 | 13.99 |
| *Euphausiid calyptopis* | 0.8 to 2.2 | 613.94 |
| *Euphausiid furcilia* | 1.0 to 5.6 | 79.68 |
| *Cirripedia nauplii* | 0.35 to 0.5 | 13.83 |
| *Pleurobrachia* sp. | 2.0 to 10.0 | 3.93 |
| *Cladocera podon* | 0.2 to 3.0 | 2.83 |
| *salp* | 1.0 to 10.0 | 79.46 |
| *Appendicularia unid* | 1.0 to 1.5 | 58.04 |
| *Oikopleura unid* | 1.0 to 1.5 | 13.83 |
| *Chaetognath unid* | 4.0 to 10.0 | 29.69 |
| *Isopod unid* | 0.4 to 1.0 | 1.97 |
| *Polychaete unid* | 0.5 to 5.0 | 4.71 |
| *Polychaete trochophore* | 0.2 to 0.8 | 2.67 |
| *Decapod zoea* | 2.0 to 5.0 | 4.40 |
| *Gastropod larvae* | 0.8 to 3.0 | 3.30 |
| *Bivalve veliger* | 0.75 to 1.0 | 4.08 |
| *Siphonophore* | 1.0 to 5.0 | 7.07 |
| *Hydromedusa* | 0.5 to 10 | 1.41 |

Source: Roberts 2016
Notes:
$m^3$ = cubic meter
mm = millimeter

The epipelagic zone in Monterey Bay is inhabited by a number of invertebrate and vertebrate species that may occur in the Action Area; including:

- Cephalopods:
  - market squid (*Doryteuthis* (=*Loligo*) *opalescens*),
  - common squid (*Onychoteuthis boreali-japanicus*), and
  - robust clubhook squid (*Onykia robusta*),
- cartilaginous fish:
  - blue shark (*Prionace glauca*),
  - common thresher shark (*Alopias vulpinus*),
  - mako shark (*Isurus oxyrinchus*),
  - basking shark (*Cetorhinus maximus*),
  - spiny dogfish (*Squalus acanthias*), and
  - ratfish (*Hydrolagus colliei*);
- a diverse array of bony fish, including:
  - Chinook salmon (*Oncorhynchus tshawytscha*),
  - anchovy (*Engraulis mordax*),
  - sardines (*Sardinops sagax*),
  - Pacific saury (*Cololabis saira*),
  - albacore tuna (*Thunnus alalunga*),
  - Pacific bonito (*Sarda chiliensis*),
  - Pacific mackerel (*Scomber japonicus*), and
  - jack mackerel (*Trachurus symmetricus*);
- and billfish, including:
  - swordfish (*Xiphias gladius*) (NOS 2014).

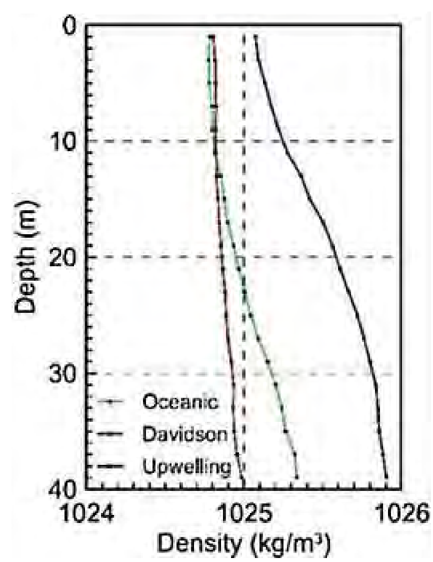
Monterey Bay is also home to diverse and abundant assemblages of marine mammals that occur in the nearshore coastal waters. Three pinniped species are common in the nearshore and coastal waters of Monterey Bay: harbor seal (*Phoca vitulina*), California sea lion (*Zalophus californianus*), and southern sea otter (*Enhydra lutris nereis*) (NOS 2014). Cetaceans (e.g., whales, dolphins, and porpoises) are highly transitory (although some may occur year around), and are typically associated with concentrations of prey that change with oceanic conditions. Common species observed in diverse marine habitats of Monterey Bay include: the humpback whale (*Megaptera novaengliae*), California gray whale (*Eschrichtius robustus*), and in the submarine canyon, the blue whale (*Balaenoptera musculus*). Many other marine mammal species have been observed in Monterey Bay but are considered rare in the nearshore habitats of, or in the immediate vicinity of, the Action Area.

Substrate: Two seafloor or benthic habitat types occur in the Action Area: soft substrate (the dominant substrate naturally present) and hard substrate (limited to the rock ballast that supports the ocean outfall pipeline). Video obtained during a recent inspection of the MRWPCA outfall revealed a rich hard-substrate assemblage on the ballast rock. Numerous species of rockfishes, sea cucumbers, anemones, solitary cup corals, and sponges were observed (CPUC and MBNMS 2017). The substrate surrounding the hard substrate/ballast rock of the discharge pipeline is classified as a soft, unconsolidated sediment (sand), predominantly rippled (Dartnell et al. 2016) (see Figure 8). This substrate is part of the continental shelf and receives silt and sand deposits from the Salinas River. The movement of these deposits is largely controlled by large waves over the Continental shelf. The sediments grade from coarse to finer sand with increased depth and decreased wave disturbance (NOS 2014). Because the Action Area is deep relative to the surf zone, sediment stability is generally greater than that of the shallower areas, and the sediments are generally finer than those of the surf zone.

The Action Area is in the soft substrate "polychaete zone," where polychaetes (marine worms) build permanent tubes and burrows, and other suspension and sessile feeding groups are common. Although no recent studies have been conducted, based on monitoring of the outfall pipe in the late 1990s, a community of tubiculous polychaetes (*Diopatra ornata*) was reported in a distinct band along the southern side of the outfall (CPUC 2009, CPUC 2015, CPUC and MBNMS 2017, Applied Marine Sciences 2000). This small "artificial reef-like" community appears to result from the increased sediment stability provided by the outfall pipe, and not from the discharge (Applied Marine Sciences 2000). The monitoring program also found that the diversity and abundance of organisms has increased, although the benthic community structure has shifted over time, with a general increase in mobile epifauna (e.g., species living on the seafloor) and opportunistic species, and a decrease in sessile species and predators. These findings are consistent with patterns observed in other parts of Monterey Bay and cannot be directly linked to the outfall (CPUC and MBNMS 2017). Species that may live in the upper few inches/cm of the oxic substrate include polychaete and oligochaete worms, amphipods, cumaceans, isopods, ostracods, mollusks, decapods, gastropods, and ophiuroides. Other invertebrates that may occur on the sea bottom include anemones, crabs, shrimp, gastropod snails, echinoderms, sea stars, and sea pens. Moving up the food chain, a number of fish species occur for all or part of their sub-adult or adult life stage on the seafloor, including flatfish, gobies, poachers, eelpouts, and sculpins. Other fish that may use the sea floor for foraging include salmon, steelhead, smelt, sturgeon, and other fish species.

Water Quality: The mixing of waters and the associated physical processes vary as a result of the oceanic seasons, and can also be influenced by large-scale oceanic events, such as the Pacific Decadal Oscillation. In addition to the oceanic climate seasons, the mixing of the water in Monterey Bay is influenced by the ocean water density (controlled by the salinity of the water), by physical processes such as waves and currents, and by physical features on the ocean floor. The salinity and temperature of the ambient water determines water density. Water with higher salinities is denser than water with lower salinities; cold water is denser than hot water. Temperature and salinity differences between the discharge and receiving waters affect the extent of the mixing. Mixing is enhanced by physical processes and turbulence induced by currents and waves. Current velocities are a function of the tidal and nontidal current and can be different throughout the water column. Wave action, particularly during stormy periods, can vertically stir the water and cause enhanced dilution.

**Figure 9 Average Seasonal Density Profiles for the Action Area of the Combined Discharge**




The average seasonal seawater density profiles in the Action Area are shown on Figure 9. During the upwelling season, a more variable vertical structure in temperature and density has been observed. Table 5 summarizes the averaged seasonal water quality properties near the diffuser. The oceanic and Davidson seasons showed weak stratification and well-mixed temperature profiles in the oceanic season and somewhat cooler temperatures in the Davidson season. Water density becomes more stratified during the upwelling season. Salinity was found to be uniform over depth, and density stratification is primarily controlled by temperature. The upwelling season showed the strongest stratification over the water column; the profiles separate into two distinct groups, with stratification for the other season being generally quite weak. Density difference over the water column ranged from zero (homogeneous) in December 2012 to 1.17 kilograms per cubic meter (kg/m$^3$) in August 2014. For most of the profiles, the density differences over the water column ranged from 0.11 to 0.65 kg/m$^3$ (Roberts 2016).

Monthly salinity near the depth of the diffuser (27 to 29 meters) varies seasonally, but does not show variation between sites or at the target depths (Table 5).

**TABLE 5 SEASONAL AVERAGE WATER QUALITY AT THE DIFFUSER DEPTH**

| Season | Temperature (°C) | Salinity (ppt) | Density ($kg/m^3$) |
|---|---|---|---|
| Davidson | 14.46 | 33.34 | 1,024.8 |
| Upwelling | 11.48 | 33.89 | 1,025.8 |
| Oceanic | 13.68 | 33.57 | 1,025.1 |

Source: Roberts 2016

Notes:

°C = degrees Celsius
$kg/m^3$ = kilogram per cubic meter
ppt = part per thousand

The water quality of Monterey Bay is a function, in part, of different constituents present in the water, as well as the seasonal ocean climate in the Bay that affects the concentration of the constituents present. The waters of Monterey Bay contain numerous legacy (persistent compounds that have been banned from use) pesticides such as organochlorine pesticides, Dieldrin and dichloro-diphenyl-trichloroethane (DDT), as well as chemical products in current use such as organophosphate pesticides, polynuclear aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs) (a legacy contaminant). The largest source of contaminants is agricultural runoff into the Pajaro and Salinas Rivers. Seasonal data collected by the Central Coast Long-Term Environmental Assessment Network (CCLEAN) between 2001 and 2013 indicate numerous instances where water quality objectives and human health alert levels in Monterey Bay were exceeded due to the presence of contaminants (CCLEAN, 2011 and 2014). Nearshore waters of Monterey Bay have failed to meet the Ocean Plan water quality objective for the protection of human health (i.e., concentrations are higher than numeric water quality objectives) for PCBs, Dieldrin, chlordanes, and DDTs. PCBs in the northern portion of Monterey Bay have increased significantly since 2006 and annual average concentrations across all samples have increased exponentially (CCLEAN, 2014). Annual reported data indicate that waters of Monterey Bay exceeded the Ocean Plan 30-day average PCB water quality objective of $1.9 \times 10^{-5}$ micrograms per liter (µg/L) for most of the years between 2004 and 2013. Table 6, below, presents a summary of long-term ambient contaminant monitoring for Monterey Bay.

Also of importance in the water quality setting of the combined discharge is the secondary treated wastewater discharged by MWRPCA at the outfall. This discharge is positively buoyant and dilutes into the waters of Monterey Bay quickly. This treated wastewater is from residential, commercial, and agricultural uses and contains permitted amounts of constituents of concern, including ammonia, heavy metals, and organic compounds. Under the proposed action, the desalination brine and GWR effluent will interact with this discharge and potentially alter water quality in the vicinity. Section 5 contains a detailed analysis of this interaction.

**TABLE 6 WATER QUALITY IN MONTEREY BAY (FROM CCLEAN 2008-2015)**

| Constituent | Reported Average Concentration (µg/L) | Reported Maximum Concentration (µg/L) | Ocean Plan Water Quality Objectives (µg/L) |
|---|---|---|---|
| Endosulfan | 0.0000039 | 0.0000390 | 0.009 (6-month median) |
| Endrin | 0.0000006 | 0.0000160*** | 0.002 (6-month median) |
| HCH | 0.0001679 | 0.0003930 | 0.004 (6-month median) |
| Fluoranthene | 0.0003068 | 0.0010800 | 15 (6-month median) |
| Aldrin** | 0.0000000 | 0.0000000** | 0.000022 (30-day average) |
| Chlordane | 0.0000155 | **0.0001140** | 0.000023 (30-day average) |
| DDT | 0.0000548 | **0.0003190** | 0.00017 (30-day average) |
| Dieldrin | 0.0000168 | **0.0000510** | 0.00004 (30-day average) |
| Heptachlor | 0.0000003 | 0.0000050 | 0.00005 (30-day average) |
| Polyaromatic hydrocarbons (PAHs) | 0.0000007 | 0.0000050 | 0.0088 (30-day average) |
| Polychlorinated biphenyls (PCBs) | **0.0023236** | **0.0069071** | 0.000019 (30-day average) |
| Toxaphene** | 0.0001414 | **0.0012139*** ** | 0.00021 (30-day average) |

NOTES:
* Concentrations higher than the Ocean Plan water quality objectives in Table 4.3-4, above, are shown in bold.
** Aldrin was not detected.
*** Endrin and Toxaphene were detected in 1 and 2 samples, respectively.

SOURCE: CCLEAN, 2016.

### 3.2.2 Salinas River Crossing Setting

The Action Area associated with the pipeline crossing of the Salinas River is in ruderal uplands, riparian areas, and aquatic habitat of the Salinas River channel. The Action Area is approximately 1.8 miles (2.9 km) upstream of the confluence of the Salinas River with Monterey Bay, and is in the area known as the Salinas River lagoon. The lagoon is formed by a sandbar at the mouth of the river which restricts the river from entering the Bay. The sandbar is typically formed in the summer, when freshwater flows in the Salinas River are lowest. During the winter, when rain events increase freshwater flows and storm wave action erodes the sand bar, the sandbar is breached. During this period, there is also the potential for the adjacent agricultural areas to be flooded. Currently, the sandbar is managed and mechanically opened once water levels in the lagoon reach a critical level (about 6 feet [1.8 meters]), to avoid flooding of the adjacent agricultural areas (Hagar Environmental Science and Monterey County Water Resources Agency 2015).

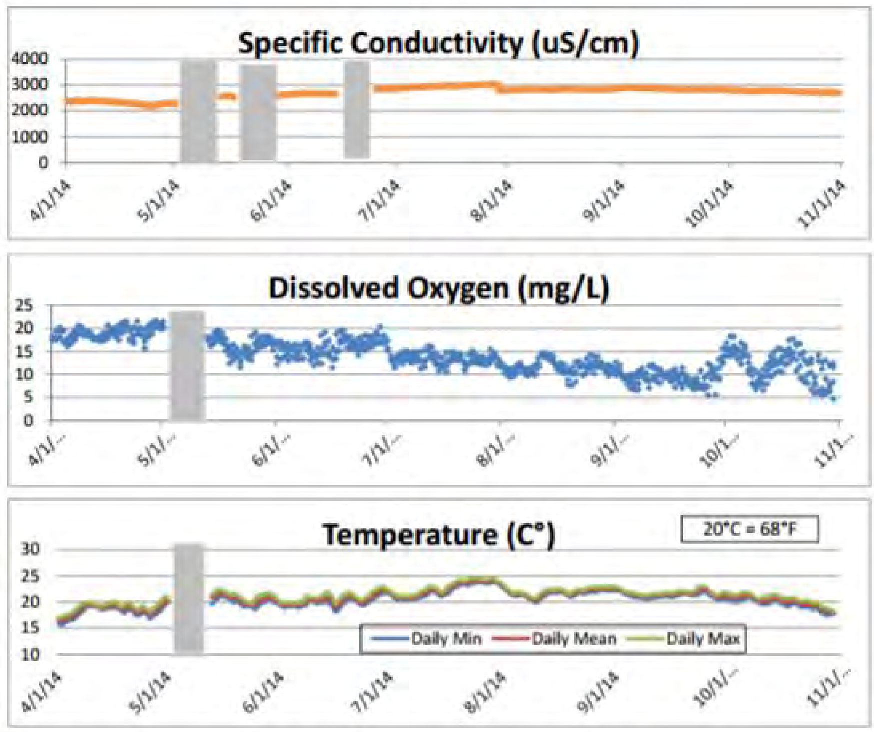
In the vicinity of the Action Area, there are multiple linear transportation crossings of the river (Figure 6). To the west of the Action Area there are twin bridges for Cabrillo Highway (U.S. Highway 1), with separate alignments for north and south bound traffic. To the east, there is an existing powerline and a railroad corridor.

#### Aquatic Habitat

In the Action Area, the Salinas River lagoon has a maximum depth of 10 to 14 feet (3 to 4.25 meters). The substrate is characterized as mud and hard sand with a silt layer (Hagar Environmental Science and Monterey County Water Resources Agency 2014). When the sandbar is open and there is a direct connection between the lagoon and the Bay, the Action Area is tidally influenced. When freshwater flows are high (associated with above-normal rainfall), the lagoon is predominantly freshwater; however, when freshwater flows are low, the lagoon is predominantly brackish (see Figure 10). Emergent vegetation is present on the north bank, along with riparian willows; the south bank is predominantly riprap (see Figure 11).

There are numerous structural features, including old pilings cut off near the water surface and large calcium-carbonate "heads" formed by aquatic/marine worm castings. Rooted and floating aquatic vegetation is present in the shallow water margins and can be extensive in the summer months (Hagar Environmental Science and Monterey County Water Resources Agency 2015).

Fish surveys conducted in the Salinas River crossing between 2002 and 2014 (HDR Engineering 2015; Hagar Environmental Science and Monterey County Water Resources Agency 2014) identified numerous species, including:




*Note: Grey text box indicates meter malfunction. Bicarbonate deposits are occurring on this meter and are contributing to probe failures.

Hagar Environmental Science and Monterey County Water Resources Agency 2014

- arrow goby (*Clevelandia ios*),
- carp (*Cyprinus carpio*),
- Chinook salmon (*Oncorhynchus tshawytscha*),[5]
- hitch (*Lavinia exilicauda*),
- largemouth bass (*Micropterus salmoides*),
- mosquitofish (*Gambusia affinis*),
- pacific herring (*Clupea pallasii*),
- pacific lamprey (*Lampetra tridentate*),
- pacific sardine (*Sardinops sagax*),
- pacific staghorn sculpin (*Leptocottus armatus*),
- prickly sculpin (*Cottus asper*),
- rockfish (*Sebastoides* spp.),
- Sacramento blackfish (*Orthodon microlepidotus*),
- Sacramento pikeminnow (*Ptychocheilus grandis*),
- Sacramento sucker (*Catostomus occidentalis*),
- shiner surfperch (*Cymatogaster aggregate*),
- starry flounder (*Platichthys stellatus*),
- steelhead (*Oncorhynchus mykiss*),
- striped bass (*Morone saxatilis*),
- threadfin shad (*Dorosoma patenense*),
- threespine stickleback (*Gasterosteus aculeatus*),
- tidewater goby (*Eucyclogobius newberryi*),

[5] One individual was caught in the fall of 2002. Since that time, no other individuals have been observed (MCWRA 2014).

- topsmelt (*Atherinops affinis*), and
- yellowfin goby (*Acanthogobius flavimanus*).

## Riparian Habitat

The Action Area includes numerous riparian habitat types, including arroyo willow thickets, coyote bush scrub, coastal brambles, ice plant mats, and ruderal habitat. Broadly, these areas are categorized as valley foothill riparian. The Salinas River crossing contains dense but narrow stands of valley foothill riparian habitat on both banks, and also contains an access road that extends to the low flow channel (see Figure 12). Descriptions of each of the vegetation types are provided below.

Arroyo willow (*Salix lasiolepis*) thickets have a variable understory, but frequently contain native California blackberry (*Rubus ursinus*), coyote brush (*Baccharis pilularis*), mule fat (*Baccharis salicifolia*), California bulrush (*Schoeneoplectus californicus*), sedges (*Carex* spp.), rushes (*Juncus* spp.), tall flatsedge (*Cyperus eragrostis*), fringed willowherb (*Epilobium ciliatum*), horsetail (*Equisetum* spp.); and nonnative poison hemlock (*Conium maculatum*), wild radish (*Raphanus sativus*), Fuller's teasel (*Dipsacus fullonum*), docks (*Rumex* spp.), and narrowleaf cattail (*Typha angustifolia*).

Coastal brambles exclusively refer to areas dominated by California blackberry; they are limited to riparian areas, principally near the Salinas River Action Area. Coastal brambles are associated with arroyo willow, boxelder (*Acer negundo*), coast live oak (*Quercus agrifolia*), coast manroot (*Marah oregana*), yellow bush lupine (*Lupinus arboreus*), and coyote brush.

Coyote brush scrub occurs as a ruderal species colonizing disturbed areas and stabilized sandy areas. Associates include California sagebrush (*Artemisia californica*), bush monkeyflower (*Mimulus aurantiacus*), California coffeeberry (*Frangula californica*), poison oak (*Toxicodendron diversilobum*), and others.

Ice plant (C*arpobrotus edulis*) mats are nonnative and have severe ecological impacts because they often carpet areas, smothering native species and preventing other communities from establishing, both due to the ice plant's vigorous growth and its extrusion of salt into the soil.

Ruderal refers to mainly herbaceous habitats that are invading highly disturbed areas. Ruderal areas contain a mix of weedy volunteer species growing in urban settings. Ruderal habitats have low diversity of native species. Characteristic species include bromes (*Bromus* spp.), fescue (*Festuca* spp.), mustards (Brassica spp.), radish (*Raphanus sativus*), thistles (*Cirsium* spp.), star-thistles (*Centaurea* spp.), ice plant, and foxtail (*Hordeum* spp.).

Riparian vegetation provides cover and resources for a variety of breeding birds, such as yellow-rumped warblers (*Dendroica coronata*), warbling vireos (*Vireo gilvus*), orange-crowned warblers (*Oreothypis celata*), and Wilson's warblers (*Cardellina puilla*). The mixed understory in this habitat supports a variety of mammals and reptiles, including raccoons, deer mice, and coastal garter snake (*Thamnophis elegans terrestris*). The Salinas River provides a wildlife movement corridor for fish, birds, and other species that migrate locally along riparian corridors (CPUC and MBNMS 2017).

## Water Quality

Water quality in the Salinas River Action Area is significantly influenced by whether the lagoon is open or closed to Monterey Bay, the amount of freshwater inflow, biological processes, and climate. When the lagoon is closed, freshwater flows predominate. Based on water quality measurements from mid-April through November, specific conductivity ranges from 2,000 to 3,000 microSiemens per cm. Higher specific conductivity readings occur in the winter months. DO varies from 5 to more than 20 mg/L, is generally higher in the spring and winter months, and tends to decrease over the summer months. Temperatures range from 15 degrees Celsius (°C) (59 degrees Fahrenheit [°F]) in the spring to a high of 25°C (77°F) in the middle of summer (Hagar Environmental Science and Monterey County Water Resources Agency 2014).

**Figure 11 Aquatic Habitat in the Action Area**

**Figure 12 Riparian Habitat in the Action Area**

## 3.3 Species with Potential to Occur

This subsection provides summaries of the life history requirements of each of the species with a high potential to occur in the Action Area. Summaries are also provided of the potential for each species to occur in the Action Area. Descriptions of the critical habitat and EFH in the Action Area are also provided in this subsection.

The life history accounts and summaries of potential to occur are provided in this section for those species that are commonly encountered in the vicinity and have a greater chance of occurring in the Action Area. Many of the species with the potential to occur in the Action Area are highly mobile, range over a large geographic area, and can occur in a wide variety of habitats. Some of these species have a small chance to occur in the Action Area, or are rarely encountered in Monterey Bay, and therefore are unlikely to be affected by the Action. However, because the Action Area is within the species range and the species cannot be eliminated from potential to occur, descriptions of the species that have a low potential to occur are presented in less detail in Section 3.4.

The anticipated effects on the species that are likely to occur and those that have low potential to occur are discussed in Section 4.

### 3.3.1 Steelhead – South Central California Coast DPS and Central California Coast DPS

The Steelhead – South-CCC DPS and CCC DPSs (*Oncorhynchus mykiss*) are both designated as a threatened species (71 Federal Register [FR] 834, January 5, 2006). The South-CCC DPS includes fish that spawn in waterways from the Pajaro River (Monterey County), south to Arroyo Grande Creek (San Luis Obispo), inclusively, and includes portions of other coastal watersheds that are seasonally accessible to fish entering from the ocean (NMFS 2013). The CCC DPS includes naturally spawned populations from the Russian River to Aptos Creek in Santa Cruz County (inclusive), as well as drainages of San Francisco and San Pablo Bays.

Steelhead employ one of three primary life history strategies: fluvial-anadromous, lagoon-anadromous, or freshwater resident. Under the fluvial-anadromous and lagoon-anadromous life histories, adult steelhead spawn in freshwater streams, and juveniles are reared in freshwater before migrating to the ocean, where they grow and mature prior to returning as adults to reproduce. In the case of the lagoon-anadromous life history, juveniles over-summer in isolated lagoons and estuaries, where they grow and mature to a larger size prior to entering the ocean. Adults typically spend between 1 and 4 years in the ocean, where they forage and mature. The ocean phase allows the species to grow larger and produce more eggs relative to the freshwater residents. The freshwater residents, known as rainbow trout, are nonanadromous and arise when barriers have been created and restrict access to estuarine and marine environments (NMFS 2016b).

The ocean phase of steelhead is not well studied, and poorly understood. Studies of other salmonid species in the ocean environments have found specimens of steelhead, and therefore it is believed that the species does not congregate in large schools like other Pacific salmon of the genus *Oncorhynchus* (NMFS 2013). Some anadromous salmonids have been found in coastal waters relatively close to their natal rivers, while others may range widely in the North Pacific (NMFS 2013; NMFS 2016b). Adults feed on aquatic and terrestrial insects, mollusks, crustaceans, fish eggs, minnows, and other small fishes (including other trout).

Because juvenile steelhead remain in the creeks year-round, adequate flows, suitable water temperatures, and an abundant food supply are necessary throughout the year to sustain steelhead populations. The most critical period is in the summer and early fall, when suitable water temperatures and abundant food supplies become limiting. Freshwater steelhead require cool, clean, well-oxygenated water, and appropriate gravel for spawning. Spawning habitat condition is strongly affected by water flow and quality, especially temperature, DO, shade, and silt load; all of which can greatly affect the survival of eggs and larvae (USFWS 2014).

#### *3.3.1.1 Potential to Occur in the Action Area*

**Steelhead have potential to occur in the both the combined discharge and Salinas River Action Areas.**

***Combined Discharge Action Area*: Suitable habitat for ocean life stages, including potential foraging and migration, is present in the Action Area. Because little is known about steelhead in the ocean environment, both the South-CCC DPS and the CCC DPS are assumed to occur in the combined discharge Action Area. The species would likely use the Action Area and other similar habitats adjacent to the Action Area as foraging grounds and during immigration and emigration events. Ocean dwelling life stages of other DPS units for the species may also occur in the Action Area. The Action Area associated with the combined discharge may be used by individuals during migration from the freshwater environments, like the Salinas River, to ocean environments; and these individuals may again migrate through the Action Area upon their return to freshwater spawning grounds. The occurrence of the species and individuals is expected to be temporary in nature, and individuals are not expected to permanently reside in the Action Area.**

***Salinas River Action Area*: Adult and juvenile steelhead of the South-CCC DPS may occur in the Salinas River Action Area, where the project proposes to construct a pipeline on the existing Monte Road Bridge crossing. Adults may occur during migration to and from spawning grounds upstream, and juveniles may forage in the Action Area as they mature and prior to out-migration to the ocean.**

**Steelhead populations in the Salinas River watershed have not been well documented, but a few point estimates show a dramatic decline in population size between the 1940s and the early 1980s. More recent population assessments conducted on the Arroyo Seco River (tributary to the Salinas River) concluded that the Salinas River run of steelhead has declined to an adult abundance averaging less than 50 fish, and that this remnant population faces a host of risks intrinsic to the low abundance of various sub-populations in the watershed (NMFS 2007).**

#### *3.3.1.2 Designated Critical Habitat*

***Combined Discharge Action Area:* DCH is not present in the Action Area associated with the combined discharge or the other project components.**

***Salinas River Action Area*: DCH is associated with the Salinas River where the pipeline would be installed under the existing bridge crossing. The Action Area overlaps 0.47 acres (0.19 hectares) of DCH, based on the delineation of ordinary high water mark. Project activities would occur from above the water surface from the bridge deck, from a barge, or adjacent to the DCH. No vegetation trimming would occur within DCH.**

### 3.3.2 Coho Salmon - Central California ESU

**The CCC ESU coho salmon was originally listed as a threatened species on October 31, 1996 (61 FR 56138), and was subsequently up-listed to endangered on June 28, 2005 (70 FR 37160). The ESU includes all naturally spawned populations of coho salmon from Punta Gorda in northern California, south to and including the Aptos Creeks in central California—as well as tributaries to San Francisco and San Pablo Bay, excluding the Sacramento-San Joaquin River system, and three artificial propagation programs: the Don Clausen Fish Hatchery Captive Broodstock Program, Scott Creek/ King Fisher Flats Conservation Program, and Scott Creek Captive Broodstock Program (77 FR 19552).**

**Coho salmon are typically associated with small to moderately sized coastal streams characterized by heavily forested watersheds; perennially flowing reaches of cool, high-quality water; dense riparian canopy; deep pools with abundant overhead cover; in-stream cover consisting of large, stable woody debris and undercut banks; and gravel or cobble substrates (Moyle 2002).**

**In contrast to the life history patterns of other anadromous salmonids, coho salmon in California generally exhibit a relatively simple 3-year life cycle. Adult salmon typically begin the freshwater migration from the ocean to their natal streams after heavy late-fall or winter rains breach the sand**

**bars at the mouths of coastal streams (61 FR 56138). Migration continues into March, but generally peaks in December and January, with spawning occurring shortly after returning to the freshwater spawning ground. Female coho salmon choose spawning sites usually near the head of a riffle, just below a pool, where water changes from a laminar to a turbulent flow and there is small to medium gravel substrate. The flow characteristics of the redd location usually ensure good aeration of eggs and embryos and flushing of waste products. Coho salmon may spawn in more than one redd and with more than one partner (CDFW 2016a).**

**After eggs hatch, the fry gradually transition from shallow water along stream margins to deep pools (CDFW 2016a). Preferred rearing habitat has little or no turbidity and abundant cover, with sustained invertebrate forage production. In the spring, as yearlings, juvenile coho salmon undergo a physiological process, or smoltification, which prepares them for living in the marine environment. They begin to migrate downstream to the ocean during late March and early April, and out-migration usually peaks in mid-May, if conditions are favorable (CDFW 2016a).**

**After entering the ocean, the immature salmon initially remain close to their parent stream. Eventually, they move north along the coast along the continental shelf, congregating in schools. Information on ocean distribution of coho salmon is sparse; however, it is believed that coho salmon ultimately join schools from Oregon and possibly Washington. During this time, they are primarily piscivorous, foraging on small fish and marine invertebrates (NOS 2014). The amount of time spent in the ocean environment is variable, but most remain for 2 years and some return to their natal streams after the first year (CDFW 2016a).**

#### *3.3.2.1 Potential to Occur in the Action Area*

***Combined Discharge Action Area*: Several of the southernmost streams associated with the coho CCC ESU discharge into Monterey Bay, including San Lorenzo, Soquel Creek, and Aptos Creek. Members of this population are believed to generally disperse north and congregate with stocks from northern California and Oregon; however, they could occur temporarily in Monterey Bay. Although the Action Areas is south of the natal streams and the associated estuarine and marine areas, the combined discharge Action Area may be temporarily occupied by coho salmon prior to dispersing north or during migrations to natal streams.**

**In the ocean, two dispersal patterns have been observed in coho salmon after emigrating from freshwater. California stocks typically remain in coastal water near their natal stream for at least the first summer; although, depending on annual and seasonal changes in oceanographic conditions, they may instead migrate northward into offshore waters of the Pacific Ocean after only spending a few weeks in coastal waters. These movements are influenced by ocean currents and the strength of the upwelling. With weak upwelling, coho salmon concentrate in upwelling zones closer to the shore and submarine canyons. Generally, the majority of juvenile salmon are found within 23 miles (37 km) of the coast. The highest concentrations appear to be found in more productive waters of the continental shelf, like those found in the combined discharge Action Area. Coho salmon rarely use areas where sea surface temperature exceeds 59 degrees Fahrenheit °F (15°C); they are generally found in the uppermost 32 feet (10 meters) of the water column. When juveniles first enter marine waters their primary diet includes marine invertebrates, such as copepods, euphausiids, amphipods, and carb larvae. Sub-adults and adults consume primarily fish, including capelin, northern anchovy, clupeids (e.g., herring, shad, and menhadens), and osmerids (e.g., smelt) (PFMC 2014). These conditions are similar to those found in the combined discharge Action Area and may support juveniles, sub-adults, and adults for short periods of time.**

***Salinas River Action Area*: The coho salmon CCC ESU occurs north of the Action Area, with the southernmost streams of the ESU found approximately 17 miles (27.3 km) north of the Salinas River. The Salinas River is not part of the coho salmon CCC ESU and therefore the Action Area associated with the pipeline crossing is not in the CCC ESU. No spawning or freshwater migration habitat is present in the Salinas River Action Area for this ESU. The Action Area associated with the Salinas**

River Lagoon is not expected to support coho salmon, and years of regular monitoring have not detected this species in the Salinas River Lagoon.

#### *3.3.2.2 Designated Critical Habitat*

*Combined Discharge Action Area*: DCH is not present in the Action Area.

*Salinas River Action Area*: DCH is not present in the Action Area.

### 3.3.3 Chinook Salmon – Sacramento River Winter Run; Central Valley Spring-Run; California Coastal ESUs

The Chinook salmon Sacramento River winter-run was originally listed as a threatened species on August 4, 1989 (54 FR 32685) and was subsequently up-listed to endangered status on January 4, 1994 (59 FR 440). Both the Central Valley spring-run and the California Coastal ESUs were listed as a threatened species on September 16, 1999 (64 FR 50394), and reaffirmed on June 28, 2005 (70 FR 37160). The Chinook salmon (*Oncorhynchus tshawytscha*) has been divided into ESUs, named for the timing of adult spawning migrations:

- The Sacramento River winter run ESU spawns in the Sacramento River and its tributaries in California, as well as in two artificial propagation programs.
- The Central Valley spring run ESU spawns in the Sacramento River and its tributaries in California, including the Feather River, as well as in the Feather River Hatchery spring-run Chinook program (NMFS 2016e).
- The California Coastal ESU spawns in coastal rivers from Redwood Creek (Humboldt County), south to and including the Russian River (NMFS 2016c).

Chinook salmon are anadromous and semelparous. As adults, they migrate from the marine environment into the freshwater rivers and streams of their birth (anadromous), where they spawn and die (semelparous). They are the largest of the Pacific salmon species and are distributed in freshwater and marine areas from California to Asia (71 FR 17757). Chinook salmon have two basic life history types: stream-type (Central Valley spring run ESU) and ocean-type (Sacramento River winter run and California Coastal ESUs). Stream-type have adults that run upstream before they have reached full maturity, in spring or summer, and juveniles that spend usually more than 1 year in fresh water. Ocean-type have adults that spawn soon after entering fresh water, in summer and fall, and juveniles that spend 3 months to a year rearing in fresh water. These variations of life history are named for the timing of spawning runs of adults, such as spring-run or fall-run (Moyle 2002).

Upon entry into the ocean, they tend to stay along the continental shelf of the California and Oregon coast, but migration may continue to higher latitudes. They stay at depths that are typically in the range of 65 to 150 feet (20 to 45 meters) although the range can vary from 0 to 328 feet (0 to 100 meters) depending on the season (CDFW 2016b). As they grow larger and mature into adults, fish becomes a dominant part of their diet. Adult Chinook salmon spend 1 to 5 years in the ocean before returning to their natal stream to spawn. As adults return to the natal stream to spawn, they depend on the nearshore and estuarine environments (NMFS 2016d).

Once they reach their natal stream, Chinook salmon select large, deep pools (more than 2 meters deep) with bedrock bottoms and moderate velocities for holding. Spawning occurs in areas with a substrate mixture of gravel and small cobbles, with low silt content and adequate subsurface flow (Moyle 2002). In general, stream-type juveniles move downstream and out to sea as smolts, at lengths of 3.15 to 6 inches (80 to 150 millimeters [mm]), but ocean-type juveniles move downstream at 1.2 to 2 inches (30 to 50 mm) to rear in the estuary (Moyle 2002).

#### *3.3.3.1 Potential to Occur in the Action Area*

*Combined Discharge Action Area*: The marine environments within MBNMS are used extensively during the ocean phase of the Chinook salmon, and therefore the various adults and sub-adults may occur in the combined discharge Action Area. The various listed and nonlisted ESUs may use the Action Area for foraging, or simply as passage through for migration and dispersal. Individuals or aggregations of various ESUs would only be expected to occur temporarily (or perhaps intermittently) and are not expected to reside permanently in the Action Area. The nearshore areas provide forage opportunities contributing to the growth and successful survival of the species (NOS 2014).

Although little information exists on Chinook salmon in marine waters, ocean type juveniles appear to be concentrated over the continental shelf, and it appears that ocean-type juveniles use different marine areas for rearing than stream-type juveniles, which are believed to migrate to ocean water farther offshore early in the ocean residence. Furthermore, different Chinook stocks may use different ocean habitats and employ a variety of migratory patterns. The majority of juvenile Chinook salmon are found within 17 miles (28 km) of the coastline; however, marine distribution is extensive and varies seasonally and interannually. Juveniles and adults may be pelagic, semi-demersal or semi-pelagic, or found near the surface. Juveniles are typically found in water depths between 98 and 262 feet (30 to 80 meters). Juveniles, sub-adults, and adults in marine waters consume fish, planktonic crustaceans, and insects, and become more piscivorous with size (PFMC 2014). These conditions are similar to conditions in the combined discharge Action Area and may support juveniles, sub-adults, and adults for short periods of time.

*Salinas River Action Area*: Historically, Chinook salmon may have spawned as far south as Ventura River (NOS 2014) and may have spawned in the rivers near the Action Area, including the Salinas River. Currently, they are only known to spawn in coastal waterways north of the Russian River and in the tributaries to and in the Sacramento River. The Salinas River Action Area is outside of the various identified Chinook salmon ESUs. There is not an ESU associated with the Salinas River or other nearby waterway; the closest ESU is well to the north on the Russian River. The long-term fisheries monitoring conducted in the Salinas River Lagoon has only found one individual over the last decade (Hagar Environmental Science and Monterey County Water Resources Agency 2015). This occurrence was from the fall of 2002. Given the amount of time since that observation and because only one individual has been observed, the species is not expected to occur in the Salinas River Action Area.

#### *3.3.3.2 Designated Critical Habitat*

*Combined Discharge Action Area*: DCH is not present in the Action Area.

*Salinas River Action Area*: DCH is not present in the Action Area.

### 3.3.4 Green Sturgeon – Southern DPS

Green Sturgeon – Southern DPS were listed as a threatened species on April 7, 2006 (71 FR 17757). They occur in nearshore waters of the Pacific Ocean from Baja California, Mexico, to the Bering Sea in Alaska. Within this range there are two DPSs: the Northern DPS, which spawns in the freshwaters of the Klamath River and Rogue River, and are not listed under the ESA; and the protected Southern DPS, which has only one confirmed spawning site in the upper main stem of the Sacramento River (NMFS 2010).

The species is long lived and does not reach sexual maturity until approximately 15 years of age, and may spawn every 3 to 5 years. Adults enter San Francisco Bay between mid-February and early May and migrate to spawning habitat. Spawning occurs from April through early July in cool, deep, turbulent areas with clean, hard substrate. Larvae and juveniles migrate downstream where they spend 1 to 4 years before migrating out to the Pacific Ocean as sub-adults, typically in winter months (NMFS 2010).

Both the Northern and Southern DPSs can co-occur in marine and estuarine environments of the west coast. In the marine environment, sub-adults and adults occupy water to a depth of 360 feet (110 meters), and congregate in coastal bays and estuaries of continental U.S. during the summer and fall. In winter and spring, they are found in aggregations in British Columbia, Canada (NMFS 2010).

Little is known about the feeding of the green sturgeon in marine environments. They likely feed on benthic invertebrates, including shrimp, mollusk, amphipods, and small fish (Moyle et al. 1992).

#### *3.3.4.1 Potential to Occur in the Action Area*

*Combined Discharge Action Area*: The Green Sturgeon – Southern DPS is known to occur in Monterey Bay, and therefore may presumably occur in the combined discharge Action Area. Monterey Bay serves as important habitat for sub-adult and adult individuals, and may provide the necessary characteristics for rearing, feeding, and growth (NMFS 2009). The Action Area may support both the protected Southern DPS and the Northern DPS (not protected under ESA), because both have been documented in Monterey Bay (NMFS 2009). Based on observations, bycatch, and tagging studies, it appears that the Southern DPS uses coastal waters between Monterey and San Francisco Bay in the spring. Upon exiting their spawning grounds in the Sacramento River, they are known to migrate south to Monterey Bay and to the north, congregating in large numbers in the Columbia River Washington estuaries and overwintering in waters off Vancouver Island, British Columbia. Waters in the Action Area are most likely used as oversummering habitat, and most records are from the spring.

*Salinas River Action Area*: This Action Area does not provide suitable spawning or freshwater migration habitat, and does not support this species.

#### *3.3.4.2 Designated Critical Habitat*

*Combined Discharge Action Area*: Critical habitat for the Green Sturgeon – Southern DPS is present in the Action Area associated with the combined discharge. The designation includes the coastal marine habitat off California from Monterey Bay, north and east to include waters in the Strait of Juan de Fuca, Washington, and extends from mean higher high water to a depth of 358 feet (109 meters) (74 FR 52300). The primary consistent elements essential for the species in coastal marine areas include migratory corridors, water quality, and food resources. The designation includes the entirety of the Action Area, including the vertical water column associated with the combined discharge.

*Salinas River Action Area*: Critical habitat for this species is not present in the Salinas River.

### 3.3.5 Leatherback Sea Turtle

The leatherback sea turtle, also known as the Pacific leatherback, was listed as an endangered species on June 2, 1970 (35 FR 19320). Leatherback sea turtles occur in all of earth's oceans, generally ranging from 71°N to 47°S and nesting from 38°N to 34°S, depending on the ocean basin. In the Pacific Ocean, they are widely distributed from waters in British Columbia and the Gulf of Alaska to Chile and New Zealand (NMFS and USFWS 2013). The species undertakes one of the longest migrations reported and is known to migrate as far as 10,000 miles (16,100 km) between nesting areas (Papua New Guinea, Indonesia, and Soloman Islands) and nonnesting areas (Pacific west coast of the U.S.) (NMFS and USFWS 1998).

Nesting occurs primarily on beaches of tropical and subtropical climates; in the eastern Pacific Ocean, nesting occurs primarily on beaches of Mexico and Costa Rica, with rare nesting events from the Gulf of California. Nesting beaches have a wide variety of characteristics, and are generally associated with deep water and strong waves and current. The species is also known to nest in areas with shallow water and mud banks. Suitable substrates are generally free of rock, coral, or other abrasive substrates, and typically include coarse-grained sand (NMFS and USFWS 2013). However, leatherback sea turtles that occur in the Pacific west coast of the U.S. originate from the western Pacific beaches.

Leatherback sea turtles are able to use a wide variety of marine ecosystems through a number of species-specific physiological, anatomical, and behavioral adaptations. Typically, they are associated with continental shelf habitat and pelagic environments (NMFS and USFWS 1998). They are able to use areas that are much colder than those in which other sea turtles are capable of surviving. They must have access to large amounts of food to meet their energetic demands. They are typically associated with areas of high productivity where they have access to food resources, including gelatinous organisms (jellyfish, particularly medusa, siphonophores, and true jellyfish), but also crustaceans, vertebrates, and plants and tunicates (salps, pyrosomas) found in temperate and boreal latitudes (NMFS and USFWS 2013; NMFS and USFWS 1998). Specific to the California, leatherbacks target dense aggregations of coast brown sea nettle (*Chrysaora fuscescens*) during the summer and fall, but also consume moon jellies (*Aurelia labiate*) (NMFS 2012).

#### *3.3.5.1 Potential to Occur in the Action Area*

*Combined Discharge Action Ar*ea: Leatherback sea turtles are known to occur in Monterey Bay, and may be present in the Action Area associated with the combined discharge. Beaches in the vicinity of the Action Area are not suitable for nesting, and nesting has not been documented in the state of California. Leatherback sea turtles have been described as the most common sea turtle in the waters off of the Pacific Coast north of Mexico, and have been reported with regularity in Monterey Bay, where they may forage and migrate from the nesting beaches of the western Pacific Ocean. As described in the *Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle* (NMFS and USFWS 1998), there have been 96 sightings within 31 miles (50 km) of Monterey Bay from 1986 to 1991. Leatherbacks have also been regularly caught in drift/gill fishing nets off Monterey Bay, and newspapers regularly report sightings.

Monterey Bay provides suitable habitat for the prey species commonly associated with the leatherback sea turtle. Because suitable pelagic and open water habitat is present and a variety of prey species may be present, the species may occur in the combined discharge Action Area from the surface to the seafloor. Leatherback sea turtles have been reported along the California coast generally from May to November. Occurrence and foraging in the Action Area may be dependent on oceanic climates, which may deter migration to nearshore habitats (NMFS 2012).

The foraging behavior of the species had been studied in Central California waters, and it was found that leatherback sea turtles dove less than 328 feet (100 meters) and spent most of the time in shallower water (262 feet [80 meters] or less). In coastal waters, they spend about 50 percent of their time at or within 3 feet (1 meter) of the surface and more than 75 percent of their time in the upper 16 feet (5 meters) of the water column (NMFS 2012).

*Salinas River Action Area*: Due to the lack of suitable habitat, they would not occur in the Action Area associated with the Salinas River.

#### *3.3.5.2 Designated Critical Habitat*

*Combined Discharge Action Area*: Critical habitat was designated for this species on January 26, 2012 (77 FR 4170) and includes the portion of the Action Area associated with the combined discharge. The Action Area is in Area 1, which includes the species' principal foraging areas, characterized by high densities of primary prey species (brown sea nettle [*C. fuscescens*]) during upwelling shadows that create retention areas (77 FR 4170). Critical habitat extends from the shoreline (extreme low water line) out to a water depth of 262 feet (80 meters).

The Primary Constituent Element essential for the species is the occurrence of prey species, primarily scyphomedusae of the order Semaeostomeae (Chrysaora, Aurelia, Phacellophora, and Cyanea), of sufficient condition, distribution, diversity, abundance, and density to support individual as well as population growth, reproduction, and development of leatherbacks (77 FR 4170).

*Salinas River Action Area*: Critical habitat for this species is not present in the Salinas River.

### 3.3.6 Humpback Whale – Mexico, Central America DPS

The humpback whale was listed as an endangered species on June 2, 1970 (35 FR 19320). In 2016, the global species level was removed, and the species was separated into 14 DPSs, of which four were listed as endangered and one was listed as threatened (81 FR 62259). Relative to the Action Area, there are two listed DPSs that overlap the west coast of California: the Central America DPS and the Mexico DPS.

The Central American DPS is listed as an endangered species, breeds in waters off of Central America in the Northern Pacific Ocean, and feeds along the west coast of the U.S. and southern British Columbia. The Mexico DPS is listed as a threatened species. It breeds or winters in the areas of mainland Mexico and the Revillagigedo Islands, transit Baja California; or feeds in the North Pacific Ocean, primarily off California, Oregon, northern Washington, southern British Columbia, the north and western Gulf of Alaska, and the East Bering Sea.

As a whole, the species migrates great distances between breeding and feeding grounds. During migration, they tend to stay near the surface. During summer and fall, they spend considerable time feeding and building fat for the winter. Prey organisms include herring (*Clupea* spp.), mackerel (*Scomber* spp.), sand lance (*Ammodytes* spp.), sardine (*Sardinops* spp.), anchovy (*Engraulis* spp.), capelin (*Mallotus* spp.), and krills (such as *Ephausia* and *Thysanoessa* and *Meganyctiphanes*). They may migrate unaccompanied or sometimes in groups, and display varied feeding strategies and behavior, including using air bubbles to herd, corral, or disorient fish (NMFS 2015). Feeding and calving occurs in shallow waters of cold, productive coastal waters. Calving grounds are common near offshore reef systems, islands, and continental shores. Studies found humpback whales foraging in water about 246 to 344 feet (75 to 105 meters) deep in 1986, and 492 feet (150 meters) deep in 1987 (NMFS 1991).

#### *3.3.6.1 Potential to Occur in the Action Area*

*Combined Discharge Action Area*: The Action Area may support the Mexico DPS and Central America DPS during the summer months. Although breeding is not expected to occur in California or the Action Area, the humpback whale Mexico DPS and Central America DPS are both known to feed along Central California coast in the late spring, summer, and early fall months. Both adults and their calves are routinely found in Monterey Bay between April and December (SIMoN 2016). In Monterey Bay, they are usually observed close to shore over the continental shelf and in the vicinity of the continental shelf break (SIMoN 2006). Although the combined discharge Action Area does not provide the topographic relief or support the depth of water where the species appear to be most commonly found, it supports suitable prey that may be consumed. The Action Area has the potential to support low densities of foraging humpback whales from either the Mexico DPS or Central America DPS (NCCOS 2003). If high concentrations of suitable prey are found in the Action Area, an individual or aggregation of individuals may be present for several days in and around the Action Area. The Action Area may also be used by calves for feeding. Humpback whales may also migrate, and occur briefly in the Action Area during the spring and fall months, or may disperse through the Action Area between foraging grounds found in Central California.

*Salinas River Action Area*: The Action Area associated with the Salinas River is outside the known range, and does not contain suitable habitat for this species.

#### *3.3.6.2 Designated Critical Habitat*

Critical habitat has not been proposed or designated for this species.

### 3.3.7 Killer Whale – Southern Resident DPS

The killer whale – southern resident DPS was listed as an endangered species on November 18, 2005 (70 FR 69903). In the Eastern North Pacific, there are three forms of killer whales, all of which have differences in morphology, ecology, and behavior; resident killer whales, transient killer whales, and offshore killer whales. There are several groups in the resident killer whale ecotype: southern, northern, southern Alaska, western Alaska, and western North Pacific residents. The southern resident DPS includes three pods: J pod, K pod, and L pod (70 FR 69903). These stable pods are formed from several related matrilineal groups, where all members assist in raising calves. Calving may occur year-round, with peaks in fall and spring.

The three pods (J, K, and L) reside in inland waterways of Washington State and British Columbia during the late spring, summer, and fall. They are known to travel as far south as central California, but winter and early spring movements and distribution are largely unknown for the population (NMFS 2008). Killer whales are apex predators that employ a variety of cooperative, sharing, and innovative learning traits. The southern resident DPS primarily feed on fish, with salmon being the prey of choice, particularly Chinook salmon, and are also known to consume herring (*Clupea* spp.), cod (*Gadus* spp.), tuna (*Thunnus* spp.), sharks, and rays.

Resident killer whales may occur in a wide variety of marine habitats, and can be found wherever adequate prey is found. They do not appear to be constrained by water depth, temperature, or salinity. They are known to feed in areas with high relief underwater topography, such as subsurface canyons, seamounts, ridges, and steep slopes, where prey may be concentrated. Chinook salmon are a primary prey item and swim at depths, on average, of about 82 to 262 feet (25 to 80 meters), whereas other salmonids are typically in the upper 100 feet (30 meters) (NMFS 2008).

#### *3.3.7.1 Potential to Occur in the Action Area*

*Combined Discharge Action Area*: Killer whale – southern resident DPS have the potential to occur in the Action Area, and are known to occur in Monterey Bay in the winter and early spring months. The observations of the southern resident DPS coincide with the period when Chinook salmon are abundant. Given the large geographic area of Monterey Bay and the relative lack of complex subsurface topography, there is limited potential for the species to occur in the Action Area. In the rare event that an individual or pod of the southern resident DPS is found in the Action Area, it would only be expected to occur temporarily.

Other ecotypes of killer whales, transient and offshore, are also known to occur in Monterey Bay. These ecotypes have been reported primarily in the Monterey Canyon and other marine waters greater than 200 feet (60 meters) deep, and less from shallower areas in the general vicinity of the Action Area.

*Salinas River Action Area*: The Action Area associated with the Salinas River is outside the known range, and does not contain suitable habitat for this species.

#### *3.3.7.2 Designated Critical Habitat*

DCH does not occur in the state of California. Critical habitat for this species was designated on November 29, 2006 (71 FR 69054), which includes areas occupied by the Southern Resident killer whales in the state of Washington. A petition was received in January 2015 to revise critical habitat to include portions of the marine waters along the west coast, because they constitute essential foraging and wintering areas (79 FR 22933). In a 12-month finding, published on February 24, 2015, the NMFS stated that it intends to proceed with the petition action to revise critical habitat (80 FR 9682). To date, proposed revisions to the critical habitat have not been published.

*Combined Discharge Action Area*: DCH is not present in the Action Area.

*Salinas River Action Area*: DCH is not present in the Action Area.

## 3.4 Species with Low Potential to Occur in the Action Area

There are several listed species that are highly unlikely to occur in the Action Area, including the following:

- eulachon – Southern DPS,
- green sea turtle - East Pacific DPS,

- Olive Ridley sea turtle,
- loggerhead sea turtle – North Pacific DPS,
- blue whale,
- fin whale,
- North Pacific right whale,
- sperm whale, and
- Guadalupe fur Seal.

These species are highly migratory, or have large geographic ranges, and use a wide variety of marine environments. Most of these species are rarely encountered in Monterey Bay, or are known primarily from the areas along continental shelf in waters that are deeper than those found in the combined discharge Action Area. These species are highly mobile and migrate and disperse over long distances, following changes in oceanic climates to concentrations of prey. For some of the species, their occurrences in Monterey Bay are limited to strandings, or are associated with rare climatic events.

Although these species are highly unlikely to occur in the combined discharge Action Area, they nonetheless have some limited potential to occur. Given the vastness of Monterey Bay, the relatively small size of the combined discharge Action Area, and the presence of other similar epipelagic and sandy benthic communities, it is all the more unlikely that they would occur specifically in the Action Area. In the rare event that one of the species is found in the combined discharge Action Area, they would likely only occur temporarily and would be capable of readily moving outside of the Action Area relatively quickly. No nesting or breeding habitat is present in the Action Area for the sea turtles, and most of the whale breeding territories do not occur in close proximity to the Action Area. These species would only rarely use the combined discharge Action Area for foraging, dispersal, and migratory life history events.

These species have no potential to occur in the Salinas River Action Area. The Salinas River Action Area is outside the known geographic range of these species, and lacks of suitable marine habitat characteristic required by these species to complete life history requirements.

Critical habitat has not been proposed or designated for many of these species. For those species with DCH, identified units do not occur in or in close proximity to the combined discharge or Salinas River Action Area.

## 3.5 Essential Fish Habitat

In the Combined Discharge Action Area, EFH is present for numerous fisheries. There are EFH designations in the Salinas River Action Area as well, where the pipeline would be constructed on the existing Monte Road Bridge outside of EFH. The various FMPs include descriptions of the EFH for all species covered in the plan, including actively managed, monitored species, and prohibited harvest species. The MSA requires federal agencies to consult with the NMFS on activities that may adversely affect EFH. These include both fishing and nonfishing adverse impacts on EFH. HAPCs are identified within EFH for habitat that are sensitive or vulnerable to environmental stress, are rare, or are particularly important ecologically. The FMPs are also required to identify potential adverse impacts on EFH and recommended conservation measures that may be implemented to reduce the impacts. Brief summaries of each EFH and their associated FMPs are provided below.

### 3.5.1 Pacific Coast Salmon Fishery Management Plan

The PCS FMP includes most of the stocks of Chinook, all of the coho salmon stocks, and pink salmon originating in Puget Sound. EFH is present in the combined discharge Action Area for two of the species: Chinook and coho salmon. Freshwater and estuarine EFH habitat components are not present in the Action Area associated with either the combined discharge or the pipeline crossing of the Salinas River; however, marine EFH is present for both species in the combined discharge Action Area. Habitat elements for the Chinook salmon and coho salmon in the marine EFH include estuarine rearing, ocean rearing, and juvenile and adult migration. Features that are important to the species include good/adequate water quality; adequate/cool water temperatures; adequate/abundant prey species and forage base; and adequate depth and habitat complexity, including vegetation and algae. Specific elements for Chinook salmon also include connectivity with terrestrial ecosystems. The areas of EFH include all marine waters north of Point Conception and the areas off Alaska extending to the exclusive economic zone (EEZ).

HAPCs have not been specifically mapped, but are generally identified based on definitions of complex channel and floodplain habitat, thermal refugia, spawning habitat, estuaries, and marine and estuarine submerged aquatic vegetation. None of these HAPCs or other areas of interest are located in the combined discharge Action Area. However, the Salinas River lagoon is an estuary, and considered a HAPC, although Chinook and coho salmon are not known from the Salinas River watershed.

### 3.5.2 Pacific Coast Groundfish Fishery Management Plan

The PCG FMP manages more than 90 species over a large and diverse area. The EFH identified is precautionary because for some species little data is available for all life stages, and uncertainty exists about the relative value of the different habitats to individual species. Due to the large number of species and the lack of data for all species life histories, the EFH has been designated for the assemblage of groundfish species. The overall existing groundfish EFH includes all waters and substrate in depths of less than 11,483 feet (3,500 meters) to the mean higher high water level or the upriver extent of saltwater intrusion; and seamounts in depths greater than 11,483 feet (3,500 meters) and any areas designated as a HAPC (PFMC 2016a).

The combined discharge Action Area is within the identified limits of the PCG EFH, and many of the Habitat Suitability Probability model results that are used to identify this EFH also identify suitable conditions for many groundfish species in various life stages (PFMC 2016a). Additionally, the Salinas River portion of the Action Area is included in PCG EFH. The upstream boundary of PCG EFH occurs where ocean-derived salts are less than 0.5 ppt, as measured during the period of average annual low flow (PFMC 2016a). The average salinity of the Salinas River portion of the Action Area is 0.94 ppt geometric mean, and is therefore within the upstream boundaries of EFH (RWQCB 2016).

Several types of HAPCs are identified in the PCG FMP; these include estuaries, canopy kelp, seagrass, and rocky reefs. None of these HAPCs or other areas of interest are located in the combined discharge Action Area. However, the Salinas River lagoon is mapped as an estuary, and considered a HAPC that is present in the Salinas River Action Area.

### 3.5.3 Coastal Pelagic Species Fishery Management Plan

The CPS includes four finfish (Pacific sardine, Pacific [chub] mackerel, northern anchovy, and jack mackerel), the invertebrate, market squid, and all euphausiid (krill) species. Finfish and squid are pelagic and occur, or are harvested from, above the thermocline in the upper mixed layer. The EFH in based on the thermal range and geographic range where the species may occur at any life stage or have occurred historically; or where environmental conditions do not preclude colonization, and accommodate the wide variation in the species range over time in response to temperature of the upper mixed layer of the ocean. Specifically, finfish and market squid EFH includes all marine and estuarine waters from the shorelines of California, Washington, and Oregon to the limits of the U.S. EEZ and above the thermocline where sea surface temperatures range between 50 and 79°F (10 to 26°C).

For krill species, the EFH includes the length of the west coast from the shoreline to the 6,000-foot (1,828-meter) isobaths, and to a depth of 1,312 feet (400 meters).

The combined discharge Action Area is well within the identified EFH and occurs in shallow water (328 feet [100 meters]) (PFMC 2016b). The geographic and temperature range are within the seasonal fluctuations observed at the diffuser depth in the combined discharge Action Area.

The Salinas River Action Area is also located in EFH for finfish. Of the finfish, only the Pacific sardine has been documented in the Salinas River Action Area. Based on the online EFH mapper, the Salinas River Action Area is near the upstream limits of the mapped EFH.

No habitat areas of particular concern were identified for the CPS.

### 3.5.4 Fishery Management Plan for U.S. West Coast Fisheries for Highly Migratory Species

The HMSs include Common Thresher shark, shortfin mako shark, blue shark, albacore tuna, bigeye tuna, northern bluefin tuna, skipjack tuna, yellowfin tuna, striped marlin, swordfish, and dorado or dolphinfish. Most of these species do not have EFH defined life history requirements that overlap either of the Action Areas; however, the common thresher shark has life history requirements that overlap with the combined discharge Action Area. Although the HMS FMP acknowledges that variation in distribution and abundance are affected by changing oceanic environmental conditions, little is known about the species distribution and habitat requirements and migration patterns. The Pacific Fishery Management Council recommends a precautionary approach to designation of EFH for HMS (PCFM 2016c).

For the common thresher shark, various life stages occur in a variety of oceanic conditions, including the epipelagic oceanic waters of California found in the combined discharge Action Area. Neonates and early juveniles likely feed on northern anchovy and other small, schooling fishes and invertebrates from Santa Cruz to Mexico over bottom depths of 36 to 2,400 feet (11 to 731 meters). Late juveniles and sub-adults also occur from 36 to 8,400 feet (11 to 2,560 meters) and feed on a variety of pelagic species, including northern anchovy, Pacific hake, Pacific mackerel, and sardine, and secondarily on a variety of other fishes, squid, and pelagic red crab; but their EFH extends, at least seasonally, to Cape Flattery, Washington.

No HAPCs were identified for the HMS.

# 4 Potential Adverse Effects (Construction)

There are two aspects of the construction that occur in the vicinity of waters that may support listed species under the jurisdiction of NMFS, critical habitat for such species, or EFH: drilling of the slant wells underneath the intertidal and subtidal waters of Monterey Bay, and installation of the overwater pipeline crossing at the Salinas River Lagoon.

## 4.1 Slant Well Drilling

Drilling of the slant wells will occur approximately 200 feet below the sediment surface; noise or vibration from this activity is unlikely to reach the water column, and is not expected to be discernable above the ambient noise of wave action (CPUC and MBNMS 2017). The disposal of water produced during well drilling and development activities will comply with the conditions of the MRWPCA's NPDES permit and General Waiver, which are set to prevent impacts on water quality. As a result, there will be no potential adverse effects on listed species under the jurisdiction of NMFS, critical habitat for such species, or EFH from drilling of the slant wells. Installation of the overwater pipeline crossing at the Salinas River Lagoon has the potential to affect steelhead, DCH for steelhead, and designated EFH, as described below.

## 4.2 Overwater Work at Salinas River Lagoon Crossing

At this location, the pipeline would be attached to an existing trellis on the Monte Road Bridge, with the assistance of a barge in the Salinas River Lagoon. The Salinas River Lagoon is a migratory corridor for adult and juvenile steelhead when the lagoon mouth is open to the ocean, and may serve as a rearing area for steelhead during the remainder of the year. Steelhead could be injured or killed if the Proposed Action adversely impacts water quality, which could occur as a result of equipment or materials falling into the water, dust mobilization, erosion, or a hazardous materials spill at Salinas River Lagoon. Construction-related noise, vibration, and artificial light could cause behavioral changes in steelhead, including dispersal or cessation of foraging, and artificial light could cause increased predation. However, all of these potential effects will be avoided or minimized through implementation of the avoidance and minimization measures presented in Section 6. The barge that will be used during construction will remain within the banks of the river for up to 1 month, but will be moving frequently and therefore is not expected to cause substantial shading effects on any one portion of the channel. Any potential effects of the overwater work on aquatic habitat at this location will be minor and temporary.

The Proposed Action at this location occurs within DCH for South-CCC DPS steelhead. Construction of the overwater crossing will require trimming of riparian vegetation (0.86 acre, or 0.35 hectare) outside and adjacent to the DCH, so that the undersurface of the bridge may be accessed to attach the new pipeline. A barge will be placed in the Salinas River Lagoon to provide a work surface for equipment attaching the pipeline to the bridge underside. This barge may occasionally contact the substrate in the Lagoon, causing a brief and temporary disturbance to the substrate. There are no trees in this area and the trimming will be limited to cutting of shrubby arroyo willows, blackberry, and coyote bush. In the riparian area leading up to the overhead portion of the pipeline on each bank, the majority of the trenching will be done in an existing unvegetated access road well above the DCH. Ground disturbance of vegetated areas will be limited to a trenched and backfilled area (0.05 acre [0.02 ha]) on top of either bank, where the pipeline would turn from the existing access road and go to the point where it would be built vertically up from the ground to the undersurface of the bridge. Since vegetation trimming will be limited to shrubs on top of the bank and outside of DCH, and disturbance to the channel due to the use of a barge will be brief and minimal, DCH is not expected to be adversely modified.

The Salinas River Lagoon is also designated as EFH for Pacific Coast Groundfish and Coastal Pelagic Species (finfish only). Potential effects on EFH at this location would be similar to the effects on DCH

**for South-CCC DPS steelhead, as described above. Overall, potential effects on EFH at this location would be minimal and temporary.**

**Implementation of the proposed avoidance and minimization measures (Section 6) will protect water quality in the Salinas River Lagoon during construction, ensure proper restoration of temporarily impacted areas, minimize erosion, and prevent the spread of invasive plants. Additionally, implementation of the mitigation and monitoring plan will offset temporary impacts on riparian vegetation at the Salinas River crossing, as described in Section 6.7.**

# 5 Potential Adverse Effects (Operations)

This section discusses potential adverse effects from the project on federally listed species under NMFS jurisdiction that may occur in the Action Area. Potential effects on the marine environment are limited to the combined discharge at the existing wastewater outfall, which may have effects in the area associated with the ZID, BMZ, and far-field dilution zone. To adequately explain and streamline the analysis of the effects of the combined discharge, Section 5.1 discusses the ecosystem level effects of the discharge. In Section 5.2, those ecosystem level effects are then discussed individually for each listed species that is potentially affected.

## 5.1 Ecological Effects of the Combined Discharge

The following subsections discuss potential direct (i.e., contemporaneous with project actions) and indirect effects (caused by the action, but occurring later in time) of the combined discharge on the marine ecosystem in the Action Area. This is compared to the baseline condition of the existing wastewater discharge. Currently, the treated wastewater flow varies throughout the year, with the highest flows observed outside of the irrigation season (November through March, with an average discharge of 18 mgd). The lowest flows occur during the irrigation season (April through October, with an average discharge of 3.7 mgd), when the treated wastewater is processed through the Salinas Valley Reclamation Plant for tertiary treatment and distributed to irrigators through the CSIP (Roberts 2016). Under the baseline conditions, there are also periods where no discharge occurs because all the treated wastewater is reclaimed for agricultural uses. The combined discharge resulting from the Proposed Action may affect marine communities through increased turbulence, alteration of water quality, and alteration of benthic communities, as discussed below.

### 5.1.1 Turbulence Due to Increased Discharge Volume

The addition of the brine to the existing wastewater flow will result in an increase in discharge velocity and a decrease in dilution rate relative to baseline conditions.

Although this turbulence will have no direct effect on listed species, which are far too large to be affected, it has been suggested that planktonic organisms entrained into the high velocity turbulent flow jets could be subject to injury and possibly mortality, due to the effects of turbulence and shear. Because plankton are a key foundation of the trophic web in marine systems, a loss of plankton, if sufficient enough in scale, could have indirect effects on listed wildlife that may forage in the Action Area. Such effects are difficult to assess, so only approximate orders of magnitude can be estimated. Experimental evidence suggests that the main turbulence effect is caused by small-scale eddies, known as the Kolmogorov scales, and that most damage may occur when they are comparable to the size of the organisms (Roberts 2016). These small eddies subject the organism to high strain rates and viscous shear stress that may cause injury or death, whereas larger eddies mainly reposition the organisms without causing significant shear.

To determine the potential effects of entrainment on plankton, modeling of the combined discharge turbulence was conducted for the Proposed Action (Appendix B). This study (Roberts 2016) found that, for the combined discharge, only a small fraction of the water passing over the diffuser is entrained. It ranges from 1.3 percent to 6.4 percent, depending on the discharge scenario. This estimate depends on the assumed value of the oceanic drift speed, conservatively assumed to be 5 centimeters per second (cm/s). For higher oceanic drift speeds, the percentage of entrainment would be less. Because the natural Kolmogorov scale near the diffuser is about 0.03 inch (1 mm), it is argued that incremental mortality due to the jets will only occur for regions where the Kolmogorov scale is shorter than this, and by organisms smaller than 0.03 inch (1 mm). We assume no incremental mortality for organisms larger than 0.03 inch (1 mm). Organisms smaller than 0.03 inch (1 mm) comprise only 27 percent of the total plankton sampled in the Action Area, and the fraction of them that would actually die in the turbulence is uncertain. According to the literature, it could be anywhere from zero to about 50 percent; the study conducted uses the conservative upper limit of 50 percent (Roberts 2016). The area of high shear impacted by the diffusers is relatively small, and transit times through this region are relatively short. Therefore, it seems reasonable to expect that, although the plankton that experience the highest shear may experience lethal damage, the overall increase in mortality integrated over the larger area will be low.

Although the information above indicates that the combined outflow will result in some harm or mortality to small (less than 0.03-inch [1.0-mm] length) plankton, the overall effect is very small in relation to the vast volume of unaffected waters in the vicinity of the outfall. The total volumes in the jets where turbulent intensities are greater than background effects were found to be almost infinitesimally small compared to the volume of the BMZ (approximately 108 by 328 feet [33 by 100 meters]), ranging from 0.006 percent to 0.4 percent (Roberts 2016). The combined discharge, being more dense, will generally dilute into the receiving waters more slowly than the treated effluent alone, resulting in less turbulence and less potential shear stress on plankton. For example, the volume of entrained water during operation of the Proposed Action is actually 7 to 22 percent of the baseline case during the winter months. However, the baseline condition during the summer months is the release of relatively little or no treated effluent, so the Proposed Action may increase entrainment during that time period.

### 5.1.2 Salinity and Water Quality

The 2015 California Ocean Plan (SWRCB 2015, revised and effective January 28, 2016), contains new requirements to address brine discharges. The most relevant of these to the present report are contained in Section III.M.3, "Receiving Water Limitation for Salinity," which states that:

> *"Discharges shall not exceed a daily maximum of 2.0 ppt above natural background salinity measured no further than 100 meters (328 ft.) horizontally from each discharge point. There is no vertical limit to this zone... the Brine Mixing Zone is the area where salinity may exceed 2.0 parts per thousand above natural background salinity, or the concentration of salinity approved as part of an alternative receiving water limitation. The standard brine mixing zone shall not exceed 100 meters (328 feet) laterally from the points of discharge and throughout the water column... The brine mixing zone is an allocated impact zone where there may be toxic effects on marine life due to elevated salinity..."*

As required by the ocean plan analysis must be completed and reported so that:

> *"For operational mortality related to discharges, the report shall estimate the area in which salinity exceeds 2.0 parts per thousand above natural background salinity or a facility-specific alternative receiving water limitation (see chapter III.M.3). The area in excess of the receiving water limitation for salinity shall be determined by modeling and confirmed with monitoring. The report shall use any acceptable approach approved by the regional water board for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge, including any incremental increase in mortality resulting from a commingled discharge."*

To meet this requirement, brine dilution and discharge velocity modeling studies (Appendix B) and an Ocean Plan compliance assessment (Appendix C) were completed in 2016. These reports provide important details used to assess the potential effects of the Proposed Action on listed species and the marine environment on which they depend. These studies modeled various operating scenarios that were considered during project planning. Of the scenarios presented in Appendices B and C, the ones that are applicable to the Proposed Action are Variant Scenarios V6 through V10 (Appendix B). Under all applicable operating scenarios, the area over which salinity may exceed 2.0 ppt above natural background salinity is extremely small and would occur within the ZID – less than 42 feet from the diffuser.

Similar to the salinity discharge requirements described above, the SWRCB 2012 Ocean Plan sets forth water quality objectives for the ocean with the intent of preserving the quality of the ocean water for beneficial uses, including the protection of both human and aquatic ecosystem health (SWRCB 2012). The RWQCBs use these objectives to develop water quality-based effluent limitations for ocean dischargers that have a reasonable potential to exceed the water quality objectives. Compounds for which requirements are set include but are not limited to heavy metals, ammonia, organic solvents, PAHs, PCBs, and phenolic compounds.

There are three primary mechanisms by which the combined discharge may affect the water quality in relation to the baseline conditions of the secondary effluent:

- An increase in salinity, because the brine contains seawater concentrate,
- Concentration of other seawater constituents (including persistent toxic compounds) in the brine, wastewater and GWR concentrate, and
- The alteration of the mixing rate of the secondary effluent into the receiving waters due to the introduction of dense brine.

It should also be noted that under baseline conditions, there is often no discharge from the wastewater outfall during the summer months, when all treated wastewater is being reclaimed for agricultural uses.

#### *5.1.2.1 Positively Buoyant Discharge Scenarios*

In the baseline condition, the secondary effluent is positively buoyant and mixes more readily into the receiving waters. Under most of the combined discharge scenarios, the discharge will be negatively buoyant and mixing will occur at a lower rate. There are a few discharge scenarios where a high volume of treated wastewater (roughly two parts treated wastewater per one part brine) outflow would sufficiently dilute the brine and GWR concentrate to the point where the plume would be positively buoyant. Under those scenarios, none of the Ocean Plan water quality objectives would be exceeded outside of the ZID (Trussell Technologies 2016), and the effects of the combined discharge would be similar to the treated wastewater discharges that occur in the baseline condition. Because the discharge would be less saline than the ambient seawater, there is no potential for impacts associated with increased salinities to surface waters. It is worth noting that upper surface waters of the ocean experience periodic and temporary drops in salinity during heavy rainfall or when storm runoff from large waterways spreads across the sea surface. Additionally, because pelagic organisms typically are either carried by currents or migrate of their own volition, pelagic organisms are not expected to experience any chronic effects from degraded water quality when they briefly pass through the relatively small ZID of a positively buoyant plume.

#### *5.1.2.2 Negatively Buoyant Discharge Scenarios*

Brine dilution modeling conducted for the Proposed Action (Roberts 2016) found that the salinity requirement of the Ocean Plan limiting salinity increases to less than 2 ppt over natural background within 100 meters from the diffuser was met in all discharge scenarios. However, salinity increases of less than 2 ppt due to the dense combined discharge may still have an effect on benthic communities, as discussed in Section 5.1.3. Based on the aforementioned modeling, the Proposed Action shows a potential to exceed certain Ocean Plan objectives under specific discharge scenarios. In particular, potential issues were identified for the discharge scenarios involving low secondary effluent flows with desalination brine and GWR concentrate. Discharges are predicted to exceed or come close to exceeding multiple Ocean Plan objectives in the ZID—specifically those for ammonia, chlordane, PCBs, tetrachlorodibenzo-p-dioxin (TCDD) equivalents, and toxaphene—because the addition of brine reduces the dilution of these constituents present in the wastewater and source water for the GWR Project (Table 7).

**TABLE 7 PREDICTED CONCENTRATIONS AT THE EDGE OF THE ZID EXPRESSED AS A PERCENTAGE OF OCEAN PLAN OBJECTIVE FOR OCEAN PLAN CONSTITUENTS OF CONCERN**

| Constituent | Units | Ocean Plan Objective | Est. Percentage of Ocean Plan objective at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | V6 | V7 | V8 | V9 | V10 |
| **Objectives for protection of marine aquatic life - 6-month median limit** | | | | | | | |
| Ammonia (as N) – 6-mo median[a] | µg/L | 600 | 185% | 192% | 177% | 74% | 25% |
| **Objectives for protection of human health - carcinogens - 30-day average limit[c]** | | | | | | | |
| Chlordane | µg/L | 2.3E-05 | 94% | 97% | 88% | 37% | 12% |
| PCBs | µg/L | 1.9E-05 | 146% | 145% | 126% | 51% | 16% |
| TCDD Equivalents[b] | µg/L | 3.9E-09 | 110% | 115% | 105% | 44% | 15% |
| Toxaphene[c] | µg/L | 2.1E-04 | 103% | 107% | 99% | 41% | 14% |

NOTE: Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[a] Ammonia (as N) represents the total ammonia concentration, i.e. the sum of unionized ammonia ($NH_3$) and ionized ammonia ($NH_4$).

[b] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values were greater than the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL value was assumed where a non-detect occurred but the MRL was greater than the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, beryllium did not exceed the Ocean Plan objective by 80 percent or more and therefore was not included.

[c] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

SOURCE: Trussell, 2016 (Appendix D3)

Ammonia clearly exceeds the Ocean Plan objective; the discharge will therefore require some form of treatment so that the Proposed Action meets water quality requirements. TCDD equivalents show a potential to exceed the Ocean Plan objective through a best-case analysis. Chlordane, PCBs, and toxaphene, which were predicted to exceed the objectives, were detected at concentrations that are orders of magnitude below detection limits of methods currently used for discharge compliance. The potential effect of each of these contaminants on benthic organisms, in the concentrations modeled to occur in the combined discharge, is discussed below.

Mixing and dilution of horizontal dense plumes from the diffuser jets could be affected by proximity to a local boundary, such as the sea floor (Roberts 2016). As a fluid moves across a surface, a certain amount of friction occurs between the fluid and the surface, which tends to slow the moving fluid. This resistance to the flow of the fluid pulls the fluid toward the surface. Thus, a fluid emerging from a nozzle (such as a dense plume from a diffuser) could potentially follow a nearby curved surface (such as the seafloor) if the curvature of the surface, or the angle the surface makes with the fluid stream, is not too sharp (i.e., acute). This effect (known as Coanda attachment) could result in substantially reduced dilution, creating a dense plume that forms a connection to, and travels along, the sea floor. In response to this concern, Roberts (2016) modeled the anticipated discharge to see if this effect was likely to occur. This study determined that conditions of the discharge, namely the expected negatively buoyant density characteristics, were not likely to result in a Coanda effect of plume attachment to the seafloor (for details regarding methods and results see Appendix B).

### Ammonia

Ammonia is present in low concentrations within the desalination brine but high concentrations in the secondary effluent and GWR brine. Ammonia is not an issue when discharging secondary effluent and GWR concentrate without desalination brine, or when the dense desalination brine is discharged with sufficient secondary effluent, so that the combined discharge is sufficiently diluted or results in a rising plume with relatively high ocean mixing in the ZID. This potential Ocean Plan exceedance emerges when the combined discharge contains a relatively small proportion of the secondary effluent and the combined discharge is therefore denser than the ambient seawater. This negatively buoyant discharge sinks, resulting in relatively low mixing in the ZID. The worst-case scenario for area affected by ammonia levels above the ocean plan limits occurs near the point where the desalination brine and GWR concentrate is discharged with a low flow of secondary effluent (Trussell Technologies 2016). This scenario ends up being a moderate flow of approximately 9.9 to 12.9 mgd of combined discharge. In these situations, the ZID extends approximately 10 to 15 feet (3 to 4.6 meters) from the diffuser (Roberts 2016).

Ammonia is expected to be the constituent with the highest exceedance, being 1.92 times the Ocean Plan objective in Scenario 7 (1 mgd secondary effluent with hauled brine, GWR concentrate, and desalination brine) (Trussell Technologies 2016). This scenario is problematic because constituents that have relatively high loadings in the secondary effluent are concentrated in the GWR concentrate. This scenario assumes that the secondary effluent and GWR concentrate flow is much smaller than the desalination brine flow, so that the resulting discharge plume is negatively buoyant and achieves poor ocean dilution. All modeled discharge scenarios that may exceed Ocean Plan objectives are negatively buoyant and so the impacts of the reduced water quality would be focused on benthic habitat.

Ammonia is naturally present in surface waters, because it is a breakdown product of organic nitrogen, is an intermediate in the process of nitrogen fixation, and can be created by the reduction of nitrate (Codling et al. 1999). However, ammonia levels increase dramatically due to anthropogenic causes such as agricultural runoff and sewage treatment, and high levels of ammonia can lead to negative effects on the marine environment. Total ammonia exists in two forms, the ionized ammonium ion ($NH_4$+) and the un-ionized ammonia ($NH_3$), which is the more toxic form (Codling et al. 1999). The level of ammonia toxicity depends on surrounding environmental factors including pH, temperature, salinity, and oxygen levels (United Kingdom Marine Special Areas of Conservation 2016). Generally, it appears that ammonia toxicity increases with decreased levels of salinity, and with low DO concentrations, although more studies are required to support this (Codling et al. 1999). Ammonia does not bioaccumulate and will not accumulate in sediments (Codling et al. 1999).

Boardman et al. conducted an experiment designed to study the effects of ammonia toxicity on saltwater organisms (Boardman et al. 2004). The organisms tested were sheepshead minnow, summer flounder, Atlantic silverside, mysid shrimp, ghost shrimp, and quahog clam (Boardman et al., 2004). The acute toxicity results found that the 96-hour no observable effects concentration ranged between 0.22 and 9.3 mg/L of unionized ammonia for the species tested, with mysid shrimp and summer flounder being the most sensitive and quahog clams being the least (Boardman et al, 2004). In typical conditions in the Action Area (35 ppt salinity, 8.0 pH, 20 °C), the unionized ammonia present would be about 3 percent of the total ammonia (Kutty 1987). The potential maximum concentration of total ammonia at the edge of the ZID would be 1,154 µg/L or 1.154 mg/L (Table 7), which would translate into an unionized ammonia value of approximately 0.035 mg/L. This value is far below the concentrations that caused observable effects on organisms in the above study.

Boardman et al. also studied chronic effects and found a much lower acute-chronic ratio than what was reported in the literature for most species (Boardman et al., 2004). After calculations, these data suggest that the current unionized ammonia limit accounting for chronic effects should be increased from 0.065 to 0.081 mg/L, or a factor of 2.31 (Boardman et al., 2004). When the typical seawater conditions of the Action Area are taken into account, this translates into a total ammonia value of 2.7 mg/L, far higher than what would be present in the worst-case scenario (1.154 mg/L). As a result, no acute or chronic effects on benthic organisms are expected from the increased ammonia.

### Chlordane

Chlordane was previously used in the U.S. as a pesticide before being banned from use in 1988 for being a probable human carcinogen (U.S. EPA 2000). Chlordane is not water-soluble and does not readily migrate through soil (Parrish et al. 1978). Studies were conducted on freshwater and saltwater invertebrates and fishes, measuring acute toxicity levels of chlordane. Saltwater invertebrates and fishes were found to be more sensitive to the effects of chlordane than freshwater species. The 96-hour LC50 (the lethal concentration at which 50 percent of the population is killed) for two benthic invertebrate species, pink shrimp (*Pandalus borealis*) and grass shrimp (*Palaemonetes sp.*), were 0.4 µg/L and 5 µg/L, respectively. The 96-hour LC50s for two saltwater fish species, the sheepshead minnow (*Cyprinodon variegatus*) and the pinfish (*Lagodon rhomboides*), were 24 µg/L and 6 µg/L respectively. Chronic toxicity of chlordane was tested for freshwater fishes by comparing any differences in growth, reproduction, and behavioral and physical changes of exposed adults and of their offspring compared with a negative control group (Cardwell et al., 1977). This study found that the lowest levels at which chlordane had these chronic effects were 0.32 µg/L for brook trout and 1.22 µg/L for bluegill. Chronic toxicity was also tested for sheepshead minnow (a saltwater fish) in another study, with results showing similar effects at 0.8 µg/L of chlordane (Parrish et al. 1978). The maximum concentration of chlordane released in the combined discharge will be 2.3E-05 µg/L, which is 34,782 times less concentrated than the minimum level of effects of chlordane on sheepshead minnow. Although only a subset of species were tested, the results of these studies can be used to conclude that the concentration levels of chlordane within the combined discharge will likely have little to no effect on benthic invertebrates and fishes in the ocean.

### PCBs

PCBs are a group of global pollutants, with the empirical formula C12H10-nCln, with n being a value between 1 and 10. The effects of PCBs vary depending on the degree of chlorination and the chemical structure (Eisler 1996). PCBs have low solubility in water, and are used for industrial processes because they are generally very thermally stable, acid- and base-resistant, nonflammable, and have other useful properties (Eisler 1996).

In high enough concentrations, PCBs can be acutely toxic to marine organisms. Studies found that after 96 hours of exposure, LC50 concentrations for aquatic invertebrates were between 12 µg/L and 10 mg/L (WHO 1993). For fish, these values ranged between 0.008 and 100 mg/L for PCB mixtures (WHO 1993). For marine invertebrates, the LC50 values ranged from 0.01 mg/L to greater than 10 mg/L (WHO 1993). The levels of PCBs released in the combined discharge would be around 1.9E-05 µg/L, which is far below the concentrations of PCB mixtures that were toxic to marine invertebrates and fishes. Therefore, it is unlikely that the levels of PCB in the combined discharge will have acute toxicity effects on marine organisms.

A major concern with PCBs is bioaccumulation, because they are lipid-soluble and will bioaccumulate in fatty tissues (WHO 1993). In the oceans, PCB levels between 0.05 and 6 nanograms per liter have been reported (WHO 1993). However, PCBs are found in much higher levels in sediments on the ocean floor due to their high affinity for suspended solids (Eisler 1996). In particular, sediments that are higher in total organic carbon tend to accumulate PCBs more readily (Dinn et al. 2012). The sediment within a few meters of the outfall is generally coarse sand, with a relatively low total organic carbon level of 1 to 2 milligrams per gram (mg/g) dry weight (ABA Consultants 1999). Comparatively soft sediments in estuarine environments often have total organic carbon levels greater than 35 mg/g dry weight (Hyland et al. 2005). The sediments in the vicinity of the outfall are also regularly transported and sorted by tidal and storm currents (ABA Consultants 1999), which limits the opportunity for accumulation of PCBs in the surrounding sediments. Because PCBs are unlikely to accumulate in sediments around the outfall, and resident benthic organisms in the vicinity are overall small and short-lived, the potential for bioaccumulation of PCBs is unlikely.

### TCDD Equivalents

TCDDs are isomers of polychlorinated dibenzo-p-dioxin (PCDD) that can be found as unintentional products in commercial herbicides and chlorophenols (Eisler 1986). These dioxins are problematic because they are relatively environmentally and chemically stable, and they can accumulate in fatty tissues (Eisler 1986). The isomer 2,3,7,8-TCDD is the most toxic of the PCDD isomers, and can have lethal, carcinogenic, reproductive, teratogenic, mutagenic, histopathologic, and immunotoxic effects (Eisler 1986). This isomer is extremely stable and nearly impossible to eradicate, and therefore has been extensively studied (Eisler 1986). Studies of the effects of 2,3,7,8-TCDD were conducted on marine species, including winter flounder (*Pseudopleuronectes americanus*), the little skate (*Raja erinacea*), fathead minnows (*Pimephales promelas*), and rainbow trout (Eisler 1986). Results found that for teleosts, there was reduced growth and fin necrosis at 0.1 ng/L of 2,3,7,8-TCDD exposure for 24 to 96 hours, and concentrations at or above 1.0 ng/L were fatal (Eisler 1986). Concentrations below 0.01 ng/L 2,3,7,8-TCDD had no observable effects (Eisler 1986). The concentration of TCDD equivalents that the proposed desalination plant would produce are equivalent to 0.0039 ng/L, which is far below the level of measurable effects studied. The studies found that invertebrates, plants, and amphibians were comparatively more resistant to 2,3,7,8-TCDD than fish (Eisler 1986). At the concentrations that would be present in the combined discharge, TCDD, including the most toxic isomer, would have little to no effects on marine invertebrates and fishes.

### Toxaphene

Toxaphene is used as an insecticide and was previously the most popular agricultural chemical globally (Eisler 1985). It is persistent in soil and water, but degrades much more quickly in air and warm-blooded organisms (Eisler 1985). In marine organisms, measurable effects were recorded for concentrations between 0.05 and 0.3 µg/L, and toxaphene caused death in organisms at and below 10 µg/L (Eisler 1985). The level at which toxaphene is considered to be safe to marine organisms is at or below 0.07 µg/L (Eisler 1985). The proposed desalination plant could release levels of toxaphene at 2.1E-04 µg/L, which is far below the concentration at which toxaphene is considered safe. Therefore, the toxaphene levels released in the desalination brine should not cause effects on marine organisms.

### Dissolved Oxygen

Adequate DO is vital for aquatic life, and higher concentrations are generally considered to be desirable. DO content in water is, in part, a function of water temperature and salinity, which affects the point at which water becomes saturated with DO. As the temperature and/or salinity of water increases, water loses the ability to hold DO and the concentration goes down. Salinity also has properties that can facilitate the creation of hypoxic zones. Because saltwater is more dense than fresh water, under certain conditions a less dense layer of fresh or low salinity water can form on top of a denser layer of high-salinity water. Such a scenario can prevent adequate mixing of the water column and prevent oxygenated water from getting to the lower depths, resulting in the heavier, saltier layer at the bottom becoming oxygen-depleted. However, DO varies according to many other factors, including photosynthesis and biological and chemical oxygen demand associated with decomposition of organic material. Ambient DO levels in Monterey Bay at a depth of approximately 100 feet (30 meters) have ranged from 4.25 mg/L to 8.00 mg/L (KLI, 1998; KLI, 1999); typically, DO in the range of 5 to 8 mg/L is considered protective of fish and marine biota, depending on the species and life-stage. Under the Ocean Plan, a discharge may not decrease DO more than 10 percent of ambient levels at the edge of the BMZ.

As described above, Coanda attachments would not occur, and modeled salinity levels are less than 2 ppt above ambient salinity at the edge of the ZID. Furthermore, to evaluate the potential for hypoxia, Geosyntec (2015) performed a mass-balance analysis (a mass-balance analysis accounts for a given material entering and leaving a system). The analysis applied a mass-balance approach to a conservative areal extent of a brine-only plume (i.e., the most dense of the proposed operational discharges) to derive estimates of oxygen demand in local sediments (70 to 180 kilograms/day) and estimates of oxygen supplied (less than 5,600 kilograms/day) by the operational discharges (including entrained seawater). Based on the results of the mass-balance analysis, the amount of oxygen supplied to the discharged plume by ambient seawater entrained during turbulent mixing and dilution is more than 30 times greater than that consumed by the sediments. Therefore, the concentration of DO in receiving ocean waters would not become depressed by more than 10 percent from that which occurs naturally and hypoxic conditions would not occur as a result of the combined discharge.

### Water Quality - Summary

As described in Section 6.7, a monitoring program of both the effluent and the receiving environment would be implemented and remedial actions taken to prevent the exceedance of Ocean Plan limits outside of the ZID during operation of the Proposed Action. In effect, this means that any degradation of water quality would be limited to the ZID, which, for negatively buoyant discharges potentially exceeding Ocean Plan limits, extends no more than 42 feet (13 meters) from the diffuser (Roberts 2016). As described above, the concentrations of constituents of concern are not expected to have measurable toxicity on marine life in the ZID.

### 5.1.3 Benthic Community Changes Due to Salinity Shifts

Because the combined discharge will typically be denser than the receiving seawater, the discharge will spread out along the seafloor following the initial dilution. The effects of the discharge on the benthic community are dependent on many factors, including the difference in salinity between the discharge and the receiving water, the type of benthic community present, and the magnitude of tidal and oceanic currents at the discharge site. The modeling conducted in this analysis conservatively assumes, consistent with the Ocean Plan, that ambient current velocity is zero and does not contribute to dilution. Discharges into enclosed embayments with limited mixing typically have greater effects than discharges in more open waters with stronger currents (Cooley et al 2013). The latter accurately describes the discharge site of the Proposed Action, because a mean oceanic drift speed of 5 cm/s is assumed for the Proposed Action's entrainment study (Roberts 2016). This current speed is considered to be conservative, because tidal currents in Monterey Bay are generally described to be on the order of 10 to 25 cm/s, and measurements taken in the vicinity of the outfall recorded subsurface currents of 6 to 13 cm/s (Breaker and Broenkow 1989).

The current wastewater output from the outfall is less dense than the receiving waters and thus is positively buoyant. As a result, the current discharge likely has minimal effect on the benthic environment, although the proposed combined discharge will occasionally be negatively buoyant and interact more directly with benthic habitat. The combined discharge will increase salinities in the affected area, which may in turn cause a shift in the composition of the benthic community in the affected area. As described above, this salinity change is below the limits of the Ocean Plan; the maximum increase in salinity is approximately 1.17 ppt above ambient at the point where the combined discharge impacts the seafloor (Roberts 2016). From there, the plume will slowly dilute as it spreads across the seafloor, and at a distance of 328 feet (100 meters) from the outfall, the maximum salinity increase on the seafloor at the edge of the BMZ is projected to be 0.98 ppt (Roberts 2016). It is difficult to quantify the impact that a 1.17-ppt increase in salinity would have on the benthic community, because most studies on the subject have analyzed the effects of much greater changes in salinity. The studies that have been done for brine discharges in California found that for the most sensitive species (Purple urchin, *Strongylocentrotus purpuratus*), the salinity that caused the lowest level of observable chronic effects was 36.8 (Phillips et al. 2012) and 36 ppt (Weston Solutions 2013). For mysid shrimp (*Americamysis bahia*), which are a common member of soft-bottom communities, the lowest elevated salinity causing observable chronic effects was 41 ppt (Weston Solutions 2013). There was no observable effect on sand dollar (*Dendraster excentricus*), another invertebrate of soft bottom substrate, in fertilization and development at salinities of ambient to 39.5 ppt (Phillips et al. 2012). As a result, acute or chronic effects on most benthic organisms inhabiting the Action Area are not expected to occur.

However, in the long term, changes in salinity may favor some organisms over others and may result in community composition changes. Such an effect has been observed in close proximity to brine discharge points associated with other desalination projects (Nabavi et al. 2013, Del-Pilar-Ruso

2008). Depending on the marine season (Davidson, upwelling, and oceanic), baseline salinity in the Action Area varies from 33.5 to 34.0 ppt, suggesting that a salinity change of 0.5 ppt or less would be similar to baseline conditions and not effect benthic community composition. The area over which salinity may increase by more than 0.5 ppt above ambient varies depending on the discharge scenario and the oceanic season, but a simple extrapolation of the near-field dilution presented in the dilution modeling (Roberts 2016) can be used to establish an approximation of the far-field dilution zone. Based on such methods, the area over which ambient salinity may be exceeded by 0.5 ppt is approximately 1,148 feet (350 meters) from the diffuser. Although this area will be localized around the diffuser, its shape will vary with the direction of currents and is expected to be skewed downslope (to the west of the diffuser). Higher current velocities will deform this area more, but will also increase dilution due to increased mixing. Such changes to benthic community composition are expected to be minimal and may not even be detectable. Several far-field brine dilution studies failed to detect any change in benthic communities outside of the ZID (WateReuse 2011, Riera et al. 2012).

### 5.1.4 Monitoring and Corrective Measures

As described in Section 6.6, CalAm would be required to perform extensive water quality assessments prior to and during implementation of the Proposed Action, in accordance with the Ocean Plan. If operational discharges cannot be demonstrated to conform to the prescribed performance standards, brine may only be released following implementation of additional design features, engineering solutions, and/or operational measures. This essentially means that the levels of constituents of concern, as described above, would be lower than presented in this analysis. Implementation of the Avoidance and Mitigation Measures would mean that the 6-month median levels of constituents of concern would not exceed the values presented in Table 7.

## 5.2 Effects of the Combined Discharge on Listed Species

### 5.2.1 Steelhead – South Central California Coast and Central California Coast DPS

There is inconclusive evidence regarding the foraging depths and habits of steelhead in marine waters. The research that has been conducted on the topic was done in marine waters of the north Pacific (Light et al. 1989), and those findings may not be transferrable to the waters of the Action Area. It is therefore conservatively assumed that steelhead may occasionally forage in the benthic areas affected by the combined discharge. As described in Section 5.1.3, some changes to the benthic community may occur in the Action Area, affecting the composition of potential forage species for steelhead in the Action Area. However, overall productivity of benthic organisms is not expected to be reduced due to the combined discharge, and the area potentially affected is very small in relation to the extent of marine habitat for this species in Monterey Bay.

### 5.2.2 Coho Salmon – Central California ESU

In marine waters, coho salmon generally feed in the upper 32 feet (10 meters) of the water column, initially feeding on plankton and then transitioning to fish as they grow larger (PFMC 2014). Consequently, there is little potential for coho to occur in the benthic area that will be most affected by the combined discharge.

### 5.2.3 Chinook Salmon – Sacramento River Winter-Run ESU, Central Valley Spring-Run ESU, and California Coastal ESU

In marine waters, Chinook salmon are typically found at depths of 98 to 230 feet (30 to 70 meters), similar to the maximum depths of the Action Area. Chinook salmon feed on a variety of benthic and pelagic fish. As described in Section 5.1.3, some changes to the benthic community may occur in the Action Area, affecting the composition of potential forage species for Chinook salmon in the Action Area due to elevated salinity up to 1,148 feet (350 meters) from the outfall structure. However, these effects would occur over a small area relative to their feeding range and overall productivity of benthic organisms is not expected to be reduced due to the combined discharge.

### 5.2.4 Green Sturgeon – Southern DPS

Because green sturgeon are a benthically oriented species, they may potentially forage in the area most affected by the combined discharge. Green sturgeon feed on a variety of benthic organisms in both marine and estuarine areas, and have a varied diet consisting of crustaceans, polychaetes, and other fish. As described in Section 5.1.3, some changes to the benthic community may occur in the Action Area, affecting the composition of potential forage species for green sturgeon in the Action Area. However, overall productivity of benthic organisms is not expected to be reduced due to the combined discharge.

DCH for the Green Sturgeon – Southern DPS is present in the Action Area associated with the combined discharge. The combined discharge associated with the Proposed Action may cause changes to the benthic community due to elevated salinity up to 1,148 feet (350 meters) from the outfall structure. As stated above, these effects would occur over a small area relative to their feeding range and overall productivity of benthic organisms is not expected to be reduced as a result of combined discharge.

### 5.2.5 Leatherback Sea Turtle

Although leatherback sea turtles are often found in depths similar to that of the combined discharge area, they typically use the upper portions of the water column, which would not be affected by the dense, sinking discharge. In the rare periods where the combined discharge would be less dense than the receiving waters, the discharge would not exceed any Ocean Plan limits, and water quality would be similar to that which regularly occurs in baseline conditions. Furthermore, as a HMS with a life span of several decades or more, individual leatherback sea turtles are not expected to reside in the Action Area for any significant portion of their life cycle.

DCH for leatherback sea turtle is present in the portion of the Action Area associated with the combined discharge. The Action Area is located in Area 1, which includes the species' principal foraging areas, and is characterized by high densities of primary prey species (brown sea nettle [*Chrysaora. fuscenscens*]) in upwelling shadows and retention areas (77 FR 4170). As discussed in Section 5.1.1, mortality of plankton due to shear stress will not affect the larger planktonic organisms on which leatherback sea turtles feed. Smaller plankton, which may support such forage species, may be affected by turbulence from the discharge, but such effects are minuscule in relation to the overall volume of Monterey Bay, as described in Section 5.1.1.

### 5.2.6 Humpback Whale

There is potential for the humpback whale Mexico DPS and Central America DPS to occur in the Action Area associated with the combined discharge. These populations of humpback whale are known to feed along the Central California coast, and specifically in Monterey Bay between April and December (SIMoN 2016). Pelagic habitat in the Action Area may support prey items consumed by the humpback whale. If high enough densities of prey items are available in the Action Area, individual or aggregations of individual humpback whales may be present for several days in the Action Area. However, humpback generally feed in areas where the depth is 246 feet (75 meters) or more (NMFS 1991), which is much deeper than the waters at the combined discharge area (115 feet [35 meters] or less). Because the combined wastewater will typically be denser than the receiving waters and predominantly affect the benthic community in relatively shallow waters, there is limited potential for humpback whales to use areas affected by the Proposed Action. Furthermore, as a HMS with a life span of several decades or more, individual whales are not expected to reside in the Action Area for any significant portion of their life cycle.

### 5.2.7 Killer Whale – Southern Resident DPS

The Southern resident DPS of killer whale is a periodic and seasonal visitor to Monterey Bay, and occasionally occurs in the Action Area. This DPS primarily feeds on fish, and may feed on resident benthic fish that may spend significant time in the Action Area. However, the Action Area is relatively flat and lacks the complex relief where potential prey items may congregate. As described in Section 5.1.3, some changes to the benthic community may occur in the Action Area due to increased salinity affecting the composition of potential forage species for killer whale or their prey. However, overall productivity of benthic organisms is not expected to be reduced due to the combined discharge, and use of the Action Area by killer whales is expected to be infrequent.

### 5.2.8 Species Highly Unlikely to Occur in the Action Area

Section 3.4 describes nine species of sea turtle and marine mammals that have low potential to occur in the Action Area. In the rare event that one of these species is found in the Action Area, they would likely only occur temporarily; there are no nesting or breeding territories in the Action Area for these species. Individuals of these species are not expected to reside in the Action Area for any significant portion of their life cycle, and only a tiny fraction of forage for such individuals would come from waters that are potentially affected by the combined discharge. With these considerations, it is expected that the combined discharge will have no discernable effect on these species, and they are not considered further.

## 5.3 Effects of the Combined Discharge on Essential Fish Habitat

As described in Section 3.5, the Action Area is in an area identified as EFH for various life stages of fish species that are managed in accordance with the following FMPs, under the MSA:

- Pacific salmon FMP,
- Pacific groundfish FMP,
- Coastal pelagic FMP, and
- HMS FMP.

Potential effects on EFH for Pacific salmon result from the same factors that may affect coho and Chinook salmon, as described in Sections 5.2.2 and 5.2.3. This includes minor changes to the benthic habitat in the area of brine dilution, primarily affecting habitat that may be used by Chinook salmon. As described in Section 5.1.1, small plankton, which may serve as forage for coho salmon, may experience mortality due to turbulence-induced shear stress. However, such effects are expected to be insignificant and discountable in relation to the volume of Monterey Bay.

Potential effects of the combined discharge on EFH for Pacific groundfish, which are benthically oriented species, are well described in Section 5.1.3. Overall, the combined discharge may result in some shifts in the species composition of benthic communities due to elevated salinity up to 1,148 feet (350 meters) from the outfall structure. This may, in turn, reduce the forage quality for some groundfish species, while improving the forage quality for others.

Potential effects of the combined discharge on EFH for CPS and HMS are not expected to occur, because the combined discharge may only exceed water quality objectives under negatively buoyant discharge scenarios, where the discharge will not interact with pelagic waters that support CPS. As described in Section 5.1.2.1, positively buoyant discharges are not expected to have an effect on water quality. Prey items for CPS include small plankton, which may be affected by turbulence-induced shear stress, as described in Section 5.1.1. However, such effects are expected to be insignificant and discountable in relation to the volume of Monterey Bay.

For all potential effects on EFH resulting from the combined discharge, implementation of the protocols described in Section 6.6 will ensure that established water quality objectives are not exceeded outside of the ZID; this will greatly limit the area of EFH potentially affected by the Proposed Action.

## 5.4 Interrelated and Interdependent Effects

The Monterey Peninsula Water Management District (MPWMD) was established by state statute in 1978 to provide integrated management of all water resources for the Monterey Peninsula; among its functions is the allocation of water supply within its boundaries. Currently, the MPWMD augments, manages, and regulates surface and groundwater resources in the Carmel Valley and the greater Monterey Peninsula. MPWMD's jurisdiction includes the area served by CalAm's Monterey District, including areas served by the Proposed Action. The MPWMD is involved in the development and implementation of many other water supply programs, such as the GWR Project, Phase I and II ASR, the operation and removal of reservoirs in the region, water conservation and reuse programs, and local water project grants. Because these projects are all related to supply and demand of fresh water often drawn from shared resources, they may be seen as interrelated projects.

USFWS and NMFS have taken the position that any entity that pumps water from the Carmel Valley Aquifer may be liable for a take of federally listed species, because the pumping may alter habitat and affect steelhead's ability to migrate in the river, and affect habitat for the federally listed California red-legged frog (*Rana draytonii*) (CPUC and MBNMS 2017). In 1997, CalAm entered into an agreement with USFWS to further regulate its well production activities in an attempt to avoid or mitigate impacts on the California red-legged frog, and has renewed that agreement several times. In 2001, CalAm negotiated a Conservation Agreement with NMFS that included various changes in operations, with the long-term goal of procuring an alternative water supply source to reduce withdrawals from the Carmel River Alluvial Aquifer.

The Proposed Action is part of the MPWSP, for which one of the primary goals is regional water use planning coordinated by the MPWMD as well as state agencies. As described in Section 2, CalAm is under a "Cease and Desist Order" from the SWRCB to reduce diversion of water from the Carmel River to 3,376 afy by the year 2021. One of the goals of this coordination is a substantial reduction in the diversion of water from the Carmel River by CalAm, a goal that is met by implementation of the Proposed Action. The Carmel River supports a population of the Steelhead – South-CCC DPS, which would benefit greatly from a substantial reduction in water diversions from the Carmel River. Consequently, the reduction in water diversion from the Carmel River is expected to have an overall beneficial effect on the Steelhead – South-CCC DPS.

The GWR Project, which will contribute RO brine to the combined discharge, will also have the net effect of diverting fresh water (e.g. from the Blanco Drain, Tembladero Slough or Salinas River) that would otherwise enter the Elkhorn Slough estuary. During the development of the Final EIR for the GWR Project, a technical memorandum (Schaaf and Wheeler, 2015) was prepared to assess the potential impact of this diversion on salinities in Elkhorn Slough. This study determined that the GWR Project would have a negligible impact on the salinity of Elkhorn Slough on an average daily, weekly, or monthly basis (Schaaf and Wheeler, 2015).

## 5.5 Cumulative Effects

As defined under the ESA, cumulative effects are those effects of future state or private activities that are reasonably certain to occur in the Action Area (50 CFR 402.02). Future federal actions that are unrelated to the Proposed Action are not considered in this section because they require separate consultation, pursuant to Section 7 of the ESA (16 U.S. Code 1536).

There are several proposed projects that may cause cumulative effects in or adjacent to the Action Area (Table 8).

### TABLE 8 PROPOSED PROJECTS IN THE VICINITY OF THE ACTION AREA

| Project Location | Project Name and Description | Estimated Construction Schedule |
|---|---|---|
| Salinas River near the City of Marina | Salinas Valley Water Project Phase II – The project would allow the MCWRA to facilitate further offsets of groundwater pumping by delivering additional surface water to the Pressure and East Side subareas. The project would divert up to 135,000 afy of water from the Salinas River for municipal, industrial, and/or agricultural uses in the Pressure and East Side subareas.<br>The project proposes two new surface water diversion points and appurtenant facilities for capture, conveyance, and delivery of the water. The capture and diversion facilities would consist of either a surface water diversion facility similar to the Salinas River Diversion Facility, or subsurface collectors such as radial arm wells. The conveyance facilities would be composed of pipelines and pump stations. The pipeline's diameter, length, destination, number and location of turnouts, locations of pump stations, and physical layout of the conveyance facilities have not been determined. The delivery facilities may consist of injection wells for ASR, percolation ponds, turnouts for direct use of the water, or other options. The construction design and physical location of the delivery facilities would be influenced by the type of facility, the end-users' intended application of the water (agricultural versus urban), and the need for water treatment (MCWRA 2014). | Construction anticipated after 2018; Project operation anticipated 2026 |
| Moss Landing / Santa Cruz County | Monterey Bay Regional Water Project (MBRWP or DeepWater Desal) – This project includes a 23 mgd seawater desalination facility and co-located 1 million-square-foot data center on a 110-acre site in Moss Landing, on Dolan Road, approximately 1,500 feet east of the Moss Landing Power Plant. The project would serve up to 25,000 afy of potable water supply to participating communities in the Monterey Bay region, potentially including the Monterey Peninsula, Castroville, Salinas, and parts of Santa Cruz County (DeepWater Desal, 2015).<br>As proposed by DeepWater Desal, the project would develop supplemental water supplies to serve the customers in CalAm's Monterey District service area. However, if the MPWSP is built, DeepWater Desal can provide water to other areas, as described above. Therefore, there are two reasonably foreseeable scenarios that include development of the DeepWater Desal Project:<br>1) Development of the DeepWater Desal Project as an alternative to the MPWSP, as described in Chapter 5 (serving CalAm's Monterey District service area). This is Alternative 3 described and analyzed in Chapter 5.<br>2) Development as a separate project in addition to the MPWSP or another alternative that would serve CalAm's Monterey District service area. In this case, the impacts of the DeepWater Desal Project are considered in the cumulative scenario as they relate to the provision of water to Santa Cruz County and the City of Salinas. | Beyond 2017 |
| Marina Coast Water District/ Salinas Valley Reclamation | RUWAP Desalination Element – On March 1, 2016, in response to a request for information, MCWD stated that the RUWAP Desalination Plant would produce up to 2,700 afy of potable water supply; 2,400 AFY would be for the former Fort Ord, as identified in the Fort Ord Reuse | Unknown |

| Project Location | Project Name and Description | Estimated Construction Schedule |
|---|---|---|
| **Plant, Monterey County** | **Authority (FORA) Base Reuse Plan (BRP) and 300 afy would be for the District's Central Marina service area, as a replacement for the existing pilot (non-operating) desalination plant (MCWD 2016). However, MCWD reported that the water source for the proposed desalination project has not yet been determined; it may be seawater-intruded groundwater from the 180-Foot Aquifer, or it may be seawater from shallow wells located along the coast. The location of the wells and pipelines must also be addressed in a feasibility study. The desalination plant site last studied was located in North Marina on a parcel owned by MCWD, adjacent to the MRWPCA Regional Wastewater Treatment Plant. In any event, a feasibility study is needed to determine the actual component sizes and the timing of this project is dependent upon the redevelopment water demands within the former Fort Ord.** | |
| **Marina Coast Water District/ Salinas Valley Reclamation Plant, Monterey County** | **RUWAP Recycled Water Element – – The Recycled Water Project includes construction of a recycled water distribution system to provide up to 1,727 afy of recycled water to urban users in the MCWD service areas, including the former Fort Ord. The water would be recycled at the existing Salinas Valley Reclamation Plant. This project includes the following facilities: a new pipeline connection to the Salinas Valley Reclamation Plant; two pump stations; 40,000 linear feet of distribution pipelines; and a 1.5-million-gallon storage tank known as Blackhorse Reservoir. MCWD now proposes to combine conveyance facilities with the approved Pure Water Monterey Project for a shared pipeline (MCWD 2016a).** | **Unknown** |
| **Cities of Castroville, Marina, Monterey, Seaside, Sand City, and County of Monterey** | **TAMC Monterey Peninsula Light Rail Project - Construction of commuter light rail service predominantly, but not exclusively, along TAMC's existing Monterey Branch Line right-of-way, from House Plaza in the city of Monterey to Blackie Road in Castroville. This 15.2-mile-long project would involve improvements to existing rail, construction of new rail, and 12 new stops/stations (one in Castroville, five in Marina, three in Seaside and Sand City, and three in the city of Monterey). Approximately 860 new parking spaces would be constructed at these stations. The project would also include a new maintenance facility; this facility would be located at one of three sites under consideration, all of which are near Highway 1 on lands formerly associated with the Fort Ord military base (TAMC 2011). TAMC has placed this project on hold indefinitely until the agency can secure funding for environmental review, design, and construction.** | **Unknown** |

Notes:

afy = acre-feet per year
ASR = aquifer storage and recovery
MCWRA = Monterey County Water Resources Agency
RUWAP = Regional Urban Water Augmentation Project
TAMC = Transportation Agency for Monterey County's

These cumulative actions are limited to those that may occur in the vicinity of the Salinas River crossing or the slant wells. Because any discharges into Monterey Bay would require a discretionary permit from NOAA and thus be considered a federal action for compliance with the ESA, there are no cumulative effects to consider with regards to the combined discharge Action Area. Of the projects identified in Table 8, the majority are not likely to impact the Salinas River or habitats that are suitable for the Steelhead – CCC DPS, because they occur in upland areas outside of the Action Area.

Many of these projects are in the early stages of planning and it is currently unclear what, if any, impacts they would have on federally listed species, including the Steelhead – South-CCC DPS, and whether some would have a federal nexus and require Section 7 consultation. All of the projects in Table 8 would be reviewed under CEQA and would be required to develop avoidance and minimization measures and disclose significant impacts on federally listed species. If the projects are expected to cause significant impacts on federally listed species, the project applicant would be required to initiate ESA consultation either under Section 7 with a federal nexus, and if take would be anticipated under Section 10 without a federal nexus.

The RUWAP Desalination Element of the Marina Coastal Water District/Salinas Valley Reclamation Plant, as described above in Table 8, may utilize shallow wells in the vicinity of the slant wells associated with the proposed project to withdraw intruding seawater for desalination treatment. While these wells may have a cumulative effect on groundwater in relation to the proposed action, the effect cannot be discerned as the RUWAP Desalination Element is only in the early stages of planning, and any analysis would be speculative.

The Proposed Action would have temporary impacts in the Salinas River Action Area that appear to overlap with one of the identified proposed projects, the Salinas Valley Water Project Phase II. The project effects associated with the Salinas River crossing are largely temporary, and are not expected to overlap with the construction or operation of the Salinas Valley Water Project Phase II. These impacts are described in Section 4.2; they include temporary removal or degradation of habitat for the Steelhead – South-CCC DPS and possible temporary disturbance of this species. Due to the nature of the Salinas Valley Water Project Phase II, it is reasonable to assume that the project would have a federal nexus and therefore does not need consideration in this cumulative analysis.

Because the Salinas River Action Area only overlaps one of the cumulative projects, and because the project impacts are temporary and separated in time from the impacts associated with the cumulative project; adverse cumulative effects on the Steelhead – South-CCC DPS are not anticipated. In addition, all of the proposed projects would likely be required to implement avoidance and minimization measures that should avoid, minimize, and compensate for significant impacts on the federally listed species and their habitat. Therefore, the net effect is a minor and temporary incremental cumulative effect on the Steelhead – South-CCC DPS. As described in Section 5.4, the Proposed Action is part of a large plan that results in substantial decreases to the diversion of water from the Carmel River, which is expected to have indirect and beneficial effects on the Steelhead – South-CCC DPS as a whole.

# 6 Proposed Avoidance and Minimization Measures

## 6.1 Retain a Lead Biologist to Oversee Implementation of Avoidance and Minimization Measures

Prior to initiation of construction, or periodic maintenance of the slant wells, CalAm and/or representatives of CalAm will retain a qualified Lead Biologist to oversee compliance with avoidance and minimization measures for all special-status species and sensitive habitats. The Lead Biologist will be onsite, or will appoint qualified biologists and/or qualified biological monitors to be onsite, during all fencing and ground-disturbing activities. The Lead Biologist, qualified biologists, and qualified biological monitors will be subject to approval by resource agencies with jurisdiction over the special-status species with the potential to occur at the project site (and local agencies, if required). Only the Lead Biologist and/or qualified biologists may lead protocol surveys and relocate special-status species, as authorized by the resource agencies with jurisdiction over these species.

In the event that construction-related activities have the potential to violate the prescribed special-status species and habitat protection measures, the project Lead Biologist, or other appointed qualified biological monitors will report to construction or operational site supervisors with authority to stop work to prevent any violations. Work will proceed only after the construction-related hazards to special-status species and habitats are removed and the species is no longer at risk. Violations will be thoroughly documented as part of compliance monitoring activities.

The Lead Biologist will ensure that all compliance monitoring activities are documented on a daily basis, and will prepare a summary monitoring report on a monthly basis to be submitted to regulatory agencies upon their request. The monthly summary monitoring report will provide information regarding the worker awareness training (see Section 6.3 below), surveys, and any observed special-status species, including any accidental injuries or fatalities. The monthly report will also document the effectiveness and practicality of the prescribed avoidance and minimization measures, and recommend modifications to the measures if needed. The Lead Biologist will supply agency staff with copies of compliance records, including any reports of noncompliance, upon request.

The Lead Biologist will have in her/his possession a copy of all compliance measures while work is being conducted onsite, and will ensure that CalAm's onsite representatives and contractors also maintain copies of the compliance measures on the site. To facilitate the Lead Biologist's role, CalAm will ensure that the Lead Biologist is fully apprised of all decisions that change or materially affect the schedule, methods, and location of work that is subject to the protective measures for biological resources.

## 6.2 General Best Management Practices

CalAm's construction contractor(s) will implement the following general avoidance and minimization measures to protect special-status species and sensitive natural communities at the facility sites during construction, and during periodic maintenance activities at the Slant Wells:

1. The construction footprint, staging areas, equipment access routes, and disposal or temporary placement of spoils will be delineated with stakes and flagging prior to construction to avoid natural resources where possible. Any construction-related disturbance outside of these boundaries, including driving, parking, temporary access, sampling or testing, or storage of materials, will be prohibited without explicit approval of the Lead Biologist.
2. New access driveways will not extend beyond the delineated construction work area boundary. Construction vehicles will pass and turn around only within the delineated construction work area boundary or local road network. Where new access is required outside of existing roads or the construction work area, the route will be clearly marked (i.e.,

**flagged and/or staked) prior to being used, subject to review and approval of the Lead Biologist.**

3. **Vehicle speeds in the project area will not exceed 15 miles per hour on roads within the sites.**
4. **Excavated soils will be stockpiled in disturbed areas lacking native vegetation. Stockpile areas will be marked by the Lead Biologist to define the limits where stockpiling can occur.**
5. **Standard BMPs (such as setbacks and use of silt fences and fiber rolls) will be employed to prevent loss of habitat due to erosion caused by project-related impacts (i.e., grading or clearing for new roads). All detected erosion will be remedied immediately upon discovery.**
6. **Fueling of construction equipment will take place in existing paved areas, and at least 50 feet from drainages (including streams, creeks, ditches, culverts, or storm drain inlets) and native habitats. Contractor equipment will be checked for leaks prior to operation and repaired when leaks are detected. Fuel containers will be stored in appropriately sized secondary containment barriers.**
7. **The introduction of exotic plant species will be avoided through physical or chemical removal and prevention. Measures to prevent the introduction of exotic plants into the construction site via vehicular sources will include implementing track cleaning or other methods of vehicle cleaning for vehicles coming to and leaving the site. Earthmoving equipment will be cleaned prior to transport to the project area. Weed-free rice straw or other certified weed-free straw will be used for erosion control. Weed populations introduced into the site during construction will be eliminated by chemical and/or mechanical means approved by CDFW and the USFWS.**
8. **Herbicides will be used as vegetation control measures only when mechanical means have been deemed ineffective. All uses of such herbicidal compounds will observe label and other restrictions mandated by the U.S. Environmental Protection Agency (U.S. EPA), California Department of Food and Agriculture, and state and federal legislation; as well as additional project-related restrictions deemed necessary by the CDFW and/or USFWS.**
9. **If special-status wildlife species are found on the site during project construction, construction activities will cease in the vicinity of the animal until the animal moves on its own outside of the project area (if possible). The wildlife resource agency(ies) with jurisdiction over the species will be consulted regarding any additional avoidance, minimization, or mitigation measures that may be necessary if the animal does not move on its own. A report will be prepared by the Lead Biologist to document the activities of the animal in the site; all fence construction, modification, and repair efforts; and movements of the animal once again outside the exclusion fence. This report will be submitted to the CPUC and pertinent wildlife agencies with jurisdiction over the wildlife species.**
10. **Work will be conducted during daylight hours to the extent practicable.**
11. **Immediately prior to conducting vegetation removal or grading activities inside fenced exclusion areas, the Lead Biologist or a qualified biologist will survey within the exclusion area to ensure that no special-status species are present. The Lead Biologist or a qualified biologist will also monitor vegetation removal or grading activities inside fenced exclusion areas for the presence of special-status species.**
12. **All vehicles and equipment will be in proper working condition to ensure that there is no potential for fugitive emissions of motor oil, antifreeze, hydraulic fluid, grease, or other hazardous materials. The Lead Biologist will be informed of any hazardous spills within 24 hours of the incident. Hazardous spills will be immediately cleaned up and the contaminated soil will be properly disposed of at a licensed facility.**
13. **A trash abatement program will be implemented during construction. Trash and food items will be contained in closed containers and removed from the construction site daily to reduce their attractiveness to opportunistic predators such as common ravens, coyotes, and feral dogs.**

14. **Workers will be prohibited from feeding wildlife and bringing pets and firearms to the construction work areas.**
15. **Intentional killing or collection of wildlife species, including special-status species, in the project area and surrounding areas will be prohibited.**
16. **All temporarily disturbed areas will be returned to pre-project conditions or better.**

## 6.3 Environmental Awareness Training

**Prior to starting work (including periodic maintenance at the Slant Wells), all construction workers at the project areas will attend a Construction Worker Environmental Awareness Training and Education Program developed and presented by the Lead Biologist, appointed qualified biologist, and/or qualified biological monitor. The program will include information on each federal and state-listed species, as well as other special-status wildlife and plant species and sensitive natural communities that may be encountered during construction activities. The training will include: information on special-status species' life history and legal protections; the definition of "take" under the ESA and California Endangered Species Act (CESA); the measures CalAm and/or its contractors have committed to implementing to protect special-status species and sensitive natural communities; reporting requirements and communication protocols; specific measures that each worker will employ to avoid "take" of special-status species; and penalties for violation of ESA and/or CESA. Training will be documented as follows:**

1. **An acknowledgement form will be signed by each worker indicating that environmental training has been completed.**
2. **A sticker will be placed on hard hats indicating that the workers have completed the environmental training. Construction workers will not be permitted to operate equipment in the construction area unless they have attended the training and are wearing hard hats with the required sticker.**
3. **A copy of the training transcript/training video and/or DVD, as well as a list of the names of all personnel who attended the training and copies of the signed acknowledgement forms, will be submitted to the CPUC.**

## 6.4 Hazardous Material Spill Prevention

1. **Any areas used for staging, laydown, material storage, equipment storage, job trailers, employee parking, or other project-related support activities that do not need to be located in the active construction area will be located away from waters or wetlands, sensitive communities, and will be protected from stormwater runoff using temporary perimeter sediment barriers such as berms, silt fences, fiber rolls, covers, sand/gravel bags, and straw bale barriers.**
2. **All potential contaminants will be stored on impervious surfaces, plastic ground covers, or in secondary containment to prevent any spills or leakage from contaminating the ground, and will be located at least 100 feet from adjacent habitat where practicable.**
3. **Any spillage of pollutants or construction material will be contained immediately in accordance with the project Storm Water Pollution Prevention Plan (SWPPP). The contaminated area will be cleaned, and any contaminated materials properly disposed of. The Lead Biologist will be notified of all spills.**

## 6.5 Minimization of Sedimentation and Turbidity

1. **A SWPPP will be prepared by a Qualified SWPPP Developer, and a Qualified SWPPP Practitioner will oversee its implementation. The SWPPP, which will include site-specific erosion and stormwater control measures to be implemented during construction of the Castroville Pipeline, will minimize or eliminate the erosion or sedimentation of the Salinas River.**

2. CalAm will require its construction contractor(s) to implement a dust control plan that includes, at minimum, the following dust control measures:
   a. Water all active construction areas at least twice daily;
   b. Cover all trucks hauling soil, sand, and other loose materials, and require trucks to maintain at least 2 feet of freeboard;
   c. Apply water three times daily on, or apply (nontoxic) soil stabilizers on, unpaved access roads, parking areas, and staging areas at construction sites;
   d. Sweep daily (with water sweepers) all paved access roads, parking areas, and staging areas at construction sites;
   e. Sweep streets daily (with water sweepers) if visible soil material is carried onto adjacent public streets;
   f. Hydroseed or apply (nontoxic) soil stabilizers to inactive construction areas (previously graded areas inactive for 10 days or more);
   g. Enclose, cover, or water twice daily exposed stockpiles (dirt, sand, etc.);
   h. Limit traffic speeds on unpaved roads to 15 miles per hour;
   i. Install sandbags or other erosion control measures to prevent silt runoff to public roadways;
   j. Replant vegetation in disturbed areas as quickly as possible;
   k. Wheel washers will be installed and used by truck operators at the exits of the construction sites to the MPWSP Desalination Plant, the slant wells, the ASR well facilities, and the Terminal Reservoir; and
   l. Post a publicly visible sign that specifies the telephone number and person to contact regarding dust complaints. This person will respond to complaints and take corrective action within 48 hours. The phone number of the Monterey Bay Unified Air Pollution Control District (MBUAPCD) will also be visible to ensure compliance with MBUAPCD rules.

## 6.6 Protocols to Avoid Exceeding Water Quality Objectives from Combined Discharge

In accordance with the Ocean Plan, CalAm will be required to perform an extensive water quality assessment prior to implementation of the Proposed Action. In addition, if operational discharges cannot be demonstrated to conform to the prescribed performance standards, brine may only be released following implementation of additional design features, engineering solutions, and/or operational measures. Both the water quality monitoring requirements and potential corrective actions are described below.

### 6.6.1 Water Quality Monitoring

To ensure that the operational discharges from the MPWSP are in compliance with the 2 ppt receiving water salinity limitation at the BMZ compliance point required by the California Ocean Plan, the discharger(s) will implement a Monitoring and Reporting Plan (Plan). The Plan will, at a minimum, include protocols for monitoring of effluent and receiving water salinity characteristics, as well as protocols for determining statistically significant changes[6] in benthic community composition within the maximum extent of the ZID in comparison to baseline conditions (established a minimum of 1 year prior to operations). Such protocols will include, but not be limited to, monitoring for benthic community health, aquatic life toxicity, and hypoxia, in the ZID. The Plan will be consistent with the standard monitoring procedures detailed in Appendix III of the Ocean Plan. Such monitoring protocols specify monitoring plan framework, scope, and methodological design for determining compliance with the Ocean Plan-defined receiving water limitations relating to salinity. Prior to

[6] Changes that are directly associated with changes in salinity resulting from operational discharges (with consideration given to natural and seasonal variations and long-term regional trends).

implementation, the Plan will be approved by the RWQCB and MBNMS. Following implementation, the Plan will be reviewed by the RWQCB, and revised if necessary, as part of the NPDES permit renewal process.

As part of the Plan, receiving water monitoring for salinity will be conducted at times when the monitoring locations are most likely to be potentially adversely affected by the discharge. The Plan will establish protocols to establish baseline biological conditions at the discharge location, as well as at a reference location outside the influence of the discharge for at least 1 year prior to commencement of project construction. To determine impacts on marine biological resources against baseline biological conditions, the discharger(s) will conduct biological surveys (e.g., Before-After Control-Impact studies), that evaluate and quantify the differences between biological communities at a reference site and at the discharge location before and after the discharge(s) commence. All monitoring data, results, and analyses will be compiled and submitted to the RWQCB and MBNMS for review. Such monitoring will continue until the RWQCB and MBNMS determine that a regional monitoring program is adequate to ensure compliance with the receiving water limitation.

At a minimum, the Plan will include the following water quality monitoring protocols and monitoring frequencies to assess baseline conditions; to track the compliance of the Project with the performance standard of ensuring that operational discharges do not exceed ambient salinity by more than 2 ppt at the edge of the BMZ; and to assess the efficacy of any operational or design features implemented:

1. At least 1 year prior to implementing operational discharges, the discharger(s) will install continuously recording automated water quality monitoring equipment, such as automatically recording water quality data sondes (water quality monitoring instruments), to monitor salinity and DO levels at 1-hour intervals in the receiving waters of Monterey Bay. The discharger(s) will install water quality monitoring equipment at a minimum of four locations within 10 feet (3 meters) of the ocean floor, as follows:
    a. One monitoring station at the edge of the ZID, but not more than 10 meters from the outfall diffuser;
    b. One monitoring station at the edge of the BMZ, representing the point of compliance with the Ocean Plan salinity standard (not more than 328 feet [100 meters] from the outfall diffuser); and
    c. A representative reference location at least 3,280 feet (1,000 meters) from the outfall diffuser, situated on the same elevation contour as that of the outfall diffuser, in an area outside the influence of operational discharges or other inputs to Monterey Bay, such as operational discharges from other facilities or fresh water inputs in the form of major surface water inputs.
2. Monitoring will be conducted for 1 year prior to the commencement of operational discharges to confirm baseline conditions.
3. Once operational discharges commence, the discharger(s) will continue monitoring (for a minimum of 5 years, as described below) to confirm compliance of operational discharges with the Ocean Plan receiving water salinity limitation, which specifies that discharges will not exceed a daily maximum of 2 ppt above natural background salinity, as measured no farther than 328 feet (100 meters) horizontally from the discharge point.

The discharger(s) will retrieve all data from deployed water quality monitoring instrumentation at least four times a year at quarterly annual intervals during both the 1-year period of baseline monitoring and during the salinity standard compliance monitoring associated with operations. Following data collection, data will be analyzed for compliance with the receiving water salinity standard defined in the Ocean Plan.

Additionally, the salinity and DO data retrieved will be used, in conjunction with biological survey data, to assess changes to benthic community composition in the ZID. The analyses and monitoring data

**will be summarized and submitted to the RWQCB and MBNMS as annual reports and made publicly available via the project website. Reports will include summary graphs of all quality assured/quality controlled data as well as statistical analyses of the data relative to historic baselines. Reports will assess water quality data in the context of relevant water quality standards. The reports will describe any measured adverse water quality related changes, such as high salinity or low DO levels that potentially impact marine habitat quality or benthic communities. The reports will include assessment of the extent to which any measured changes were attributable to controllable factors, such as the variation of combined flows as part of operational discharges.**

**The analysis and reporting conducted as part of the Plan will determine the need for corrective actions to be implemented in the form of the design features and operational measures described below. As part of such a determination for implementation of corrective actions, a schedule for implementation will be provided, along with a rationale for how such design features and/or operational measures were selected and the expected results following implementation. All analysis and reporting, including determinations for the need for corrective actions to be implemented, the schedule for implementation, and the rationale for selected corrective actions, will be approved by the RWQCB and MBNMS. If at the end of five complete years of monitoring operational discharges, the 24-hour average salinity measured at the edge of the BMZ is less than 75 percent of the salinity performance standard for 45 days without interruption under all discharge scenarios representative of typical operations (i.e., irrigation season and nonirrigation season operations), and with approval by the RWQCB and MBNMS, the discharger(s) may terminate the monitoring and reporting specified as part of this mitigation measure (but not terminate monitoring and reporting required as part of compliance with NPDES permit conditions or Ocean Plan monitoring and reporting requirements for discharges into California ocean waters).**

### 6.6.2 Corrective Actions

**If the results of the water quality assessment and waste disposal study find that operational discharges will not meet the NPDES water quality requirements, including the Ocean Plan receiving water limitation for salinity, at the edge of the ZID and the BMZ (incorporated here as performance standards), then the MPWSP operational discharges will not be released as proposed. Such operational discharges will be subject to additional design features, engineering solutions, and/or operational measures to reduce the concentration of water quality constituents to be in conformance with the Ocean Plan water quality objectives and amended NPDES permit requirements at the edge of the ZID or BMZ, as applicable. Such necessary design features and operational measures will either be implemented individually or in combination to achieve compliance (unless the RWQCB determines that different but equally effective measures be employed).**

**Such possible additional design features and operational measures include:**

1. **Additional pre-treatment of source water to the Desalination Plant: Feasible methods to remove PCBs and other organic compounds from the source water include additional filtration or use of granular activated carbon (GAC)—a U.S. EPA-approved method.**
2. **Treatment of discharge: The dischargers must consider one or more of the alternative feasible methods that remove residual compounds from the discharge to meet water quality objectives at the edge of the ZID. These methods include the following:**
   a. **Use of GAC (similar to that under the additional pre-treatment of source water described above, but with such treatment applied to the effluent following processing at the desalination facility instead of to the source water from the slant wells);**
   b. **Advanced oxidation with ultraviolet light with concurrent addition of hydrogen peroxide; or**
   c. **Biologically active filtration downstream of ozone treatment to reduce the concentration of ammonia and residual organic matter present in the ozone effluent and to reduce the solids loading on the membrane filtration process. The filtration system will consist of gravity-fed filter basins with granular media and ancillary systems such as an alkalinity**

addition system for pH control, backwash water basin (also used for membrane filtration backwash), and backwash water basin and pumps.

3. Retrofitting the existing outfall to increase dilution: If this operational measure is implemented, the dischargers will retrofit the outfall diffuser to include inclined diffuser jets positioned at the optimum angle to achieve maximum dilution.
4. Flow Augmentation: If this operational measure is implemented, the dischargers will decrease the density difference of the discharge and the receiving water through the addition of up to 5 mgd of flows, with densities close to freshwater to increase the minimum dilution of dense discharges.

## 6.7 Mitigation and Monitoring Plan

Temporarily impacted habitat will be restored to previous conditions or better at the end of construction. To the extent feasible, topsoil will be salvaged during grading and earthmoving activities, stockpiled separately from subsoil, and protected from erosion (e.g., covered or watered). Composting additives will be used to amend the soil, if needed, and compacted topsoil will be properly prepared prior to reuse for post-construction restoration of temporarily disturbed areas. A minimum of 12 inches of topsoil will be salvaged (or if there is less than 12 inches of topsoil initially, as much as practicable). Restoration and compensatory mitigation will be conducted in conformance with the terms of the Habitat Mitigation and Monitoring Plan (HMMP), as described below. Compensatory mitigation for permanent impacts on sensitive natural communities will occur, and at a ratio of 1:1 or greater, specified in regulatory permits issued for the Proposed Action.

CalAm will develop and submit a HMMP to the appropriate resource agencies (California Coastal Commission, CDFW, Central California RWQCB, U.S. Army Corps of Engineers, USFWS, and local agencies that require a habitat mitigation and monitoring plan) for approval prior to project construction. The HMMP will be implemented at all areas where special-status species habitat or sensitive natural communities will be restored, created, or enhanced to mitigate for project impacts either prior to, concurrently with, or following project construction, as specified in the HMMP. The HMMP will outline measures to be implemented to, depending on the mitigation requirements, restore, improve, or reestablish special-status species habitat, sensitive natural communities, and critical habitat on the site, and will include the following elements:

1. Name and contact information for the property owner of the land on which the mitigation will take place;
2. Identification of the water source for supplemental irrigation;
3. Identification of depth to groundwater;
4. Site preparation guidelines to prepare for planting, including coarse and fine grading;
5. Plant material procurement, including assessment of risk of introduction of plant pathogens through use of nursery-grown container stock versus collection and propagation of site-specific plant materials, or use of seeds;
6. Planting plan outlining species selection and planting locations and spacing, for each vegetation type to be restored;
7. Planting methods, including containers, hydroseed or hydromulch, weed barriers and cages, as needed;
8. Soil amendment recommendations;
9. Irrigation plan, with proposed rates (in gallons per minute), schedule (i.e., recurrence interval), and seasonal guidelines for watering;
10. Site protection plan to prevent unauthorized access, accidental damage, and vandalism;
11. Weeding and other vegetation maintenance tasks and schedule, with specific thresholds for acceptance of invasive species;

12. Performance standards by which successful completion of mitigation can be assessed in comparison to a relevant baseline or reference site, and by which remedial actions will be triggered; all success criteria to be summarized in tabular form;
13. Monitoring methods and schedule;
14. Reporting requirements and schedule;
15. Adaptive management and corrective actions to achieve the established success criteria;
16. Educational outreach program to inform operations and maintenance departments of local land management and utility agencies of the mitigation purpose of restored areas to prevent accidental damages; and
17. Description of any other compensatory mitigation in the form of land purchase, establishment of conservation easements or deed restrictions, contribution of funds in lieu of active restoration, purchase of mitigation bank credits, or other means by which the mitigation site will be preserved in perpetuity.

# 7 Determinations

## 7.1 Steelhead – South-CCC and CCC DPS

As described in Section 4.2, installation of the overwater pipeline crossing of the Salinas River may have minor and temporary effects on waters occupied by the Steelhead – South-CCC DPS. Additionally, the construction at this location will have temporary effects on 0.67 acre (0.27 hectare) of riparian habitat along the Salinas River.

As described in Section 5.2.1, the Steelhead – South-CCC and CCC DPS will only temporarily move through areas associated with combined discharge from the Proposed Action. The Proposed Action may cause minor changes to the benthic community in the vicinity of the discharge due to elevated salinity up to 1,148 feet (350 meters) from the outfall structure. However, such changes are not expected to have adverse effects on steelhead due to the transient nature of the exposure.

Implementation of the Avoidance and Minimization Measures described in Sections 6.1 through 6.5 will prevent injury or harassment of the Steelhead – South-CCC DPS during construction of the Salinas River Crossing, and those described in Section 6.7 will ensure that impacts on riparian habitat at the Salinas River are mitigated. Additionally, the Avoidance and Minimization Measures described in Section 6.6 will ensure that water quality objectives associated with the combine discharge are met. Therefore, MBNMS has determined the Proposed Action *may affect, but is not likely to adversely affect* the Steelhead – South-CCC and CCC DPS.

There is DCH for the Steelhead – South-CCC DPS in the Salinas River Action Area, where the pipeline will be installed on the existing bridge crossing. The crossing itself will be above the high water line and there will be no impacts on the wetted channel outside of minor and temporary disturbances associated with the use of a barge during construction. Construction of the crossing will result in 0.67 acre (0.27 hectare) of temporary impacts on riparian shrubs outside of, but adjacent to the DCH. Due to the temporary nature of these impacts, and their minimal overlap with DCH, MBNMS has determined the Proposed Action *may affect, but is not likely to result in destruction or adverse modification of critical habitat* Implementation of the mitigation and monitoring plan (Section 6.7) for the Proposed Action ensure that areas of temporary impact are properly restored. Critical habitat for steelhead is not present in the Action Area associated with combined discharge.

## 7.2 Coho Salmon-CCC ESU

There is no spawning or migration habitat present at the Salinas River crossing or other portions of the Action Area for coho salmon.

As described in Section 5.2.2, coho salmon forage within the upper 32.8 feet (10 meters) of the water column, and therefore will not occur in the benthic area that will be most affected by the mixed combined discharge. Therefore, MBNMS has determined the Proposed Action would have *no effect* on CCC-ESU coho salmon.

There is no critical habitat for coho salmon in the Action Area.

## 7.3 Chinook Salmon – Sacramento River Winter-Run ESU, Central Valley Spring-Run ESU, and California Coastal ESU

It is unlikely that Chinook salmon would appear in the Action Area at the Salinas Lagoon, as there has only been one occurrence within a span of 10 years, in the fall of 2002. There are no known spawning events of Chinook salmon in the Salinas River.

Chinook salmon may be present in the Action Area associated with the combined discharge, as described in Section 5.2.3. As described in Section 5.2.3, changes to the benthic community in the Action Area are not expected to reduce overall productivity of benthic organisms, and would only affect a tiny portion of habitat for this species in Monterey Bay. Additionally, the Avoidance and Minimization Measures described in Section 6.6 will ensure that Ocean Plan water quality objectives are met. As a result, such effects are expected to be insignificant and discountable, and MBNMS has determined the Proposed Action *may affect, but is not likely to adversely affect* Chinook salmon of the Sacramento River winter-run, Central Valley spring-run, or California Coastal ESU.

DCH for Chinook salmon is not present in the Action Area.

## 7.4 Green Sturgeon – Southern DPS

The Action Area associated with the Salinas River does not provide suitable spawning or freshwater migration habitat for green sturgeon, and therefore the species is not expected to occur at that portion of the Action Area.

However, green sturgeon may be present in the Action Area associated with combined discharge. The Green Sturgeon – Southern DPS is known to occur in Monterey Bay, which provides important habitat for sub-adult and adult individuals, and may provide necessary features required for rearing, feeding, and growth. As described in Section 5.2.4, there may be minor changes to the benthic community as a result of the combined discharge, but these effects would be minor and are not expected to reduce overall productivity or forage quality for the species. Additionally, the Avoidance and Minimization Measures described in Section 6.6 will ensure that Ocean Plan water quality objectives are met. Therefore, MBNMS has determined the Proposed Action *may affect, but is not likely to adversely affect* the Green Sturgeon – Southern DPS.

DCH for the Green Sturgeon – Southern DPS is present in the Action Area associated with the combined discharge. The discharge associated with the Proposed Action may cause changes to the benthic community due to elevated salinity up to 1,148 feet (350 meters) from the outfall structure. However, overall productivity of benthic organisms is not expected to be reduced as a result of combined discharge. Additionally, the Avoidance and Minimization Measures described in Section 6.6 will ensure that water quality objectives associated with the combine discharge are met. Therefore, MBNMS has determined the Proposed Action *may affect, but is not likely to adversely affect* green sturgeon DCH.

## 7.5 Leatherback Sea Turtle

Due to the lack of suitable habitat, leatherback sea turtle would not occur in the Action Area associated with the Salinas River.

As described in Section 5.2.5, leatherback sea turtles may occur in the Action Area of the combined discharge, but typically use the upper portions of the water column, which would not be affected by the dense, sinking discharge. In the rare periods where the mixed discharge would be less dense than the receiving waters, the discharge would not exceed any Ocean Plan limits. Furthermore, as an HMS with a life span of several decades or more, individual leatherback sea turtles are not expected to reside in the Action Area for any significant portion of their life cycle. Therefore, MBNMS has determined the Proposed Action would have *no effect* on leatherback sea turtle.

As described in Section 5.2.5, mortality due to turbulence-induced shear stress from the combined discharge will not directly affect organisms on which this species feeds. Further down the food chain, smaller plankton that support forage species may be affected by the discharge, but such an affect is insignificant and discountable in relation to the overall volume of the DCH. Additionally, the Avoidance and Minimization Measures described in Section 6.6 will ensure that the combined discharge will meet Ocean Plan water quality objectives. Therefore, MBNMS has determined the Proposed Action *may affect, but is not likely to adversely affect* leatherback sea turtle DCH.

## 7.6 Humpback Whale

As described in Section 5.2.6, there is limited potential for humpback whales to use areas affected by the Proposed Action due to the water depth. Due to the transient nature of exposure to the combined discharge area and the fact that the combined discharge would be most likely to affect the benthic community, MBNMS has determined the Proposed Action would have *no effect* on the humpback whale.

Critical habitat for the humpback whale has not been designated.

## 7.7 Killer Whale – Southern Resident DPS

The southern resident DPS killer whale is known to occur in Monterey Bay during the winter and early spring months. However, there is limited potential for the species to occur in the Action Area associated with combined discharge, due to the lack of complex subsurface topography. As described in Section 5.2.7, there may be minor changes to the benthic community in the area affected by the combined discharge, but such changes are expected to have an insignificant or discountable effect on killer whale. Additionally, the Avoidance and Minimization Measures described in Section 6.6 will ensure that water quality objectives associated with the combine discharge are met. Therefore, MBNMS has determined the Proposed Action *may affect, but is not likely to adversely affect* southern resident DPS killer whale.

Currently, DCH for killer whale is not present in the Action Area. Proposed revisions to include areas of marine habitat along the west coast as critical habitat for killer whale are in progress, but have not been published to date. Therefore, MBNMS has determined the Proposed Action would have *no effect* on killer whale DCH.

## 7.8 Essential Fish Habitat

As described in Section 3.4, the Action Area is in an area identified as EFH for various life stages of fish species that are managed in accordance with the following FMPs, under the MSA:

- PCS FMP,
- PCG FMP,
- CPS FMP, and
- HMS FMP.

As described in Section 5.3, the combined discharge may result in the mortality of small plankton due to entrainment, and an increase of salinity may result in a shift in benthic species composition in the Action Area. However, such effects are expected to be insignificant and discountable in relation to the volume of EFH within Monterey Bay.

As described in Section 4.2, potential effects on EFH at the Salinas River Lagoon would be similar to the effects on DCH for South-CCC DPS steelhead, as described above. Overall, potential effects on EFH at this location would be minimal and temporary.

The PCG, HMS, and PCS FMPs also identify numerous potential conservation measures that may be appropriate to avoid, reduce, or rectify potential effects associated with desalinations plants. These potential conservation measures are reflected in the proposed avoidance and minimization measures associated with the combined discharge (Section 6.6). For all potential effects on EFH resulting from the combined discharge, implementation of the protocols described in Section 6.6 will ensure that established water quality objectives are not exceeded outside of the ZID, limiting the area of EFH potentially affected by the Proposed Action. MBNMS has determined that although the Proposed Action *may result in adverse effects* on EFH designated by the Pacific salmon, Pacific groundfish, coastal pelagic, or HMS FMPs, such effects will be insignificant and will not preclude use of the Action Area by commercially managed species.

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# Appendix A. NMFS Species List Letter

# National Marine Fisheries Service West Coast Region Species list – Generated via Provided Google Earth Tool

(http://www.westcoast.fisheries.noaa.gov/maps_data/california_species_list_tools.html)

Quad Name **Marina** **"X" indicates critical habitat may be present**

Quad Number **36121-F7**

## ESA Anadromous Fish

SONCC Coho ESU (T) -
CCC Coho ESU (E) -
CC Chinook Salmon ESU (T) -
CVSR Chinook Salmon ESU (T) -
SRWR Chinook Salmon ESU (E) -
NC Steelhead DPS (T) -
CCC Steelhead DPS (T) -
SCCC Steelhead DPS (T) - **X**
SC Steelhead DPS (E) -
CCV Steelhead DPS (T) -
Eulachon (T) -
sDPS Green Sturgeon (T) - **X**

## ESA Anadromous Fish Critical Habitat

SONCC Coho Critical Habitat -
CCC Coho Critical Habitat -
CC Chinook Salmon Critical Habitat -
CVSR Chinook Salmon Critical Habitat -
SRWR Chinook Salmon Critical Habitat -
NC Steelhead Critical Habitat -
CCC Steelhead Critical Habitat -
SCCC Steelhead Critical Habitat - **X**
SC Steelhead Critical Habitat -
CCV Steelhead Critical Habitat -
Eulachon Critical Habitat -
sDPS Green Sturgeon Critical Habitat - **X**

## ESA Marine Invertebrates

Range Black Abalone (E) - **X**

Range White Abalone (E) -

## ESA Marine Invertebrates Critical Habitat

Black Abalone Critical Habitat -

## ESA Sea Turtles

East Pacific Green Sea Turtle (T) - **X**

Olive Ridley Sea Turtle (T/E) - **X**

Leatherback Sea Turtle (E) - **X**

North Pacific Loggerhead Sea Turtle (E) - **X**

## ESA Whales

Blue Whale (E) - **X**

Fin Whale (E) - **X**

Humpback Whale (E) - **X**

Southern Resident Killer Whale (E) - **X**

North Pacific Right Whale (E) - **X**

Sei Whale (E) - **X**

Sperm Whale (E) - **X**

## ESA Pinnipeds

Guadalupe Fur Seal (T) - **X**

Steller Sea Lion Critical Habitat -

## Essential Fish Habitat

Coho EFH -

Chinook Salmon EFH -

Groundfish EFH - **X**

Coastal Pelagics EFH - **X**

Highly Migratory Species EFH - **X**

**MMPA Species (See list at left)**

**ESA and MMPA Cetaceans/Pinnipeds**
**See list at left and consult the NMFS Long Beach office**
**562-980-4000**

MMPA Cetaceans - **X**

MMPA Pinnipeds - **X**

# Appendix B. Modeling Brine Disposal into Monterey Bay within MBNMS

# Modeling Brine Disposal into Monterey Bay

Philip J. W. Roberts, PhD, PE
Consulting Engineer
Atlanta, Georgia, USA

Final report

Prepared for
ESA | Environmental Science Associates
San Francisco, California

July 6, 2016

# CONTENTS

# EXECUTIVE SUMMARY

It is proposed to dispose of brine concentrate resulting from reverse osmosis (RO) seawater desalination into Monterey Bay, California. The disposal will be through an existing outfall and diffuser usually used for domestic wastewater. Previous analyses of the mixing characteristics and dilution of the effluent are updated to account for new flow scenarios, new research on the dynamics of dense jets, the internal hydraulics of the outfall, revision of the California Ocean Plan, and potential mortality of organisms due to jet-induced turbulence.

The California Ocean Plan (SWRCB, 2015) contains new requirements on concentrate disposal, in particular the definition of a brine mixing zone (BMZ) at whose boundary salinity increment limitations must be met and within which salinity must be estimated. It also requires estimates of the effect of velocity shear and turbulence on the mortality of larvae and other organisms that are entrained into the high velocity diffuser jets. New flow scenarios consisting of various combinations of brine and treated domestic effluent have also been proposed, and new data on density stratification around the diffuser have been obtained. Finally, no detailed computations of the internal flow hydraulics of the diffuser have previously been made to address the variation of flow along the diffuser and its effect on dilution.

The outfall diffuser consists of "duckbill" check valves whose opening varies with changing flow rate and it has a fixed opening in the end gate for flushing purposes. An iterative procedure was used that accounts for the flow characteristics of the valves, friction losses, and density head. The total head loss in the outfall and the flow distribution between the various ports were computed for the various flow scenarios. For dense discharges, the flow per port increases towards the diffuser end; for buoyant discharges the flows decrease. Flow variations were generally less than about ±7% from the average flow. About 5% of the total flow exits from the end gate opening. These flow variations were accounted for in the dilution simulations.

Several flow and environmental scenarios were analyzed. They consist of various combinations of brine and brine blended with secondary effluent and GWR effluent. The flow combinations occur at different times of the year and the environmental conditions that correspond to each scenario was analyzed. The most important ambient characteristics that affect dilution are the density stratification in the water column and the ambient density at the discharge depth. Density data obtained for the project (Figure 2) were analyzed and seasonal profiles obtained. The final combinations of flow and ambient conditions that were analyzed are summarized in Table 6. Zero current speed was assumed for all dilution calculations.

Dilutions for brine solutions resulting in dense effluents were first computed. For each flow scenario, the internal hydraulics were computed and the maximum and minimum flows per port and their corresponding equivalent port diameters were computed. Dilutions were calculated for each and the lowest dilution adopted. Dilution was calculated by a semi-empirical equation due to Cederwall and by the UM3 module of the US EPA model suite Visual Plumes (Table 7). The results were in close agreement and the Cederwall predictions were adopted as the most conservative. Minimum (centerline) dilutions on the seabed were generally greater than 16:1 at distances of about 10 to 30 ft from the diffuser. The salinity requirement of the Ocean Plan that the salinity increment be less than 2 ppt over natural background within 100 m from the diffuser was met in all cases. Increases in salinity are highest on the seabed, and will only be above background for a few meters above the seabed. They will be zero throughout most of the water column.

Discharges of flows that are positively buoyant were analyzed separately. Dilution and plume rise height were modeled by the modules UM3 and NRFIELD of Visual Plumes. NRFIELD is the most appropriate model and its predictions of minimum dilution were in good agreement with UM3 predictions of *average* dilution. The results are summarized in Table 8. Dilutions are generally very high, always exceeding 100:1, and the plume is usually trapped below the water surface by the ambient stratification.

For some dense flow cases, particularly when small volumes of secondary effluent are added to the brine, it is possible that dilutions may not be sufficient to achieve water quality standards. Mitigation schemes to enhance dilution for these cases were considered and analyzed, including:

1. Increase the jet velocity and decrease the density difference between the effluent and receiving water by augmenting the discharges with treated freshwater from the GWR or desalination facility.

   The effect of adding freshwater on dilution for the problematical cases are shown in Figure 18. Small additions do not substantially increase dilution. As the effluent density approaches background levels, dilution increases exponentially. The water quality requirements for these cases could be achieved by adding about 2 to 4 mgd of freshwater.

2. Vary the flow per port by either temporarily storing on site in a storage basin and pumping briefly at higher flow rates, by closing off some ports, or by opening some closed ports.

   The effect of varying the flow per port is shown in Figure 20. The dilution is relatively insensitive to flow rate. As the flow increases, the jet velocity increases and entrainment increases. However, the check valves also open offsetting this increase. The flow and heads needed to meet the water quality requirements are excessive. Varying the flow rate is not an effective strategy for increasing dilution.

3. Discharge through upwardly inclined nozzles either by retrofitting the existing horizontal nozzles or by constructing a new dedicated brine diffuser.

   Discharge through upwardly inclined jets increases the length of dense jet trajectories and increases dilution. Jets at 60° to the horizontal (the de facto standard) were evaluated. The results are shown in Table 16. The inclined nozzles increase dilution of dense discharges substantially. All dilution requirements, including the problematical cases, would be met. The effect of retrofitting the nozzles on the dilution of positively buoyant discharges was also evaluated. The effect was small, dilutions were reduced by less than 10% compared to horizontal nozzles.

The 2015 California Ocean Plan requires an evaluation *of "...mortality that occurs due to shearing stress resulting from the facility's discharge..."* It has been suggested that planktonic organisms entrained into the high velocity turbulent jets could be subject to possibly fatal injury. Experimental evidence suggests that the main effect occurs to organisms whose size is about the same as the small-scale turbulent eddies, known as the Kolmogorov scales, which subject them to high strain rates and viscous shear stresses. The effects vary by organism; the relevant literature is summarized in Appendix C. Surveys of plankton in the vicinity of the diffuser were made and are summarized in Figure 9. As precise estimates of plankton mortality due to turbulence are not presently possible several approaches to this problem are taken.

The turbulence characteristics of jets are reviewed and turbulent length scales estimated for the various brine discharge scenarios (Table 10). The Kolmogorov scales range from about 0.012 mm near the nozzle to 2.5 mm at the jet edges at seabed impact. Exposure of larvae to jet turbulence ranges from a few seconds to minutes. The scales are smaller than or comparable to the smallest organisms of interest (Table 9) so some effects may be anticipated. The scales are somewhat smaller than those due to natural turbulence in the ocean, which is about 1 mm. Therefore, the Kolmogorov scale of the ocean is also comparable to larvae size and may cause natural mortality. The major issue is then incremental mortality due to the jets.

The total volumes in the jets where turbulent intensities are greater than background effects were computed (Table 10). They are almost infinitesimally small compared to the volume of the BMZ, ranging from 0.006% to 0.4%.

The fraction of the ambient flow passing over the BMZ that is entrained by the diffuser, and therefore the fraction of larvae that is entrained, was estimated (Table 10). For the brine discharges, it ranges from 1.7% to 6.4%.

Not all of the organisms that are entrained by the diffuser will die. The fraction of organisms passing over the diffuser that die is estimated to be less than 0.23%. As discussed, this is believed to be a very conservative estimate. Total incremental mortality was also estimated in Table 11.

The volumes entrained into the brine discharges are compared to that for the present baseline domestic wastewater discharge case (P1). They are much lower, ranging from 7 to 22%. This is mainly because the dilutions for the domestic discharges are much higher. Therefore, organism mortality for the brine discharges would also be expected to be about 7 to 22% of the baseline case.

# LIST OF FIGURES

# LIST OF TABLES

# 1. INTRODUCTION

## 1.1 Study Purpose

It is proposed to dispose of the brine concentrate resulting from reverse osmosis (RO) seawater desalination into Monterey Bay, California. The disposal will be through an existing outfall and diffuser usually used for domestic wastewater disposal. Previous analyses of the mixing characteristics and dilution of the effluent were made by Flow Science (2008), and updated in 2014 (Flow Science, 2014) to accommodate new flow scenarios. The 2014 analysis used the same procedures as the 2008 report although new research on the dynamics of dense jets has been reported since 2008 and reviews and testimony have raised new questions. In addition, water quality requirements for concentrate discharges around the world and the literature on the environmental impacts of brine discharges were reviewed in SCCWRP (2012), leading to the revision of the California Ocean Plan (SWRCB, 2016) to include brine discharges. These revisions include new requirements on concentrate disposal, in particular the definition of a brine mixing zone (BMZ) at whose boundary salinity increment limitations must be met and within which salinity must be estimated. New issues were also raised, particularly the effect of velocity shear and turbulence on the mortality of larvae and other organisms that are entrained into the high velocity diffuser jets. New flow scenarios consisting of various combinations of brine and treated domestic effluent have also been proposed, and new data on density stratification around the diffuser have been obtained. Finally, no detailed computations of the internal flow hydraulics of the diffuser have been made to address the variation of flow along the diffuser and its effect on dilution.

The purpose of this report is to analyze the internal hydraulics of the outfall and diffuser, to update the analyses of the dynamics and mixing of various discharge scenarios, and to address the new issues raised, particularly the effects of velocity shear and jet turbulence.

Specific tasks are:

- Compute outfall and diffuser internal hydraulics and flow distribution accounting for the effects of check valves;
- Recompute dilutions for various scenarios of flow and effluent density;
- For dense discharges, compute salinity within the BMZ and at its boundary;
- Estimate regions where salinity exceeds 2 ppt;
- For buoyant discharges, compute dilutions and plume behavior for the new oceanic density stratification data;
- Address shear and turbulence mortality;

- Discuss mitigation, i.e. modifications to the diffuser if improvements to mixing are indicated.

The ambient receiving water conditions and new data are discussed in Section 2.1, and the discharge scenarios are discussed in Sections 2.2 and 2.3 and summarized in Section 2.4. Details of the outfall and diffuser are presented in Section 3 and results of the hydraulics analyses are summarized. The calculation procedure is detailed in Appendix A.

### 1.2 California Ocean Plan

The 2015 California Ocean Plan (SWRCB, 2016, revised and effective January 28, 2016), contains new requirements to address brine discharges. The most relevant of these to the present report are contained in Section III.M.3, "Receiving Water Limitation for Salinity" which states that:

*"Discharges shall not exceed a daily maximum of 2.0 parts per thousand (ppt) above natural background salinity measured no further than 100 meters (328 ft) horizontally from each discharge point. There is no vertical limit to this zone...*

*the Brine Mixing Zone is the area where salinity may exceed 2.0 parts per thousand above natural background salinity, or the concentration of salinity approved as part of an alternative receiving water limitation. The standard brine mixing zone shall not exceed 100 meters (328 feet) laterally from the points of discharge and throughout the water column...*

*The brine mixing zone is an allocated impact zone where there may be toxic effects on marine life due to elevated salinity...*

*For operational mortality related to discharges, the report shall estimate the area in which salinity exceeds 2.0 parts per thousand above natural background salinity or a facility-specific alternative receiving water limitation (see chapter III.M.3). The area in excess of the receiving water limitation for salinity shall be determined by modeling and confirmed with monitoring. The report shall use any acceptable approach approved by the regional water board for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge, including any incremental increase in mortality resulting from a commingled discharge."*

## 2. MODELING SCENARIOS

### 2.1 Environmental Conditions

The discharges are to be made through the existing Monterey Regional Water Pollution Control Agency (MRWPCA) wastewater outfall offshore of Marina, California, shown in Figure 1. The dynamics and mixing of the discharges depend on the receiving water density structure and ocean currents. The analyses presented here assume zero current speed, which is the worst-case condition in terms of dilution, so the main environmental parameter is the receiving water density structure. Particularly important is the density difference between the effluent and receiving water, and, for buoyant discharges, the density stratification over the water column.

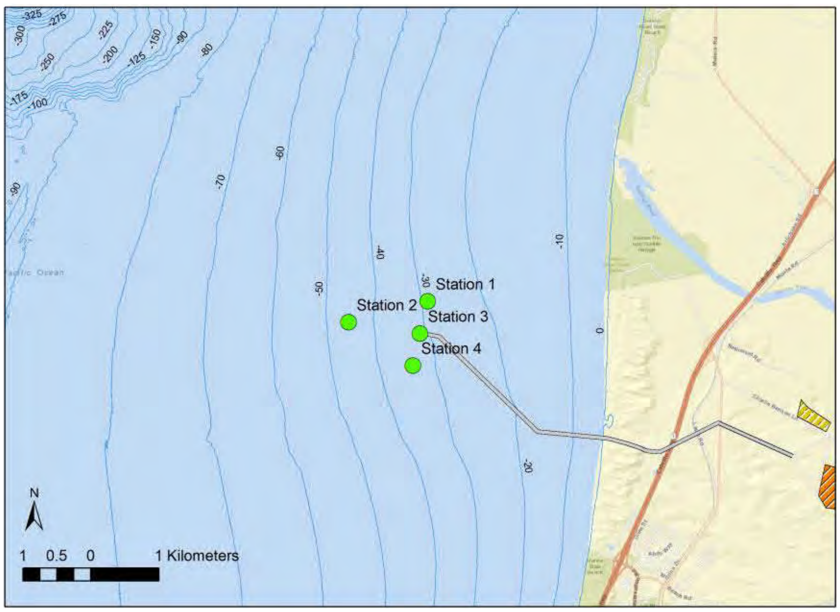



**Figure 1. MRWPCA outfall near Marina, CA., and sampling locations for water column profiles. Bathymetry is in meters.**

Monthly measurements of CTD (conductivity-temperature-depth) were made by Applied Marine Sciences (AMS, 2016) over the water column at the four locations shown in Figure 1. The objective of the monitoring was to gather data over a two-year period that reflected ocean conditions during this time period around the MRWPCA outfall. Monthly data were collected between February 2014 and December 2015.

Traditionally, three oceanic seasons have been defined in Monterey Bay: Upwelling (March-September), Oceanic (September-November), and Davidson (November-March). Therefore, the profiles were assessed with consideration given to these seasons, as well as over the entire sampling period.

It was found that there was little variation between the profiles taken at the four sites in any one day, so they were averaged together; they are plotted by season in Figure 2. The Upwelling season showed the most variable vertical structure in temperature and density. The Oceanic and Davidson seasons showed weak stratifications with essentially well-mixed temperature profiles with the oceanic season somewhat cooler than Davidson. Salinity was fairly uniform over depth so density was often controlled by temperature. The Upwelling season showed the strongest stratifications over the water column, and the profiles separate into two distinct groups with stratification for the other seasons being generally quite weak. Density differences over the water column ranged from zero (homogeneous) in December 2012 to 1.17 kg/m$^3$ in August 2014. For most of the profiles the density differences over the water column ranges from 0.11 to 0.65 kg/m$^3$.

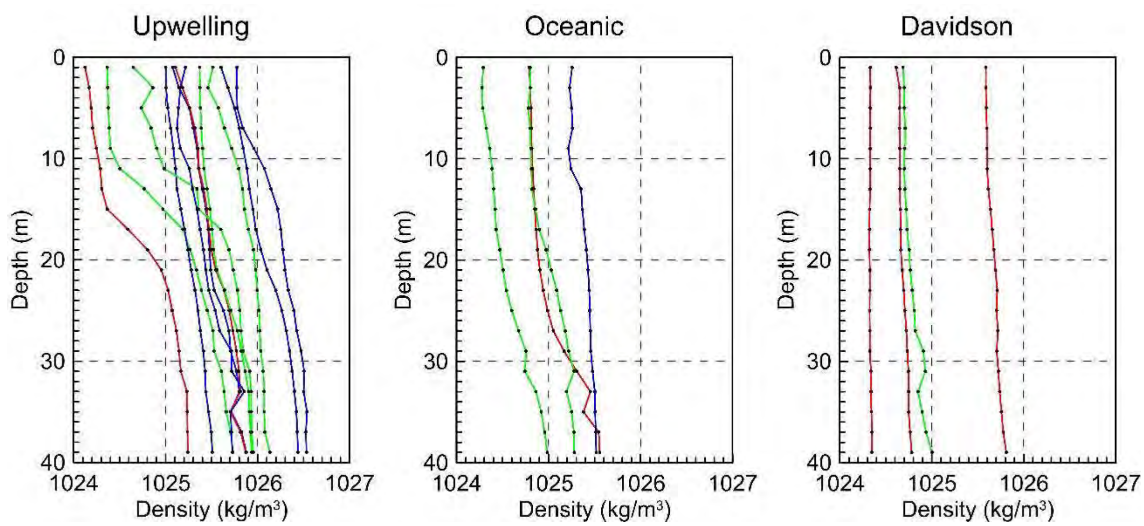



**Figure 2. Seasonal density profiles at the sites shown in Figure 1.**

The profiles within each season were then averaged to obtain representative profiles for the dilution simulations. The profiles are shown in Figure 3 and are tabulated in Appendix B.

Monthly variations of salinity near the depth of the diffuser (assumed to be the measurements around 27 to 29 m) are shown in Figure 4. The salinities vary seasonally, but little between the sites or the chosen depths. The bottom salinities and temperatures were averaged seasonally as summarized in Table 1.

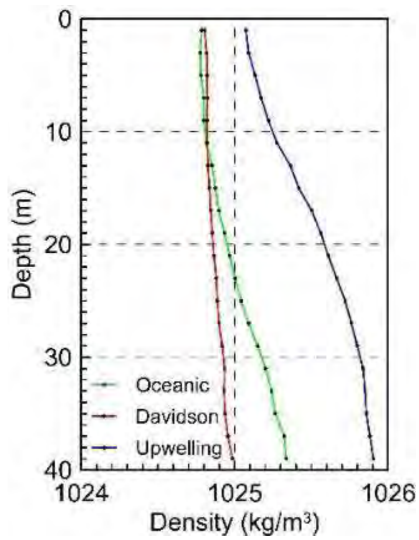



**Figure 3. Seasonally averaged density profiles.**

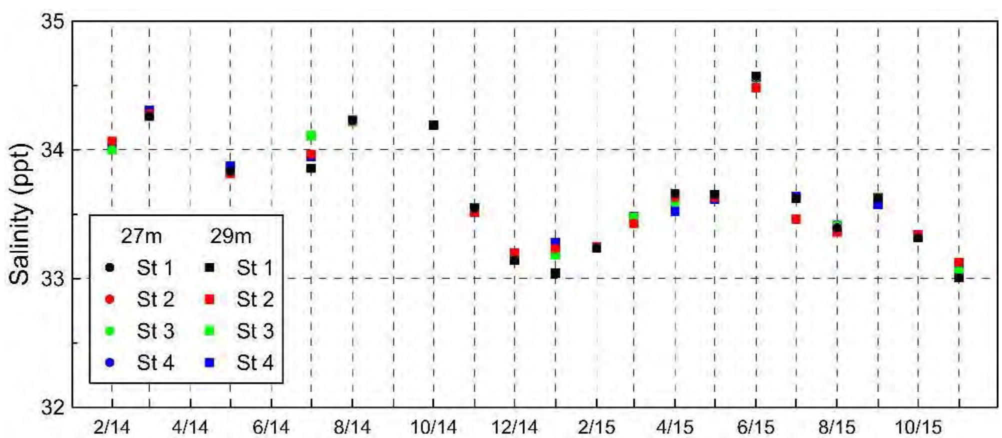



**Figure 4. Monthly salinity variations at 27 and 29 m depths.**

**Table 1. Seasonal Average Properties at Diffuser Depth**

| Season | Temperature (°C) | Salinity (ppt) | Density (kg/m³) |
|---|---|---|---|
| Davidson | 14.46 | 33.34 | 1024.8 |
| Upwelling | 11.48 | 33.89 | 1025.8 |
| Oceanic | 13.68 | 33.57 | 1025.1 |

### 2.2 Discharge Scenarios Under Proposed Project

The Monterey Peninsula Water Supply Project (MPWSP) Desalination Plant would treat the source oceanic water at a 42 percent recovery rate to produce 9.5

mgd of desalinated product water. Approximately 14 mgd of brine would be generated, consisting of concentrates from the pretreatment and reverse osmosis (RO) processes as well as waste effluent produced during routine backwashing and operation and maintenance of the pretreatment filters. The brine generated in the desalination process would be discharged into Monterey Bay through the MRWPCA's existing ocean outfall. The outfall consists of an 11,260-foot-long pipeline terminating in a diffuser with 129 operational ports at a depth of approximately 100 feet. The outfall and diffuser and their internal hydraulics are discussed further in Section 3.

During certain times of the year, the brine would be blended with treated wastewater (when available) from the MRWPCA Regional Wastewater Treatment Plant, forming a combined discharge. Table 2 (Table 4.3-8 from the DEIR) shows the monthly projected brine flows from the MPWSP Desalination Plant and the average monthly wastewater flows from MRWPCA.

**Table 2. Monthly Average Flows of Secondary Wastewater from the MRWPCS Treatment Plant (mgd) (1998–2012) and Estimated Brine Flows Under the MWPWSP**

| Months | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sept | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Brine-Only | *13.98* | 13.98 | 13.98 | 13.98 | 13.98 | 13.98 | *13.98* | 13.98 | *13.98* | 13.98 | 13.98 | 13.98 |
| Treated Wastewater from MRWPCA | *19.78* | 18.41 | 14.68 | 7.02 | 2.40 | 1.89 | 0.90 | 1.03 | 2.79 | 9.89 | 17.98 | 19.27 |
| Combined Discharge (Brine+wastewater) | *33.76* | 32.39 | 28.66 | 21.00 | 16.38 | 15.87 | 14.88 | 15.01 | 16.77 | 23.87 | 31.96 | 33.25 |

NOTE: Shaded cells represent the seasonal discharge scenarios used in the analysis of operational water quality impacts.

Numbers in *italics* represent the flow rates used in the modeling analysis of salinity (discussed in Impact 4.3-5), the results of which were used to analyze other constituents in the brine and combined discharges (discussed below in this impact analysis). In the case of the combined discharge, the modeling analysis also used low wastewater flow rates of 0.25, 0.5, 1, and 2 mgd and a moderate flow of 9 mgd.

SOURCES: MRWPCA, 2013; Trussell Technologies, 2015 in DEIR Appendix D4.

As shown in Table 2, the treated wastewater flow varies throughout the year, with the highest flows observed during the non-irrigation season (November through March) and the lowest flows during the irrigation season (April through October), when the treated wastewater is processed through the SVRP for tertiary treatment and distributed to irrigators through the Castroville Seawater Intrusion Project (CSIP).

During the irrigation season, on some days, all of the wastewater flows could be provided to irrigators, and only the project brine would be discharged into Monterey Bay through the outfall. The analysis presented in the DEIR assumed that the brine would be discharged without dilution during the entire irrigation season (dry months), reflected in scenario 2 in Table 3.

During the non-irrigation season (wet months), the analysis presented in the DEIR assumed that a combined discharge (i.e. brine blended with treated wastewater) would be released. For the combined discharge scenario, the data analysis accounted for different wastewater flows ranging from 19.78 mgd in the winter/Davidson season (when higher discharge flows are anticipated) to lower flows of 1 and 2 mgd (Table 3). Scenarios 3 through 6 reflect the proposed combined project discharges during the non-irrigation season as well as during the irrigation season when a low volume of secondary effluent is discharged.

**Table 3. Proposed Project Discharge Scenarios**

| No. | Scenario | Discharge flows (mgd) | |
|---|---|---|---|
| | | Secondary Effluent | Desal Brine |
| 1 | Baseline | 19.78[a] | 0 |
| 2 | Desal only | 0 | 13.98 |
| 3 | Desal and low SE[b] | 1 | 13.98 |
| 4 | Desal with low SE | 2 | 13.98 |
| 5 | Desal with moderate SE | 9 | 13.98 |
| 6 | Desal with high SE | 19.78 | 13.98 |

[a] All model scenarios involving high secondary effluent flows used for assessing impacts related to the proposed and variant project conditions use the maximum documented average wet season wastewater flow of 19.78 mgd.
[b] Secondary effluent

## 2.3 Discharge Scenarios Under Project Variant

Under the Project Variant, the MPWSP Desalination Plant would treat 15.5 mgd of source water at a 42 percent recovery rate. Approximately 8.99 mgd of brine would be generated, consisting of concentrates from the pretreatment and reverse osmosis (RO) processes as well as waste effluent produced during routine backwashing and operation and maintenance of the pretreatment filters. The brine generated in the desalination process would be discharged through the MRWPCA ocean outfall as with the Proposed Project (above).

The Project Variant would also include operation of the proposed Groundwater Replenishment Project (GWR) Project, which would involve RO treatment of a minimum of 3.9 mgd of source water to produce 3.2 mgd of product water and 0.73 mgd of effluent[1]. Operation of the Project Variant would result in discharge scenarios that would include brine from the MPWSP Desalination Plant,

[1] A minimum of 4,320 acre-feet per year (AFY) of source water would be treated to produce 3,500 AFY of product water. At the time of this analysis, the available data for the GWR Project, i.e., 0.73 mgd of GWR effluent flow was used for the modeling analysis (also see Flow Science, Inc., 2014).

and/or effluent from the proposed GWR project, and/or treated wastewater from the existing MRWPCA wastewater treatment plant. Depending on the operational scenario, the following discharges (also summarized in Table 4) would be released into Monterey Bay through the MRWPCA outfall:

Variant Scenario 1, Brine-only: 8.99 mgd of brine would be generated at the Desalination Plant and discharged alone through the MRWPCA outfall. This operating scenario would occur if the GWR Project comes on line after the MPWSP Desalination Plant, or the GWR Project periodically shuts down.

Variant Scenarios 2 through 5, Brine-with-Wastewater: 8.99 mgd of brine would be discharged with varying volumes of treated wastewater from the MRWPCA Regional Wastewater Treatment Plant. This operating scenario would occur when treated wastewater is available and if the GWR Project comes on line after the MPWSP Desalination Plant, or the GWR Project periodically shuts down.

(Previously modeled, no update needed) GWR-only discharge: 0.94 v of effluent generated under the MRWPCA-proposed GWR Project would be discharged alone through the MRWPCA outfall. This operating scenario would occur if the GWR Project comes on line before the MPWSP Desalination Plant, or the MPWSP Desalination Plant periodically shuts down.

Variant Scenario 6, Blended discharge: 8.99 mgd of brine generated from the MPWSP Desalination Plant would be blended with 0.94 mgd of GWR-effluent. This operating scenario would typically occur in the irrigation season.

Variant Scenarios 7 through 10, Combined discharge: The blended discharge (brine and GWR effluent) would be combined with varying volumes of treated wastewater from the MRWPCA Regional Wastewater Treatment Plant. This operating scenario would typically occur in the non-irrigation season.

Not Modeled, GWR-with-Wastewater: 0.94 mgd of GWR-effluent would be discharged with varying volumes of treated wastewater from the MRWPCA Regional Wastewater Treatment Plant without brine generated from the MPWSP Desalination Plant. This operating scenario would occur when treated wastewater is available and if the GWR Project comes on line before the MPWSP Desalination Plant, or the MPWSP Desalination Plant periodically shuts down. These scenarios have been modeled and impacts assessed and documented in the Final EIR for the Pure Water Monterey GWR Project (MPWPCA, 2015).

**Table 4. Variant Project Discharge Scenarios**

| No | Scenario | Discharge flows (mgd) | | |
|---|---|---|---|---|
| | | Secondary Effluent | Desal Brine | GWR |
| 1 | Desal only | 0 | 8.99 | 0 |
| 2 | Desal and low (1) SE | 1 | 8.99 | 0 |
| 3 | Desal and low (2) SE | 2 | 8.99 | 0 |
| 4 | Desal and moderate SE | 5.8 (Davidson) | 8.99 | 0 |
| 5 | Desal and high SE | 19.78 | 8.99 | 0 |
| 6 | Desal and GWR | 0 | 8.99 | 0.94 |
| 7 | Desal and GWR and low (1) SE | 1 | 8.99 | 0.94 |
| 8 | Desal and GWR and low (2) SE | 3 | 8.99 | 0.94 |
| 9 | Desal and moderate SE and GWR | 5.3 (Upwelling) | 8.99 | 0.94 |
| 10 | Desal and high SE and GWR | 15.92 | 8.99 | 0.94 |

Notes:

[a] All model scenarios involving high secondary effluent flows used for assessing impacts related to the proposed and variant project conditions use the maximum documented average wet season wastewater flow of 19.78 mgd.

## 2.4 Updated Model Scenarios

The assumed effluent characteristics for the three seasonal scenarios are summarized in Table 5.

**Table 5. Assumed Effluent Characteristics**

| Season | Brine[1] | | Secondary Effluent[1] | | GWR | |
|---|---|---|---|---|---|---|
| | Salinity (PPT) | Temp (°C) | Salinity (PPT) | Temp (°C) | Salinity [2] (PPT) | Temp[1] (°C) |
| Upwelling | 58.23 | 9.9 | 0.8 | 24 | 5.8 | 24.4 |
| Davidson | 57.40 | 11.6 | 0.8 | 20 | 5.8 | 20.2 |
| Oceanic | 57.64 | 11.1 | 0.9 | 24 | 5.8 | 24.4 |

[1]FlowScience (2014), Table C3 and C6 (p.C-7 and C-17), Appendix C.

[2]Pure Water Monterey Groundwater Replenishment Project Consolidated FEIR (2016): "The discharge of reverse osmosis concentrate would not involve high salinities because the concentrate would be far less saline than ambient ocean water (5,800 mg/L of TDS compared to 33,000 to 34,000 mg/L). The secondary effluent (approximately 1,000 mg/L of TDS) and GWR reverse osmosis concentrate (approximately 5,000 mg/L of TDS) are relatively light and would rise when discharged."

Note: Salinity value of 4 PPT for GWR effluent estimated in Flow Science (2014).

Using the discharge scenarios in Table 3 for the Proposed Project and in Table 4 for the Project Variant, previous model analyses will be updated as follows:

Revise the near-field brine discharge modeling by adjusting the number of open ports (129 versus 120 used prior), the height of the ports off the ocean floor (4 feet versus 3.5 feet used prior), and flow scenarios (Table 2 for the Project and Table 3 for the Variant).

Using the revised modeling for each scenario, compute dilution ratios, calculate the volume of ocean water that exceeds 2 ppt above ambient, plot the gradient of salinity between the port and the edge of the Zone of Initial Dilution ZID, calculate the eddy size and velocity of the plume and determine marine losses due to shear stress, if any. Also calculate the salinity beyond the ZID but within the regulatory mixing zone (100 m from the port).

Combining the assumed environmental conditions from Table 1, the flows from Tables 3 and 4, and the assumed effluent conditions from Table 5, we arrive at 16 possible flow scenarios. Their conditions are summarized in Table 6. The Proposed Project scenarios are labeled P1 though P6 and the Project Variant scenarios are Labeled V1 through V10.

**Table 6. Modeled Discharge Scenarios**

| Case No. | Season | Background | | | Brine | | | Secondary effluent | | | GWR | | | Combined discharge | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Temp. (°C) | Salinity (ppt) | Density ($kg/m^3$) | Flow (mgd) | Temp. (°C) | Salinity (ppt) | Flow (mgd) | Temp. (°C) | Salinity (ppt) | Flow (mgd) | Temp. (°C) | Salinity (ppt) | Flow (mgd) | Salinity (ppt) | Density ($kg/m^3$) |
| P1 | Baseline | - | - | - | - | - | - | 19.78 | 20.0 | 0.8 | 0 | 20.0 | 5.8 | 19.78 | 0.80 | 998.8 |
| P2 | Upwelling | 11.48 | 33.89 | 1025.8 | 13.98 | 9.9 | 58.23 | 0 | 24.0 | 0.8 | 0 | 24.4 | 5.8 | 13.98 | 58.23 | 1045.2 |
| P3 | Davidson | 14.46 | 33.34 | 1024.8 | 13.98 | 11.6 | 57.40 | 1.00 | 20.0 | 0.8 | 0 | 20.2 | 5.8 | 14.98 | 53.62 | 1041.2 |
| P4 | Davidson | 14.46 | 33.34 | 1024.8 | 13.98 | 11.6 | 57.40 | 2.00 | 20.0 | 0.8 | 0 | 20.2 | 5.8 | 15.98 | 50.32 | 1038.5 |
| P5 | Davidson | 14.46 | 33.34 | 1024.8 | 13.98 | 11.6 | 57.40 | 9.00 | 20.0 | 0.8 | 0 | 20.2 | 5.8 | 22.98 | 35.23 | 1026.4 |
| P6 | Davidson | 14.46 | 33.34 | 1024.8 | 13.98 | 11.6 | 57.40 | 19.78 | 20.0 | 0.8 | 0 | 20.2 | 5.8 | 33.76 | 24.24 | 1017.6 |
| V1 | Upwelling | 11.48 | 33.89 | 1025.8 | 8.99 | 9.9 | 58.23 | 0 | 24.0 | 0.8 | 0 | 24.4 | 5.8 | 8.99 | 58.23 | 1045.2 |
| V2 | Upwelling | 11.48 | 33.89 | 1025.8 | 8.99 | 9.9 | 58.23 | 1.00 | 24.0 | 0.8 | 0 | 24.4 | 5.8 | 9.99 | 52.48 | 1040.5 |
| V3 | Upwelling | 11.48 | 33.89 | 1025.8 | 8.99 | 9.9 | 58.23 | 2.00 | 24.0 | 0.8 | 0 | 24.4 | 5.8 | 10.99 | 47.78 | 1036.6 |
| V4 | Davidson | 14.46 | 33.34 | 1024.8 | 8.99 | 11.6 | 57.40 | 5.80 | 20.0 | 0.8 | 0 | 20.2 | 5.8 | 14.79 | 35.20 | 1026.4 |
| V5 | Upwelling | 11.48 | 33.89 | 1025.8 | 8.99 | 9.9 | 58.23 | 19.78 | 24.0 | 0.8 | 0 | 24.4 | 5.8 | 28.77 | 18.75 | 1012.7 |
| V6 | Upwelling | 11.48 | 33.89 | 1025.8 | 8.99 | 9.9 | 58.23 | 0 | 24.0 | 0.8 | 0.94 | 24.4 | 5.8 | 9.93 | 53.27 | 1041.1 |
| V7 | Davidson | 14.46 | 33.34 | 1024.8 | 8.99 | 11.6 | 57.40 | 1.00 | 20.0 | 0.8 | 0.94 | 20.2 | 5.8 | 10.93 | 47.78 | 1036.5 |
| V8 | Davidson | 14.46 | 33.34 | 1024.8 | 8.99 | 11.6 | 57.40 | 3.00 | 20.0 | 0.8 | 0.94 | 20.2 | 5.8 | 12.93 | 40.52 | 1030.6 |
| V9 | Upwelling | 11.48 | 33.89 | 1025.8 | 8.99 | 9.9 | 58.23 | 5.30 | 24.0 | 0.8 | 0.94 | 24.4 | 5.8 | 15.23 | 35.01 | 1026.1 |
| V10 | Davidson | 14.46 | 33.34 | 1024.8 | 8.99 | 11.6 | 57.40 | 15.92 | 20.0 | 0.8 | 0.94 | 20.2 | 5.8 | 25.85 | 20.67 | 1014.7 |

## 3. OUTFALL HYDRAULICS

The Monterey Regional Water Pollution Control Agency (MRWPCA) outfall at Marina, shown in Figure 5, conveys the effluent to the Pacific Ocean to a depth of about 100 ft below Mean Sea Level (MSL). The ocean segment extends a distance of 9,892 ft from the Beach Junction Structure (BJS). Beyond this there is a diffuser section 1,406 ft long. The outfall pipe consists of a 60-inch internal diameter (ID) reinforced concrete pipe (RCP), and the diffuser consists of 480 ft of 60-inch RCP with a single taper to 840 ft of 48-inch ID. The diffuser has 171 ports of two-inch diameter: 65 in the 60-inch section and 106 in the 48-inch section. The ports discharge horizontally alternately from both sides of the diffuser at a spacing of 16 ft on each side except for one port in the taper section that discharges vertically for air release. The 42 ports closest to shore are presently closed, so there are 129 open ports distributed over a length of approximately 1024 ft. The 129 open ports are fitted with four inch Tideflex "duckbill" check valves (the four inch refers to the flange size not the valve opening). The valves open as the flow through them increases so the cross-sectional area is variable. The end gate has an opening at the bottom about two inches high. The effect of the valves on the flow distribution in the diffuser is discussed in Appendix A.


**Figure 5. The MRWPCA outfall**

The diffuser section sits on rock ballast as shown in Figure 6. The ports are approximately six inches above the rock ballast and nominally 54 inches above the sea bed, although this varies. For the dilution calculations, they are assumed to be 4 ft above the bed. The diffuser is laid on a slope of about 0.011 and the depths of the open ports range from about 98 to 110 ft below MSL.

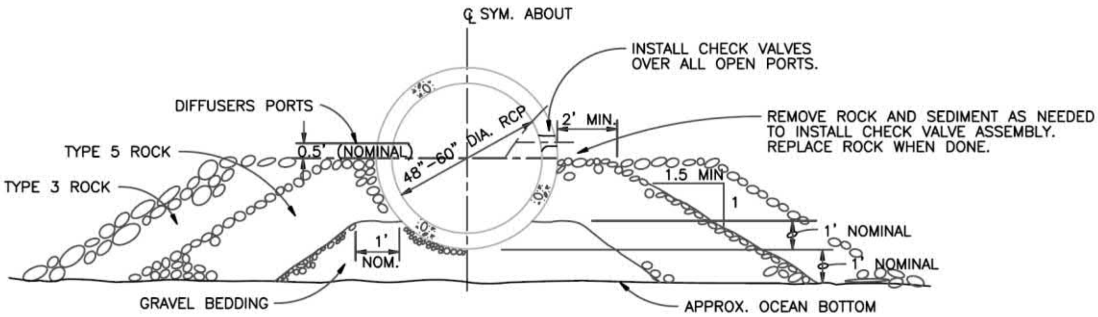



**Figure 6. Typical diffuser cross section**

The procedure for analyzing the internal hydraulics of the outfall and diffuser is discussed in Appendix A. Using these procedures, the head losses and the flow distribution between the ports and the end gate port were computed for the various flow scenarios of Table 6. Some typical distributions of flow among the ports, for scenarios P1 (19.78 mgd of secondary effluent), P2 (13.98 mgd of pure brine), and P6 (33.76 mgd of brine and secondary effluent) are shown in Figure 7.

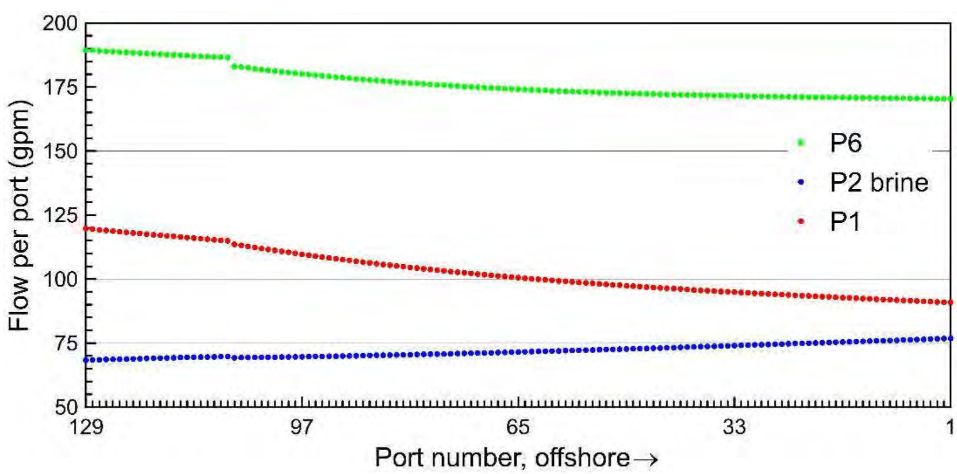



**Figure 7. Typical port flow distributions.**

For the pure brine discharge P2 (density greater than seawater) the flow per port increases in the offshore direction because of the density head. For the buoyant discharges P1 and P6 (less dense than seawater) the flow decreases in the offshore direction. The port discharges vary by about ±7% from the average, and about 5% of the flow exits from the opening in the end gate. These flow variations are accounted for in the dilution simulations, and the worst cases for dilution are chosen.

## 4. DENSE DISCHARGE DILUTION

### 4.1 Introduction

Discharges that are more dense than the receiving seawater result in a sinking plume that impacts the sea floor at some distance from the nozzle as shown in Figure 8. The jet, because of its high exit velocity, entrains seawater that mixes with and dilutes the effluent.

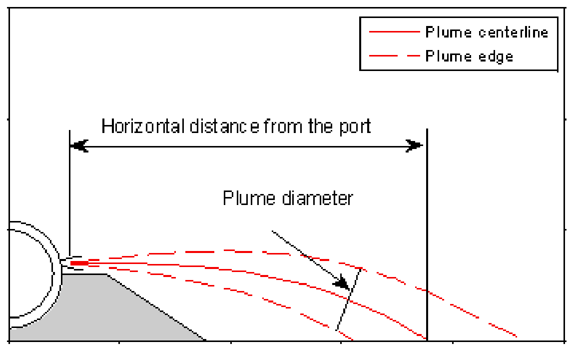



**Figure 8. Horizontal dense jet dynamics (DEIR, Appendix D2).**

Three-dimensional laser-induced fluorescence (3DLIF) images of a horizontal negatively buoyant jet similar to those considered here are shown in Figure 9. The images are obtained by scanning a laser sheet horizontally thought the flow to which a small amount of fluorescent dye has been added. The fluoresced light is captured and converted to tracer concentrations and dilution and imaged by computer graphics techniques as described in Tian and Roberts (2003). The left image shows the outer surface of the jet in gray scale and the right image shows the outer surface as semi-transparent with tracer concentrations in false color in a vertical plane through the jet centerline.

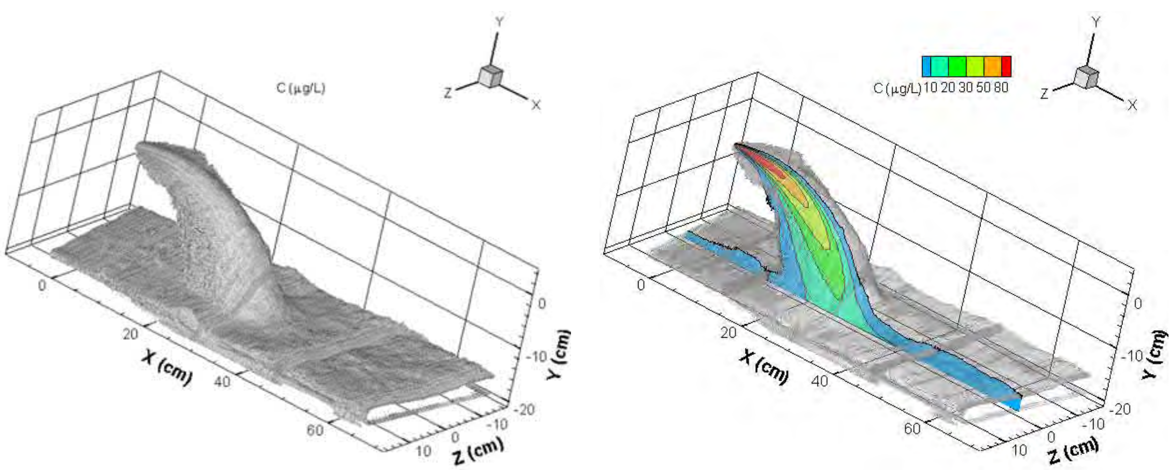



**Figure 9. 3DLIF images of horizontal dense jet (Nemlioglu and Roberts, 2006).**

It can be seen that high tracer concentrations (i.e. salinity) are confined to a relatively small volume near the nozzle and attenuate rapidly with distance from the nozzle. The highest salinity on the floor occurs where the jet centerline impacts it, and it is the dilution and salinity at this point that is computed here.

In the Flow Science (2014) report, they analyze this situation using a semi-empirical method and also the mathematical model UM3 in the US EPA model suite Visual Plumes. In the semi-empirical method, the jet trajectory and impact point are predicted by an analysis due to Kikkert et al. (2007) and dilution was then predicted by assuming it to occur from jet-induced entrainment. Although the Kikkert analysis can be applied, it was derived primarily for upwardly-inclined dense jets rather than horizontal, as occur here, and the dilution analysis neglects any effects of buoyancy on entrainment. Furthermore, the Flow Science report considers the centerline dilution predictions of the entrainment model UM3 to be unreliable due to a study by Palomar at al. (2012a, 2012b) which concluded that UM3 (and other entrainment models) underestimated impact dilutions by 50-65%. They therefore used UM3 *average* dilutions as estimates of *centerline* dilutions. The observations of Palomar et al., however, only applied to jets inclined upwards at 30° to 60° to the horizontal, where mixing is greater due to gravitational instabilities. For small fractional density differences, the dynamics of horizontal dense jets are the same as for positively buoyant jets (with a change in the sign of the density difference). Therefore, a simpler semi-empirical analysis can be applied, and UM3, which is well-tested and validated for such situations, is also applicable. The new analysis and application of UM3 are described below.

For the jet situation shown in Figures 8 and 9 it can be shown that the centerline dilution $S_m$ at any vertical distance $z$ from the nozzle is given by (Roberts et al. 2010):

$$\frac{S_m}{F_j} = f\left(\frac{z}{dF_j}\right) \tag{1}$$

where $F_j$ is the densimetric Froude number of the jet:

$$F_j = \frac{u_j}{\sqrt{g_o' d}} \tag{2}$$

$u_j$ is the jet velocity, $g_o' = g\left(\rho_a - \rho_o\right)/\rho_o$ is the modified acceleration due to gravity, $g$ is the acceleration due to gravity, $\rho_a$ and $\rho_o$ are the ambient and effluent densities, respectively, and $d$ the (round) nozzle diameter. Experimental measurements of the centerline dilutions plotted according to Eq. 1 are shown in Figure 10.

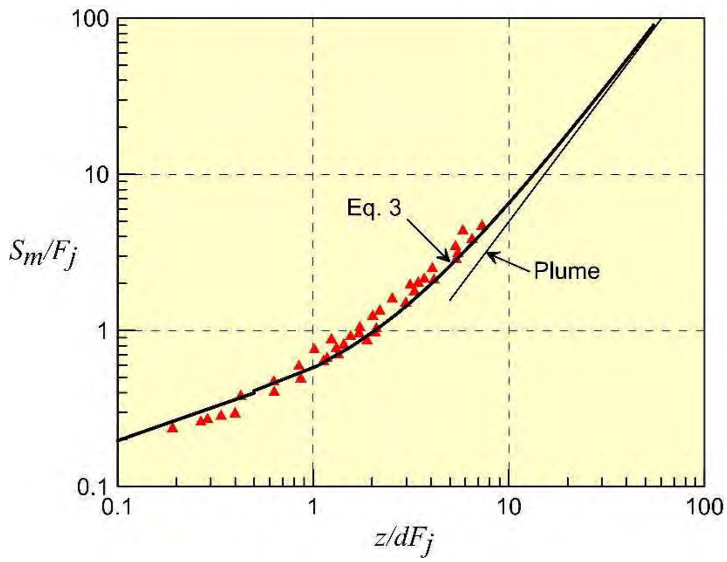



**Figure 10. Centerline dilution of a horizontal buoyant jet into a stationary homogeneous environment (Roberts et al. 2010).**

A fit to these data for $z/dF_j > 0.5$ has been suggested by Cederwall (1968):

$$\frac{S_m}{F_j} = 0.54\left(0.66 + 0.38\frac{z}{dF_j}\right)^{5/3} \tag{3}$$

which is plotted on Figure 10. This equation is used to predict dilutions below.

The dilution and trajectories of the jets can also be predicted by UM3. UM3 is a Lagrangian entrainment model described in Frick (2003, 2004).

### 4.2 Results

The following procedure was followed to determine the dilutions for dense discharges. First the internal hydraulics program (Section 3) was run for each case summarized in Table 6 to determine the flow distribution between the ports. Because the flow varies between the ports and because the effective port diameter varies with flow rate, it is not immediately obvious where along the diffuser the lowest dilution will occur. Therefore, dilutions were computed for the innermost and outermost ports. Depending on flow and density, the innermost ports would sometimes discharge the lowest flow, and sometimes the highest. The conditions resulting in lowest dilutions were chosen; sometimes this would occur at the innermost port and sometimes the outermost.

A typical jet trajectory output from UM3 (for the pure brine case, P2) is shown in Figure 11. For this case, the jet centerline impacts the seabed about 10 ft from the nozzle and the jet diameter is about 5 ft. Similar simulations were run for all dense scenarios, and the results, using the Cederwall formula and UM3, are summarized in Table 7.

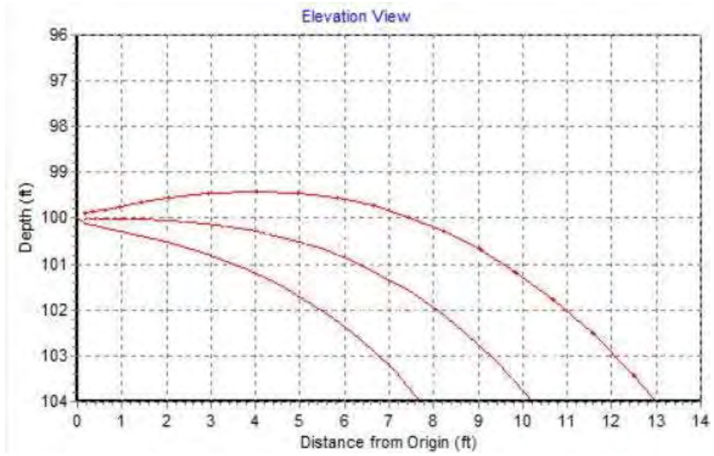



**Figure 11. Typical graphics output of jet trajectory from UM3: Pure brine case, P2.**

It is remarkable how close the dilution predictions of UM3 and Cederwall are. Cederwall's are generally more conservative, so these values are adopted. Jet impact distances from UM3 are also shown in Table 7. Jet diameters are generally much less than the port spacing of 16 ft, so no merging is expected before bottom impaction. The results are comparable to the Flow Science semi-empirical method.

The worst case, as expected, is the pure brine case, P2. For this case, the minimum centerline dilution is 15.5 and the salinity increment is 1.6 ppt, well within the BMZ limit of 2 ppt. The distance up to the impact point can be interpreted as the Zone of Initial Dilution (ZID). In all cases, the salinity limit is met within the ZID, whose length ranges from about 9 ft for scenario V1 up to 42 ft for scenario V9, where the density difference is much less and the jet trajectory is much flatter.

The jets will continue to dilute and will ultimately merge beyond the ZID. The increase in dilution up to the edge of the BMZ is difficult to estimate as there are no experiments available for these horizontal dense jet flows. Some guidance can be obtained from experiments on buoyant jets and inclined dense jets, however. Roberts et al. (1997) estimates a dilution increase of about 60% from the impact point to the end of the near field for single (non-merging) 60° inclined jets. For merged jets or plumes the increase in dilution is less; Abessi and Roberts (2014) reported a dilution increase of about 22% from impact point to the end of the near field. This is in keeping with the differences in dilution between non-merged and merged positively buoyant jets impacting water surfaces reported in Tian et al. (2004). The spacing between the individual jets on each side of the diffuser is 16 ft therefore it is conservatively assumed that they will merge within the BMZ and the increase in dilution from the impact point to the BMZ is 20%. This increase is used to predict the BMZ dilutions in Table 7.

**Table 7. Summary of Dilution Simulations for Dense Effluent Scenarios**

| Case No. | Background conditions | | Effluent conditions | | Port conditions | | | | | | Cederwall formula | | | UM3 | | Cederwall at BMZ | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Salinity | | | | | |
| | Salinity (ppt) | Density (kg/m³) | Salinity (ppt) | Density (kg/m³) | Flow (gpm) | Diam. (in) | Height (ft) | Velocity (ft/s) | Froude no. | $z_o/dF$ | Dilution | At impact (ppt) | Incre-ment (ppt) | Dilution | Impact distance (ft) | Dilution | Salinity incre-ment- (ppt) |
| P1 | - | - | 0.80 | 998.8 | - | - | - | - | - | - | - | - | - | - | - | - | - |
| P2 | 33.89 | 1025.8 | 58.23 | 1045.2 | 76.3 | 1.87 | 4.0 | 8.9 | 29.0 | 0.89 | 15.6 | 35.45 | 1.56 | 16.3 | 10.3 | 18.7 | 1.30 |
| P3 | 33.34 | 1024.8 | 53.62 | 1041.2 | 75.0 | 1.86 | 4.0 | 8.9 | 31.4 | 0.82 | 16.2 | 34.60 | 1.25 | 16.9 | 10.7 | 19.4 | 1.04 |
| P4 | 33.34 | 1024.8 | 50.32 | 1038.5 | 80.8 | 1.89 | 4.0 | 9.2 | 35.5 | 0.72 | 17.0 | 34.34 | 1.00 | 17.8 | 11.8 | 20.5 | 0.83 |
| P5 | 33.34 | 1024.8 | 35.23 | 1026.4 | 117.8 | 2.07 | 4.0 | 11.2 | 120.3 | 0.19 | 38.7 | 33.39 | 0.05 | 35.3 | 29.0 | 46.5 | 0.04 |
| P6 | 33.34 | 1024.8 | 24.24 | 1017.6 | 188.5 | 2.28 | 4.0 | 14.8 | 71.5 | - | - | - | - | - | - | - | - |
| V1 | 33.89 | 1025.8 | 58.23 | 1045.2 | 50.8 | 1.67 | 4.0 | 7.4 | 25.6 | 1.12 | 15.9 | 35.42 | 1.53 | 16.3 | 8.7 | 19.0 | 1.28 |
| V2 | 33.89 | 1025.8 | 52.48 | 1040.5 | 54.3 | 1.70 | 4.0 | 7.7 | 30.1 | 0.94 | 16.7 | 35.00 | 1.11 | 17.4 | 9.8 | 20.0 | 0.93 |
| V3 | 33.89 | 1025.8 | 47.78 | 1036.6 | 54.6 | 1.71 | 4.0 | 7.6 | 34.7 | 0.81 | 17.7 | 34.67 | 0.78 | 18.5 | 10.9 | 21.3 | 0.65 |
| V4 | 33.34 | 1024.8 | 35.20 | 1026.4 | 77.9 | 1.88 | 4.0 | 9.0 | 102.0 | 0.25 | 34.5 | 33.40 | 0.05 | 32.5 | 24.0 | 41.4 | 0.04 |
| V5 | 33.89 | 1025.8 | 18.75 | 1012.7 | 160.8 | 2.21 | 4.0 | 13.5 | 48.9 | - | - | - | - | - | - | - | - |
| V6 | 33.89 | 1025.8 | 53.27 | 1041.1 | 54.3 | 1.70 | 4.0 | 7.7 | 29.5 | 0.96 | 16.6 | 35.06 | 1.17 | 17.2 | 9.7 | 19.9 | 0.98 |
| V7 | 33.34 | 1024.8 | 47.78 | 1036.5 | 58.3 | 1.74 | 4.0 | 7.9 | 34.2 | 0.81 | 17.4 | 34.17 | 0.83 | 18.2 | 10.9 | 20.9 | 0.69 |
| V8 | 33.34 | 1024.8 | 40.52 | 1030.6 | 66.5 | 1.80 | 4.0 | 8.4 | 50.6 | 0.53 | 21.3 | 33.68 | 0.34 | 22.1 | 14.7 | 25.5 | 0.28 |
| V9 | 33.89 | 1025.8 | 35.01 | 1026.1 | 77.8 | 1.88 | 4.0 | 9.0 | 260.5 | 0.10 | 77.1 | 33.90 | 0.01 | 55.4 | 42.1 | 92.5 | 0.01 |
| V10 | 33.34 | 1024.8 | 20.67 | 1014.7 | 143.3 | 2.16 | 4.0 | 12.6 | 52.6 | - | - | - | - | - | - | - | - |

Finally, note that the computed salinities occur only along the seabed. Salinities decrease with height and will only be above ambient within the spreading layer on the bottom. For most of the water column, incremental salinities will be much less than the values in Table 7.

### 4.3 Other Considerations

The increase in dilution beyond the impact point, or ZID, above is the increase in dilution up to the end of near field, defined as (Abessi and Roberts, 2014) the point where the turbulence induced by the discharge collapses under the influence of its self-induced density stratification. Again, there are no direct experiments to estimate this distance for this horizontal flow case, but Abessi and Roberts (2014) estimate the ratio of the near field length to the impact distance to be about 3:1. The impact distances in Table 7 range from about 9 to 42 ft, so, assuming the ratio of 3:1 to apply here, the end of the near field will always be within the BMZ distance of 100 m (328 ft). The assumption that dilution stops at the end of the near field is a conservative one as further dilution will occur due wave effects and entrainment as the gravity current flows down the bottom slope.

The dilution calculations assume the discharges to be from round nozzles whose area is the same as the effective opening of the check valves. There are no models to predict the dilution from elliptically-shaped check valves but experiments (Lee and Tang, 1999) show that the centerline dilutions from elliptical nozzles are greater than from equivalent round nozzles due to the larger surface area available for entrainment and that the dilutions asymptotically approach those of equivalent round nozzles at about 12 equivalent jet diameters from the nozzle.

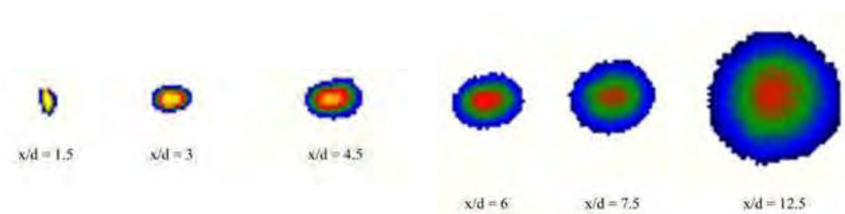



**Figure 12. Cross sections of a jet from a check valve illustrating the transition from elliptical to round shapes. From Lee and Tang (1999).**

Mixing of horizontal dense jets can also be affected by proximity to the local boundary which may cause a Coanda attachment. Some experiments on this phenomenon have been reported by Shao and Law (2011); a figure from their paper is shown in Figure 12. They find that the flow transitions to a wall-dense-jet with momentum continuing to play a role in mixing. They investigated Coanda attachment of the jet to the lower boundary and found that none occurred for a parameter which they defined as: $z_o/l_M > 0.12$. This parameter is essentially the same as $z_o/dF$ shown in Table 7. Only case V9 is close to this value and the dilutions for this cases are very high. It is therefore concluded that Coanda attachment will not have any effect on the dynamics or mixing of the brine jets. And furthermore, because of the strong mixing and entrainment in the wall jet region, it is expected that the additional dilution beyond the impingement point will be actually much greater than the 20% assumed above.

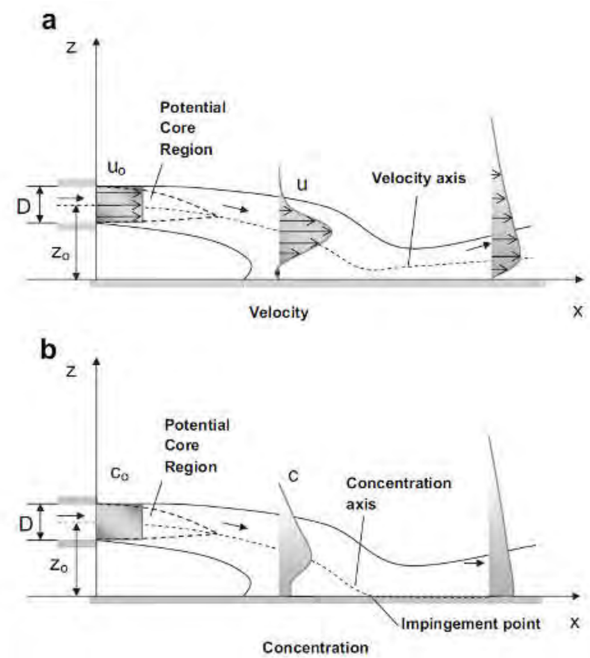



**Figure 13. Dense jet impacting a local boundary. From Shao and Law (2011).**

## 5. BUOYANT DISCHARGE DILUTION

### 5.1 Introduction

Positively buoyant (or just buoyant) discharges, i.e. that have densities less than the receiving seawater, require different procedures than for negatively buoyant ones. Inspection of Table 6 shows there are only four positively buoyant scenarios; P1, the baseline with pure secondary effluent, P6, high volumes of brine and secondary effluent, and V5 and V10, Project Variants with moderate brine volumes and high secondary effluent and GWR volumes. Positively buoyant effluents rise in the water column and are either trapped by the ambient density stratification if it is strong enough, or reach the water surface if it is weak. A laboratory photograph of a buoyant discharge from a multiport diffuser into a stationary stratified environment is shown in Figure 13.

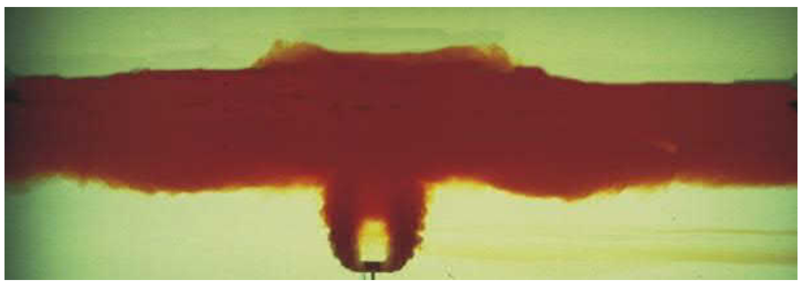


**Figure 14. Trapped buoyant plume from multiport diffuser in stratified environment, from Roberts et al. (1989).**

The plume dynamics are simulated with two models in Visual Plumes: UM3 and NRFIELD. UM3 is an entrainment model that was previously described. NRFIELD is based on the experiments on multiport diffusers discharging from two sides described in Roberts et al. (1989) and subsequently updated with the new experimental data of Tian et al. (2004) and others. NRFIELD is specifically designed for conditions typical of very buoyant discharges of domestic effluent from multiport diffusers into stratified oceanic waters so is judged most appropriate here. It also includes the lateral spreading after the terminal rise height and subsequent turbulent collapse at the end of the near field. The primary outputs from NRFIELD are the minimum (centerline) dilution, the plume rise height, and wastefield thickness at the end of the near field.

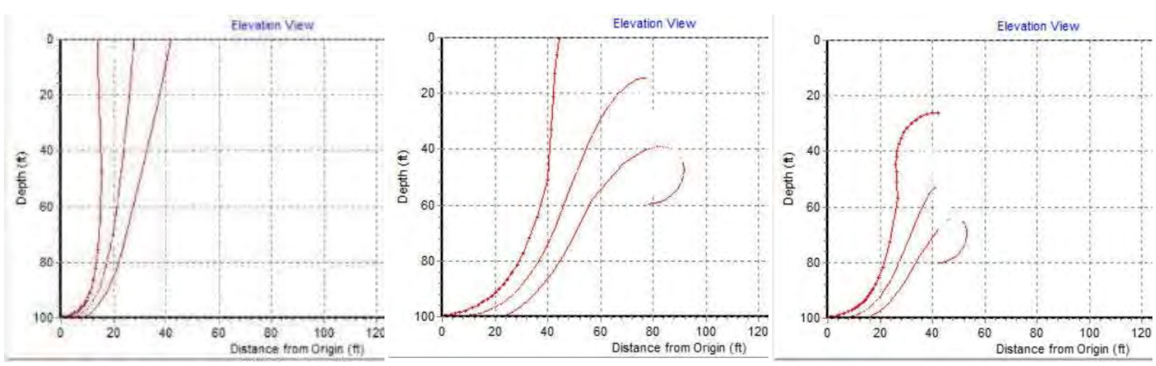
The following procedure was used for the dilution simulations. The internal hydraulics program, Section 3, was first run for each of the three scenarios. The average port diameter and flows were then obtained. UM3 and NRFIELD were then run for the chosen flow and ambient combination scenarios summarized in Table 6: P1 with Upwelling, Davidson, and Oceanic conditions; P6 with Davidson, and V5 with Upwelling. The seasonal average density stratifications that were discussed in Section 2.1 and plotted in Figure 3 were used and zero current speed was assumed. UM3 assumes the discharges are from one side so the usual assumption was used that the diffuser consists of 129 ports spaced 8 ft apart. NRFIELD assumes the correct configuration of ports on either side spaced 16 ft apart; the correction is made internally in Visual Plumes.

### 5.2 Results

The results are summarized in Table 8 and some graphical jet trajectories from UM3 are shown in Figure 14. For UM3 the average dilutions at the terminal rise height are given along with the centerline rise heights, for NRFIELD the near field (minimum) dilution is given along with the height of the near field (centerline) dilution and the height to the top of the spreading wastefield layer.

**Table 8. Summary of Dilution Simulations for Buoyant Effluent Scenarios**

| No. | Flow rate (mgd) | Effluent density (kg/m$^3$) | Port diam. (in) | Ocean condition | UM3 simulations | | NRFIELD simulations | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | | | Average dilution | Rise height (center-line) (ft) | Minimum dilution | Rise height (center line) (ft) | Rise height (top) (ft) |
| P1 | 19.78 | 998.8 | 2.00 | Upwelling | 191 | 58 | 186 | 59 | 42 |
| P1 | 19.78 | 998.8 | 2.00 | Davidson | 327 | 100 (surface) | 351 | 100 | 100 |
| P1 | 19.78 | 998.8 | 2.00 | Oceanic | 240 | 82 | 239 | 50 | 72 |
| P6 | 33.76 | 1017.6 | 2.25 | Davidson | 154 | 86 | 163 | 86 | 89 |
| V5 | 28.77 | 1012.7 | 2.18 | Upwelling | 122 | 47 | 105 | 41 | 43 |
| V10 | 25.85 | 1014.7 | 2.13 | Davidson | 195 | 100 (Surface) | 221 | 100 | 100 |




a) **P1 Davidson** b) **P6 Davidson** c) **V5 Upwelling**

**Figure 15. Graphics outputs from UM3 simulations.**

It can be seen that the *average* dilution predicted by UM3 is very close to *minimum* (centerline) dilution predicted by NRFIELD. Similar observations were made by Isaacson et al. (1983) in connection with physical model studies on the San Francisco outfall. The reason is apparently that the increase in mixing and dilution in the transition from vertical to horizontal flow and merging of the plumes from both sides, neither of which are incorporated into UM3, are accounted for in the ratio of average to minimum dilutions. Therefore, we use the average dilution predicted by UM3 but interpret it as the minimum centerline dilution. Similar observations are reported in model comparisons by Frick and Roberts (2016). The near field dilution is synonymous with the initial dilution in the ZID as defined in the California Ocean Plan.

Dilutions are generally high: The lowest is 105 for scenario V5 which was run with strong (Upwelling) stratification. The highest dilution was 351 for scenario P1 (pure secondary effluent) with weak (Davidson) stratification which resulted in a surfacing plume. Generally speaking, strong stratification results in lower dilutions and reduced rise height, and weak stratification result in higher dilutions and increased rise height. All of the scenarios resulted in submerged plumes except for case P1 with Davidson conditions.

Note that all the simulations were run for zero current, as specified in the Ocean Plan. More realistic simulations with currents would predict higher dilutions and deeper submergences.

The lower density difference and therefore relatively greater influence of source momentum flux results in flatter jet trajectories, as seen in Figure 14ab, cases P6 and V5.

# 6. Shear and Turbulence Effects

## 6.1 Introduction

The 2015 California Ocean Plan contains the following requirement for mitigation of marine life or habitat lost due to a desalination facility:

> *"For operational mortality related to discharges, the report shall estimate the area in which salinity exceeds 2.0 parts per thousand above natural background salinity or a facility-specific alternative receiving water limitation (see chapter III.M.3). The area in excess of the receiving water limitation for salinity shall be determined by modeling and confirmed with monitoring. The report shall use any acceptable approach approved by the regional water board for evaluating mortality that occurs due to shearing stress resulting from the facility's discharge, including any incremental increase in mortality resulting from a commingled discharge."*

The purpose of this section is to evaluate mortality due to the discharge. In particular, it has been suggested that planktonic organisms entrained into the high velocity turbulent jets could be subject to injury, possibly mortality, due to the effects of turbulence and shear. This is difficult to estimate, so only approximate orders of magnitude can be made. Somewhat similar concerns arise due to entrainment into water intakes, for example Tenera (2014), although the considerations for jets are different and somewhat more complex.

Experimental evidence suggests that the main turbulence effect is caused by small-scale eddies, known as the Kolmogorov scales, and that most damage may occur when they are comparable to the size of the organisms. These small eddies subject the organism to high strain rates and viscous shear stress that may cause injury or death whereas larger eddies mainly translate the organisms without causing significant shear. The effects vary by organism, and a number of studies on the effects of flow and turbulence on marine and freshwater organisms have been reported. They are summarized in Appendix C.

Most relevant here are the studies of Rehmann et al. (2003) and Jessop (2007). Rehmann et al. performed laboratory experiments in which zebra mussel veligers were subject to controlled turbulence in beakers. The turbulence intensity was such that the Kolmogorov scale, $L_k \sim 0.1$ mm. They found that mortality increased sharply to about 65% when the size of the larvae was about 90% of the Kolmogorov scale. Jessop (2007) measured survival rates in a highly turbulent tidal channel with $0.06 < L_k < 0.25$ mm. Survival rates varied with species; thin-shelled veligers showed significant mortality of 45% to 64%, but some taxa showed no mortality.

These and other results are difficult to translate to jet turbulence for a number of reasons. In the laboratory experiments, the organisms were subject to fairly homogeneous turbulence for long periods: 24 hours. In the field experiment the turbulence was variable during the organisms' transit through the channel. The duration of exposure to high turbulence is unknown but was probably a few minutes and the variation of conditions during transit are also unknown.

In contrast, the turbulence in jets is not homogeneous: it varies along the centerline and also laterally across the jet. Kolmogorov scales are smallest near the nozzle and increase along the trajectory; they are shortest on the centerline and increase towards the jet edges. Also, transit times of entrained organisms within the jets are short, of the order of seconds, and vary according to where along the trajectory they are entrained and how they wander within the jet.

In the following we take several approaches to this problem. In Sections 6.3 and 6.4 we discuss turbulence characteristics of jets and estimate turbulence length scales for the various brine discharge scenarios. We estimate the total volumes where effects may be expected and express it as a fraction of the total volume of the BMZ. Then we estimate the fraction of the ambient flow that passes over the diffuser that is entrained, and therefore the fraction of larvae entrained. Finally, in Section 6.5, we estimate the total numbers of organisms entrained by the diffuser and the number that may be subject to mortality.

### 6.2 Plankton Field Data

In order to estimate planktonic levels, seawater samples were taken on May 14, 2016 along the three towed transects shown in Figure 16. The results are summarized by taxonomic group and size ranges in Table 9.


**Figure 16. Transect lines for plankton samples 5/14/16.**

**Table 9. Summary of Plankton Tows Monterey May 14, 2016**

| Taxonomic Group | | Size (mm) | Count (#/m$^3$) |
|---|---|---|---|
| Copepods | Copepod_unid | 0.3 - 5.0 | 33.73 |
| | Calanoid | 1.0 - 5.0 | 3052.72 |
| | Oithona_sp | 0.5 - 2.0 | 369.85 |
| | Corycaeus_sp | 0.3 - 1.5 | 64.31 |
| | Copepod_nauplii | 0.1 - 0.2 | 77.69 |
| | | Copepod total | 3598.29 |
| Other | Euphausiid_nauplii | 0.35 - 0.5 | 13.99 |
| | Euphausiid_Calyptopis | 0.8 - 2.2 | 613.94 |
| | Euphausiid_furcilia | 1.0 - 5.6 | 79.68 |
| | Cirripedia_nauplii | 0.35 - 0.5 | 13.83 |
| | Pleurobrachia_sp | 2.0 - 10.0 | 3.93 |
| | Cladocera_podon | 0.2 - 3.0 | 2.83 |
| | Salp | 1.0 - 10.0 | 79.46 |
| | Appendicularia_unid | 1.0 - 1.5 | 58.04 |
| | Oikopleura_unid | 1.0 - 1.5 | 13.83 |
| | Chaetognath_unid | 4.0 - 10.0 | 29.69 |
| | Isopod_unid | 0.4 - 1.0 | 1.97 |
| | Polychaete_unid | 0.5 - 5.0 | 4.71 |
| | Polychaete_trochophore | 0.2 - 0.8 | 2.67 |
| | Decapod_zoea | 2.0 - 5.0 | 4.40 |
| | Gastropod_larvae | 0.8 - 3.0 | 3.30 |
| | Bivalve_veliger | 0.75 - 1.0 | 4.08 |
| | Siphonophore | 1.0 - 5.0 | 7.07 |
| | Hydromedusa | 0.5 - 10 | 1.41 |
| | | Other total | 938.82 |
| | | Overall total | 4537.11 |

### 6.3 Jet Turbulence and Entrainment

The turbulence generated by the diffuser is discussed below, in particular the spatial variations of turbulence intensity and length scales (eddy sizes) of the turbulence. The diffuser discharges are initially horizontal and have relatively flat trajectories (Figures 8, 9, and 11) so it reasonable to analyze them as pure jets (i.e. flows driven by momentum only).

The properties of jets are well known, and summarized for example in Fischer et al. (1979). An LIF image of a jet and a depiction of its main features are shown in Figure 17. Closer to the nozzle the jet is more fine-grained but the turbulent scales increase along its trajectory. External flow is entrained into the jet (and dilutes it) and the jet width increases linearly with distance from the nozzle.

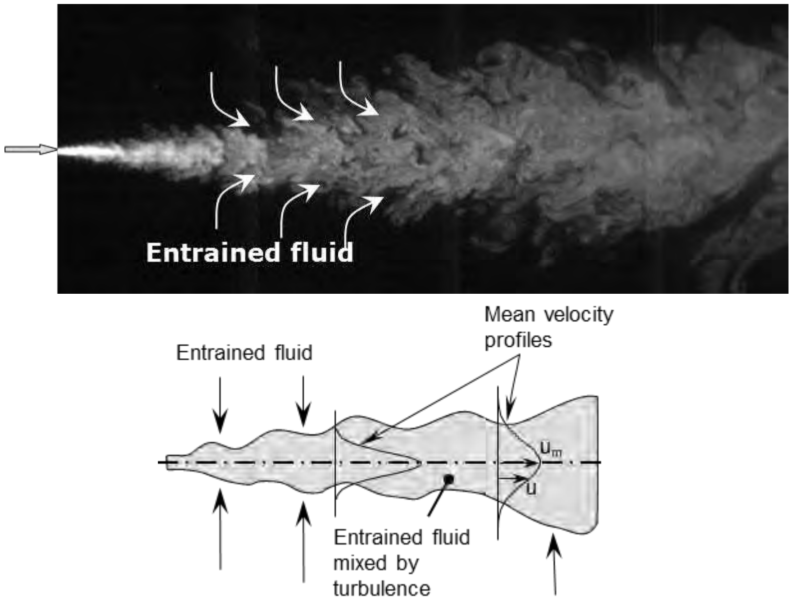



**Figure 17. LIF image and main properties of a jet**

Beyond the zone of flow establishment, which is about 6*d* long, the centerline velocity $u_m$ decreases rapidly with distance *x* according to:

$$u_m = 6.2u\frac{d}{x} \tag{4}$$

where *u* is the jet velocity and *d* the diameter. The half-width of the jet *w,* defined as two standard deviations of a Gaussian velocity distribution, increases linearly with distance according to:

$$w = 0.15x \tag{5}$$

Combining Eqs. 4 and 5, we see that the average mean shear in the jet $d\bar{u}/dr$ where $\bar{u}$ is the local velocity and *r* the radial distance is:

$$\frac{d\bar{u}}{dr} \approx \frac{u_m}{w} \approx 41\frac{ud}{x^2} \tag{6}$$

So it decreases even more rapidly than velocity with distance from the nozzle. Note that the mean shear on the jet centerline is zero.

The turbulence properties in the jet can be estimated from the experimental data of Webster et al. (2001). They show that the relative turbulence intensity on the centerline, $\tilde{u}/u_m \approx 0.3$ where $\tilde{u}$ is the rms value of the turbulent velocity fluctuations. The intensity decreases with radial distance to zero at the edge of the jet, defined approximately by Eq. 5.

The size of the small-scale (Kolmogorov) eddies η can be estimated from:

$$\eta \sim \left( \frac{\nu^3}{\varepsilon} \right)^{1/4} \tag{7}$$

where ν is the kinematic viscosity of seawater and ε the energy dissipation rate, that can be approximated as:

$$\varepsilon \sim \frac{\tilde{u}^3}{l_L} \tag{8}$$

where $l_L$ is a measure of the largest (energy containing) eddies in the jet. According to Wygnanski and Fiedler (1969) these length scales also increase linearly with distance from the nozzle and vary radially across the jet. On the centerline, $l_L \sim 0.016x$, i.e. about 1/12 of the jet width.

Finally, combining the above equations we find:

$$\frac{\eta_c}{x} = 0.24\,\mathrm{Re}^{-3/4} \tag{9}$$

where $\mathrm{Re} = ud/\nu$ is the jet Reynolds number and $\eta_c$ the size of the Kolmogorov eddies on the jet centerline. The Kolmogorov scale therefore increases linearly along the jet trajectory.

The radial variation of turbulence intensity and turbulent length scales across the jet is now considered. Near the jet edge, $l_L \sim 0.03x$ according to Wygnanski and Fiedler, i.e. about 1/25 of the jet width, and the turbulence intensity is about $\tilde{u}/u_m \approx 0.04$ according to Webster et al. (2001). Combining Eqs. 7 and 8 we can estimate the ratio of the Kolmogorov scale on the centerline to that at the jet edge as:

$$\frac{\eta_c}{\eta_e} = \left\{ \frac{(\ell_c/\ell_e)}{(\tilde{u}_c/\tilde{u}_e)^3} \right\}^{1/4} \approx 0.2 \tag{10}$$

where the subscripts *c* and *e* refer to the jet centerline and edge, respectively. Eq. 10 indicates that the Kolmogorov scales at the jet edge are about five times larger than on the centerline.

Travel times of entrained larvae along the jet trajectory will vary, depending on where along the trajectory they enter the jet and whether they mainly travel on the centerline, on the edge, or in between. On the centerline, the velocity decreases according to Eq. 4 so the travel time along the trajectory to the impact point is given approximately by:

$$t = \int_0^L \frac{dx}{u_m} = \int_0^L \frac{x}{6.2ud} dx = \frac{L^2}{12.4ud} \tag{11}$$

where *L* is the length of the trajectory from the nozzle to the seabed impact point.

As previously discussed, the jet properties were predicted by UM3 (Table 7). In addition, the diameters of the jets at impact $d_j$ were obtained and the volumes of the 129 jets computed, assuming them to be conical up to impact:

$$V_j = 129 \times \frac{d_j^2 L}{12} \tag{12}$$

This volume was computed as a fraction of the water volume in the BMZ, $V_{BMZ}$, computed from:

$$V_{BMZ} = L \times w_{BMZ} \times H + \pi\left(\frac{w_{BMZ}^2}{4}\right) \times H = 10^8 \quad \text{ft}^3 \tag{13}$$

where $L$ = 1024 ft is the diffuser length, $w_{BMZ}$ = 656 ft (200 m) is the width of the brine mixing zone, and $H$ = 104 ft is the average water depth at the diffuser.

In desalination projects, the word entrainment arises in two contexts. It refers to flow drawn into intakes, and, in the jets and plumes that arise in brine diffusers, it refers to the flow induced by velocity shear at the edge of the jet (see Figure 17). This flow, commonly referred to as entrained flow, mixes with and dilutes the effluent stream. Below we consider the magnitude and spatial variation of the entrained velocity and the magnitude of the entrained flow expected to be subjected to significant shear and turbulence effects.

The velocity at which flow is entrained into the jet is directly proportional to the local centerline velocity and is given by:

$$u_o = \alpha u_m \tag{14}$$

where $u_o$ is the entrainment velocity at a radial distance $r = b_w$ from the jet centerline and $b_w$ is defined from the usually assumed radial velocity variation:

$$\frac{u_r}{u_m} = \exp\left\{-\frac{r^2}{b_w^2}\right\} \tag{15}$$

where $u_r$ is the entrainment velocity at radial distance $r$. The length scale $b_w$ grows linearly with $x$ according to (Fischer et al. 1979):

$$b_w = 0.107x \tag{16}$$

The variation of the entrained velocity $u_e$ with radial distance $r$ beyond the edge of the jet can be determined by continuity:

$$u_o 2\pi b_w = u_e 2\pi r$$

or

$$u_e = u_o \frac{b_w}{r} \tag{17}$$

i.e. the entrained velocity decreases rapidly with distance from the jets in inverse proportion to the distance *r*.

Combining Eqs. 4, 13, 15, and 16, we find:

$$u_e = 6.2 \times 0.107 \alpha \frac{ud}{r}$$

Assuming $\alpha$ = 0.0535 (Fischer et al., 1979), this becomes:

$$u_e = 0.035 \frac{ud}{r} \tag{18}$$

In other words, the entrainment velocity is constant with *x*, the distance along the jet, but decreases rapidly away from the jet in the radial direction. The entrainment velocity at any location depends only on the source momentum flux of the jet, which is proportional to *ud*.

Now we apply this result to case P2. From Table 7, *u* = 8.9 ft/s, and *d* = 1.87 in, yielding:

$$u_e = \frac{0.049}{r} \quad \text{ft/s} \tag{19}$$

So, at a distance of 3 ft from the jet centerline, the velocity has fallen to about 0.02 ft/s (0.5 cm/s), already much smaller than typical oceanic velocities.

The total volume entrained into the jets is directly related to dilution. It is given by (Fischer et al. 1979):

$$Q_E = Q \times S_a \tag{20}$$

where *Q* is the source discharge rate and $S_a$ the average dilution. The average dilution $S_a = 1.4 S_m$ where $S_m$ is the minimum centerline dilution. So a centerline dilution of 16:1 requires entraining about 22 times the source flow rate.

The total flux of water passing over the diffuser and BMZ can be estimated from:

$$Q_{BMZ} = \bar{U} \times \left(L + 2w_{BMZ}\right) \times H \tag{21}$$

where $\bar{U}$ is the mean oceanic drift speed. The ADCP measurements of Tenera (2014) at a depth of 30 m near the mouth of the Monterey Canyon imply a mean drift speed of about 5 cm/s.

### 6.4 Results and Discussion

The main flow properties for the various dense discharge scenarios of Tables 6 and 7 were computed according to Eqs. 9 through 21. The results are summarized in Table 10 where the kinematic viscosity $\nu$ was assumed to be $1.2 \times 10^{-5}\ \text{ft}^2/\text{s}$ and the mean oceanic drift speed $\bar{U} = 5\ \text{cm/s}$. In addition, estimates of scales, dilution and entrainment for the baseline domestic wastewater discharge (Case P1, 19.78 mgd) are also shown.

For case P2 (pure brine), the Kolmogorov scale on the centerline ranges from about 0.012 mm near the nozzle to 0.14 mm at the impact point. At the jet edge it therefore ranges from about 0.06 mm near the nozzle to about 0.7 mm. The mean shear rates range from about 57 $sec^{-1}$ near the nozzle to 0.4 $sec^{-1}$ at the impact point.

The maximum centerline travel time is about 8 seconds. The mean velocity profiles of Webster et al. (2001) show that the jet velocity is greater than about 20% of the maximum over about 80% of the jet width. Therefore, closer to the jet edges, travel times will be around 40 seconds. Organisms entrained and traveling near the jet edges will undergo lower intensities (larger eddies) but for longer times.

Clearly, the Kolmogorov scales in the jet will be smaller to or comparable than the smallest organisms of interest (Table 9). They range from 0.012 to 2.5 mm. These are mostly somewhat smaller than the Kolmogorov scale due to natural turbulence in the ocean which in Monterey is about 1 mm (Walter et al. 2014). Therefore, the Kolmogorov scale of the natural turbulence is also comparable to larvae size and may cause natural mortality. The incremental mortality due to the jets are estimated below.

In turbulence, there is a continuous spectrum of eddy sizes and turbulent kinetic energy from the smallest (Kolmogorov) to the largest (energy-containing) eddies. For case P2, they range from about 0.01 mm to 0.24 m, so there will be some eddies of size comparable to the organism sizes that may affect them. It should be noted, however, that the strain rates (and shear stresses) are maximum at the Kolmogorov scale and decrease as the eddy size increases.

The volume of water in the jets where turbulent intensities are greater than background is almost infinitesimally small compared to the volume of the BMZ. It ranges from 0.006% for case P2 to 0.4% for case V9.

For the brine discharges, only a small fraction of the water passing over the diffuser is entrained. It ranges from 1.7% for case P2 to 6.4% for case V9. This estimate depends on the assumed value of the oceanic drift speed, conservatively assumed to be 5 cm/s. For higher speeds it would be less.

The area of high shear impacted by the diffusers is relatively small and transit times through this region relatively short. Thus, it seems reasonable to expect that, while the larvae that experience the highest shear may experience lethal damage, the overall increase in mortality integrated over the larger area will be low.

The volumes entrained into the brine discharges are much less than into the baseline (P1) case. This is mainly because the dilutions for the baseline case is much higher. For the brine discharges the entrainment rates range from 7 to 22% of those for the baseline case. Therefore, organism mortality for the brine discharges would also be expected to be about 7 to 22% of the baseline case.

**Table 10. Summary of Turbulence and Entrainment Calculations**

| Case No. | Effluent | | Port conditions | | | UM3 predictions | | | | | Travel time center-line | Total volume as % of BMZ | Kolmogorov scales | | Entrained flows | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Flow | Density | Velocity | Diam. | Reynolds number ($x10^{-5}$) | Dilution | Impact distance | Diam-eter | Traj-ectory | Volume | | | At 1 ft | At impact | Volume | As % of BMZ flux |
| | (mgd) | ($kg/m^3$) | (ft/s) | (in) | | | (ft) | (in) | (ft) | ($ft^3$) | (sec) | | (mm) | (mm) | (mgd) | |
| P1 | 19.78 | 998.8 | 10.0 | 1.96 | 1.36 | 191 | - | - | - | - | - | - | 0.01 | - | 5290 | 28.5 |
| P2 | 13.98 | 1045.2 | 8.9 | 1.87 | 1.16 | 16.3 | 10.3 | 49 | 12.0 | 52.4 | 8.4 | 0.0064 | 0.012 | 0.140 | 319 | 1.7 |
| P3 | 14.98 | 1041.2 | 8.9 | 1.86 | 1.14 | 16.9 | 10.7 | 51 | 12.5 | 59.1 | 9.1 | 0.0073 | 0.012 | 0.146 | 354 | 1.9 |
| P4 | 15.98 | 1038.5 | 9.2 | 1.89 | 1.21 | 17.8 | 11.8 | 56 | 13.6 | 78.3 | 10.2 | 0.0096 | 0.011 | 0.153 | 398 | 2.1 |
| P5 | 22.98 | 1026.4 | 11.2 | 2.07 | 1.62 | 35.3 | 29.0 | 140 | 31.9 | 1137.0 | 42.3 | 0.1397 | 0.009 | 0.290 | 1136 | 6.1 |
| P6 | 33.76 | 1017.6 | 14.8 | 2.28 | 2.35 | - | - | | | | | | | | | |
| V1 | 8.99 | 1045.2 | 7.4 | 1.67 | 0.86 | 16.3 | 8.7 | 41 | 10.4 | 31.7 | 8.5 | 0.0039 | 0.015 | 0.152 | 205 | 1.1 |
| V2 | 9.99 | 1040.5 | 7.7 | 1.70 | 0.91 | 17.4 | 9.8 | 46 | 11.5 | 43.6 | 9.9 | 0.0054 | 0.014 | 0.161 | 243 | 1.3 |
| V3 | 10.99 | 1036.6 | 7.6 | 1.71 | 0.91 | 18.5 | 10.9 | 50 | 12.7 | 58.4 | 11.9 | 0.0072 | 0.014 | 0.177 | 285 | 1.5 |
| V4 | 14.79 | 1026.4 | 9.0 | 1.88 | 1.18 | 32.5 | 24.0 | 116 | 26.5 | 644.3 | 40.2 | 0.0792 | 0.012 | 0.305 | 673 | 3.6 |
| V5 | 28.77 | 1012.7 | 13.5 | 2.21 | 2.07 | - | - | | | | | | | | | |
| V6 | 9.93 | 1041.1 | 7.7 | 1.70 | 0.91 | 17.2 | 9.7 | 46 | 11.4 | 44.0 | 9.7 | 0.0054 | 0.014 | 0.160 | 239 | 1.3 |
| V7 | 10.93 | 1036.5 | 7.9 | 1.74 | 0.95 | 18.2 | 10.9 | 52 | 12.7 | 61.7 | 11.3 | 0.0076 | 0.014 | 0.171 | 278 | 1.5 |
| V8 | 12.93 | 1030.6 | 8.4 | 1.80 | 1.05 | 22.1 | 14.7 | 70 | 16.6 | 147.1 | 17.7 | 0.0181 | 0.013 | 0.208 | 400 | 2.2 |
| V9 | 15.23 | 1026.1 | 9.0 | 1.88 | 1.17 | 55.4 | 42.1 | 204 | 46.1 | 3473.9 | 121.5 | 0.4268 | 0.012 | 0.531 | 1181 | 6.4 |
| V10 | 25.85 | 1014.7 | 12.6 | 2.16 | | - | - | | | | | | | | | |

### 6.5 Plankton Entrainment and Mortality

Estimated rates of organism entrainment into the jets were computed as a product of the entrained volumes from Table 10 and organism concentrations in in Table 9. The results are shown in Table 11, sorted by organism size from smallest to largest. Although the absolute numbers of entrained organisms are high, they represent only a small fraction of those passing over the diffuser, which is similar to the fraction of water entrained: about 2 to 6% according to Table 10.

Because the natural Kolmogorov scale near the diffuser is about 1 mm, it is argued that incremental mortality due to the jets will only occur for regions where the Kolmogorov scale is shorter than this and by organisms smaller than 1 mm. We assume no incremental mortality for organisms larger than 1 mm. Organisms smaller than 1 mm comprise only 27% of the total, and the fraction of them that actually die is uncertain. According to the literature it could be anywhere from zero to about 50%; we assume the conservative upper limit of 50%. The results are summarized in Table 11.

We emphasize that 50% is most probably a very conservative upper limit to the fractional mortality. As discussed, organisms in a jet are subject to its turbulence for only brief periods of seconds and the turbulence intensity decreases rapidly as they travel through the jet.

It is useful to combine these estimates to obtain an upper bound for the fraction of entrained organisms passing over the diffuser that may be subject to mortality. For case P2, we have, from Tables 10 and 11.

$$\begin{pmatrix}\text{Fraction of}\\ \text{BMZ flux}\\ \text{entrained}\end{pmatrix}\times\begin{pmatrix}\text{Fraction of}\\ \text{organisms}\\ <1\text{ mm}\end{pmatrix}\times\begin{pmatrix}\text{Fraction}\\ \text{mortality}\end{pmatrix}=0.017\times0.266\times0.50=0.0023=0.23\%$$

Note that similar calculations are made for intakes. For example, Tenera (2014) estimated larvae entrainment into a proposed intake near the head of the Monterey Canyon. Because intakes are essentially point sinks, the concept of water flux passing over them is meaningless so the methods used here do not apply. They use the ETM (Empirical Transport Model) approach whereby the proportional mortality of larvae in the source water population is estimated. They estimate the highest estimated proportional mortality to be of order 0.1% for a 63 mgd intake. For the diffuser, the volumes entrained for dilution are about 5 to 20 times this amount so if the same approach were used here approximately 0.5 to 2.0% of the source flow would be subject to mortality, similar to that estimated in Table 10. The difference of course is that 100% mortality of entrained organisms is assumed for intakes whereas a much smaller fraction, if any, larvae die in passing through the jets.

**Table 11. Estimates of entrainment and mortality. Organisms sorted by size, small to large. Case P2**

| Taxonomic Group | | Size (mm) | Count (#/m$^3$) | % of total | Cumulative % | Entrainment (#/day) | Incremental mortality (#/day) |
|---|---|---|---|---|---|---|---|
| Copepods | Copepod_nauplii | 0.1 - 0.2 | 77.69 | 1.71 | 1.71 | 114,680,910 | 57,340,455 |
| Other | Cladocera_podon | 0.2 - 3.0 | 2.83 | 0.06 | 1.77 | 4,172,099 | 2,086,050 |
| Other | Polychaete_trochophore | 0.2 - 0.8 | 2.67 | 0.06 | 1.83 | 3,940,942 | 1,970,471 |
| Copepods | Copepod_unid | 0.3 - 5.0 | 33.73 | 0.74 | 2.58 | 49,790,726 | 24,895,363 |
| Copepods | Corycaeus_sp | 0.3 - 1.5 | 64.31 | 1.42 | 3.99 | 94,933,608 | 47,466,804 |
| Other | Euphausiid_nauplii | 0.35 - 0.5 | 13.99 | 0.31 | 4.30 | 20,649,175 | 10,324,588 |
| Other | Cirripedia_nauplii | 0.35 - 0.5 | 13.83 | 0.30 | 4.61 | 20,409,510 | 10,204,755 |
| Other | Isopod_unid | 0.4 - 1.0 | 1.97 | 0.04 | 4.65 | 2,902,172 | 1,451,086 |
| Copepods | Oithona_sp | 0.5 - 2.0 | 369.85 | 8.15 | 12.80 | 545,978,077 | 272,989,039 |
| Other | Polychaete_unid | 0.5 - 5.0 | 4.71 | 0.10 | 12.91 | 6,953,004 | 3,476,502 |
| Other | Hydromedusa | 0.5 - 10 | 1.41 | 0.03 | 12.94 | 2,086,050 | 1,043,025 |
| Other | Bivalve_veliger | 0.75 - 1.0 | 4.08 | 0.09 | 13.03 | 6,026,992 | 3,013,496 |
| Other | Euphausiid_Calyptopis | 0.8 - 2.2 | 613.94 | 13.53 | 26.56 | 906,316,100 | 453,158,050 |
| Other | Gastropod_larvae | 0.8 - 3.0 | 3.30 | 0.07 | 26.63 | 4,868,389 | 2,434,194 |
| Copepods | Calanoid | 1.0 - 5.0 | 3052.72 | 67.28 | 93.91 | 4,506,487,870 | 0 |
| Other | Euphausiid_furcilia | 1.0 - 5.6 | 79.68 | 1.76 | 95.67 | 117,622,706 | 0 |
| Other | Salp | 1.0 - 10 | 79.46 | 1.75 | 97.42 | 117,305,750 | 0 |
| Other | Appendicularia_unid | 1.0 - 1.5 | 58.04 | 1.28 | 98.70 | 85,679,028 | 0 |
| Other | Oikopleura_unid | 1.0 - 1.5 | 13.83 | 0.30 | 99.01 | 20,418,019 | 0 |
| Other | Siphonophore | 1.0 - 5.0 | 7.07 | 0.16 | 99.16 | 10,430,248 | 0 |
| Other | Pleurobrachia_sp | 2.0 - 10 | 3.93 | 0.09 | 99.25 | 5,804,344 | 0 |
| Other | Decapod_zoea | 2.0 - 5.0 | 4.40 | 0.10 | 99.35 | 6,492,125 | 0 |
| Other | Chaetognath_unid | 4.0 - 10 | 29.69 | 0.65 | 100.00 | 43,832,517 | 0 |
| | | Totals | 4537.11 | | | 6,697,780,360 | 891,853,877 |

## 7. Dilution Mitigation

### 7.1 Introduction

This section explores methods to increase dilution for dense discharges (brine, and brine comingled with secondary and GWR effluents). In particular, it has been suggested that some combinations of effluents may not achieve sufficient dilution to meet the water quality requirements of the Ocean Plan. Particularly troublesome may be ammonia levels when low to moderate volumes of secondary effluent are added to brine. Trussell (2016) identifies some cases, reproduced in Table 12, where the dilutions predicted from Tables 7 and 8 are insufficient to achieve the target goals of 80% of the compliance limit. Note that the dilution $D_m$ used in Table 9 is $D_m = S_m - 1$ where $S_m$ is the dilution in Tables 7 and 8 to agree with the definition of dilution used in the Ocean Plan. It can be seen that cases V6, V7, and V8 may not achieve sufficient dilution.

**Table 12. Minimum Dms required for Variant Project with GWR concentrate flow (Trussell, 2016)**

| Case No. | Minimum required Dm for compliance | | | | Modeled Dm | | |
|---|---|---|---|---|---|---|---|
| | WW flow (mgd) | 50% of Dm required | 80% of Dm required | 100% of Dm required | Cederwall | UM3 | NRFIELD |
| V6 | 0.0 | 69 | 37 | 30 | 15.6 | 16.2 | - |
| V7 | 1.0 | 65 | 41 | 32 | 16.4 | 17.2 | - |
| V8 | 3.0 | 73 | 46 | 37 | 21.6 | 22.2 | - |
| V9 | 5.3 | 80 | 50 | 40 | 76.6 | 55.0 | - |
| V10 | 15.9 | 96 | 60 | 48 | - | 194 | 220 |

Several possible mitigation strategies have been suggested to increase dilution:

1. Augment the discharges by adding treated RO water to the brine from the GWR or desalination facility. This would increase the jet velocities and decrease the density difference between the effluent and receiving water, both of which will increase dilution.
2. Increase the flow per port by either temporarily storing on site in a storage basin and pumping briefly at higher flow rates, or by closing off some ports. Both would increase the jet velocity and increase dilution.
3. Discharge through upwardly inclined nozzles either by retrofitting the existing horizontal nozzles or by constructing a new dedicated brine diffuser.

These options are analyzed in this section, focusing on cases V6, V7, and V8. In addition, the effect of retrofitting upward nozzles on the MRWPCA diffuser on the dilution of positively buoyant discharges is discussed along with some engineering issues.

### 7.2 Flow Augmentation

In this scenario, flows with densities close to freshwater are added to the brine and secondary effluent mixtures to increase jet velocity and decrease the density difference between the combined effluent and the receiving water.

The following procedure was followed to analyze this scenario. A quantity of water was added to the base flow and the new flow rate and effluent density were computed. The internal hydraulics program was then run and the variations in effective port diameter and flow per port along the diffuser were obtained. The calculations account for the variation of port opening with flow as explained in Appendix A. Dilution calculations were then performed for the ports with highest and lowest flows and the lowest value of dilution chosen. The dilution calculations were performed using the Cederwall equation (Eq. 3), and UM3 was also run for some cases to determine jet trajectories.

The results are plotted as functions of flow added in Figure 18 and are summarized in Table 13. The effect of added flow on the jet trajectories predicted by UM3 is shown in Figure 19 for two typical cases: V6.10 and V6.14.

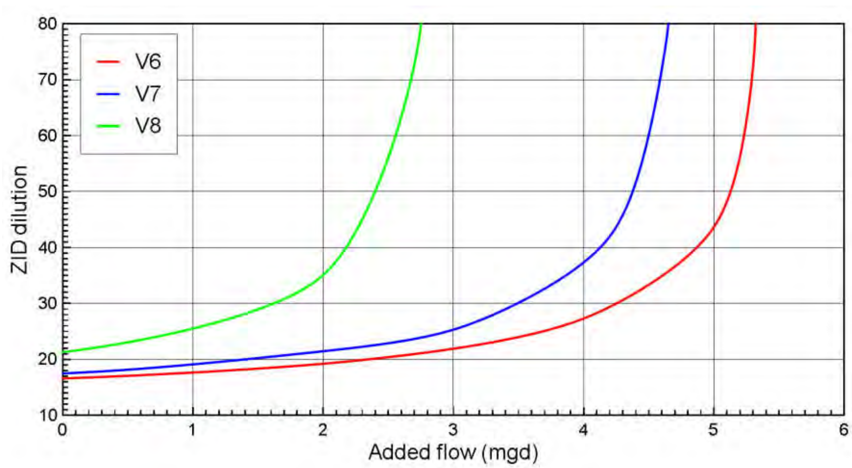



**Figure 18. Effect on dilution of added freshwater flows to cases V6, V7, and V8.**

## Table 13. Effect of added flow on dilution for selected scenarios

| Case No. | Background density | Makeup Flow | Combined flow | | Port conditions | | | | | | | Dilution by Cederwall formula |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Flow | Density | Flow | | Diam. | Height | Velocity | Froude no. | y/dF | |
| | (kg/m³) | (mgd) | (mgd) | (kg/m³) | (gpm) | (cfs) | (in) | (ft) | (ft/s) | | | |
| V6.10 | 1025.8 | 0.0 | 9.9 | 1041.1 | 54.3 | 0.121 | 1.70 | 4.0 | 7.7 | 29.5 | 0.96 | 16.6 |
| V6.11 | 1025.8 | 0.5 | 10.4 | 1039.0 | 56.3 | 0.126 | 1.72 | 4.0 | 7.8 | 32.0 | 0.87 | 17.0 |
| V6.12 | 1025.8 | 1.0 | 10.9 | 1037.2 | 58.8 | 0.131 | 1.74 | 4.0 | 7.9 | 34.9 | 0.79 | 17.6 |
| V6.13 | 1025.8 | 2.0 | 11.9 | 1033.9 | 58.6 | 0.131 | 1.74 | 4.0 | 7.9 | 41.3 | 0.67 | 19.2 |
| V6.14 | 1025.8 | 3.0 | 12.9 | 1031.1 | 63.9 | 0.142 | 1.78 | 4.0 | 8.2 | 52.6 | 0.51 | 21.9 |
| V6.15 | 1025.8 | 4.0 | 13.9 | 1028.7 | 72.4 | 0.161 | 1.84 | 4.0 | 8.7 | 74.3 | 0.35 | 27.3 |
| V6.16 | 1025.8 | 5.0 | 14.9 | 1026.7 | 76.3 | 0.170 | 1.87 | 4.0 | 8.9 | 136.2 | 0.19 | 43.7 |
| V6.17 | 1025.8 | 5.3 | 15.2 | 1026.1 | 77.8 | 0.173 | 1.88 | 4.0 | 9.0 | 243.6 | 0.10 | 72.6 |
| V7.10 | 1024.8 | 0.0 | 10.9 | 1036.5 | 58.3 | 0.130 | 1.74 | 4.0 | 7.9 | 34.2 | 0.81 | 17.4 |
| V7.11 | 1024.8 | 0.5 | 11.4 | 1034.8 | 57.2 | 0.128 | 1.73 | 4.0 | 7.8 | 36.7 | 0.76 | 18.1 |
| V7.12 | 1024.8 | 1.0 | 11.9 | 1033.2 | 60.2 | 0.134 | 1.75 | 4.0 | 8.0 | 41.0 | 0.67 | 19.1 |
| V7.13 | 1024.8 | 2.0 | 12.9 | 1030.5 | 66.5 | 0.148 | 1.80 | 4.0 | 8.4 | 51.2 | 0.52 | 21.4 |
| V7.14 | 1024.8 | 3.0 | 13.9 | 1028.2 | 67.3 | 0.150 | 1.81 | 4.0 | 8.4 | 66.3 | 0.40 | 25.3 |
| V7.15 | 1024.8 | 4.2 | 15.1 | 1025.8 | 77.3 | 0.172 | 1.87 | 4.0 | 9.0 | 129.8 | 0.20 | 42.0 |
| V7.16 | 1024.8 | 4.6 | 15.5 | 1025.1 | 78.8 | 0.176 | 1.88 | 4.0 | 9.1 | 241.4 | 0.11 | 72.0 |
| V7.17 | 1024.8 | 4.75 | 15.7 | 1024.8 | 78.8 | 0.176 | 1.88 | 4.0 | 9.1 | 1283.9 | 0.02 | 353.5 |
| V8.10 | 1024.8 | 0.0 | 12.9 | 1030.6 | 66.5 | 0.148 | 1.80 | 4.0 | 8.4 | 50.6 | 0.53 | 21.3 |
| V8.11 | 1024.8 | 0.5 | 13.4 | 1029.4 | 69.3 | 0.155 | 1.82 | 4.0 | 8.6 | 57.8 | 0.46 | 23.0 |
| V8.12 | 1024.8 | 1.0 | 13.9 | 1028.3 | 72.6 | 0.162 | 1.84 | 4.0 | 8.8 | 67.5 | 0.39 | 25.5 |
| V8.13 | 1024.8 | 2.0 | 14.9 | 1026.3 | 76.3 | 0.170 | 1.87 | 4.0 | 8.9 | 104.1 | 0.25 | 35.1 |
| V8.14 | 1024.8 | 2.5 | 15.4 | 1025.3 | 78.3 | 0.175 | 1.88 | 4.0 | 9.1 | 182.6 | 0.14 | 56.1 |
| V8.15 | 1024.8 | 2.8 | 15.7 | 1024.8 | 78.3 | 0.175 | 1.88 | 4.0 | 9.1 | 1291.0 | 0.02 | 355.4 |

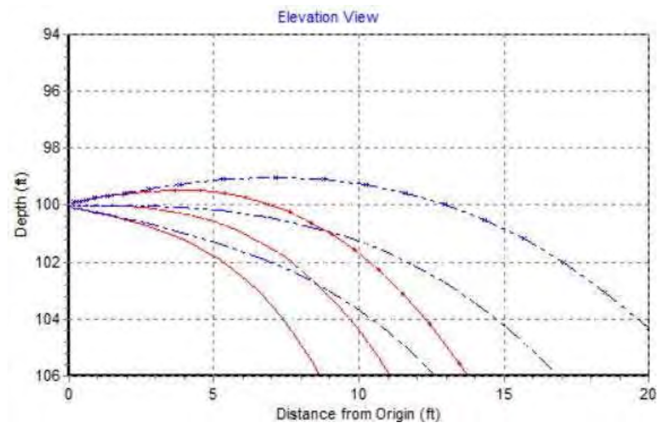



**Figure 19. Jet trajectories predicted by UM3 for flow cases V6.10 (red) and V6.14 (blue).**

The higher jet velocity and smaller density differences leads to a flatter and longer trajectory and therefore higher dilution. Of these, the main effect is due to the decreased density difference because the ports open as the flow increases, offsetting the increased jet velocity that would occur for a fixed office.

For low added volumes the effect on dilution is small. As the flow increases to where the density of the combined effluent approaches that of the background, i.e. the flow becomes neutrally buoyant, the dilution increases exponentially. It becomes theoretically infinite as for this case the jet trajectory is then horizontal and the jet centerline does not impact the seabed. For the three cases considered, the additional volumes required to satisfy the dilution requirements of Table 12 and the volumes for neutral buoyancy are summarized in Table 14.

**Table 14. Effect of added freshwater volumes**

| Case No. | Base flow | For 80% compliance | | Additional flow for neutral buoyancy |
|---|---|---|---|---|
| | | Dilution needed | Additional flow | |
| | (mgd) | | (mgd) | (mgd) |
| V6 | 9.9 | 38 | 4.8 | 5.5 |
| V7 | 10.9 | 42 | 4.2 | 4.8 |
| V8 | 12.9 | 47 | 2.3 | 2.8 |

Note that the actual volumes required to achieve the water quality requirements would be slightly less than those given in Table 14 due to "in-pipe" dilution by the added flow that will reduce the source concentrations.

### 7.3 Varied Port Flow

This mitigation technique varies the flow per port. This can be accomplished either by holding the effluent temporarily in a storage basin and then pumping intermittently at higher flow rates or by closing some of the open ports or opening some of the closed ports. More port flow increases the jet exit velocity which increases entrainment and increases the jet trajectory length thereby increasing dilution. Because these strategies are essentially identical in terms of their effect on dilution, only the former case is analyzed here. The results can also be used to estimate the effects of opening or closing ports. There are presently 129 open ports and 42 closed ports. So opening all ports would result in a reduction in the flow per port by 25%. This case is included below.

The procedure is similar to that of the previous section. A pumping rate was assumed and the internal hydraulics program was run. The highest and lowest port flows and their diameters were obtained and dilution calculations run for both. The lowest was chosen. For each pumping rate, the composition of the effluent, i.e. its density, was assumed constant and equal to that of the base cases.

The resulting dilutions are plotted as a function of pumping rate in Figure 20 and summarized in Table 15. The effect of increased flow on jet trajectory predicted by UM3 is shown for two typical cases in Figure 21.

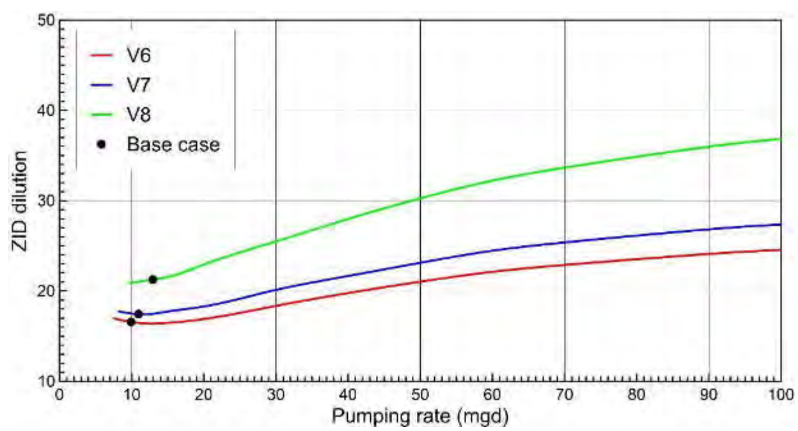



**Figure 20. Effect of pumping rate on dilution for flow cases V6, V7, and V8.**

The increased jet velocity leads to a longer and flatter trajectory leading to increased dilution at the impact point. However, as the flow increases, the port opening also increases, offsetting the increased jet velocity.

The dilution increases quite slowly in response to increased flow rate and the required dilutions cannot be achieved for flows below about 100 mgd, where the head required would exceed 50 ft. Note that the effect on dilution of closing ports is the same and can be readily estimated. For example, a doubling of the pumping rate is equivalent to closing half the ports.

**Table 15. Effect of added flow on dilution for selected scenarios**

| Case No. | Background density | Effluent | | Port conditions | | | | | | | Dilution by Cederwall formula |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Flow | Density | Flow | | Diam. | Height | Velocity | Froude no. | y/dF | |
| | (kg/m³) | (mgd) | (kg/m³) | (gpm) | (cfs) | (in) | (ft) | (ft/s) | | | |
| V6.20 | 1025.8 | 9.9 | 1041.1 | 54.3 | 0.121 | 1.70 | 4.0 | 7.7 | 29.5 | 0.96 | 16.6 |
| V6.21 | 1025.8 | 12.0 | 1041.1 | 64.8 | 0.145 | 1.79 | 4.0 | 8.3 | 30.9 | 0.87 | 16.4 |
| V6.22 | 1025.8 | 15.0 | 1041.1 | 75.1 | 0.167 | 1.86 | 4.0 | 8.9 | 32.6 | 0.79 | 16.5 |
| V6.23 | 1025.8 | 20.0 | 1041.1 | 103.3 | 0.230 | 2.01 | 4.0 | 10.5 | 36.9 | 0.65 | 16.9 |
| V6.24 | 1025.8 | 30.0 | 1041.1 | 160.5 | 0.358 | 2.21 | 4.0 | 13.4 | 45.2 | 0.48 | 18.3 |
| V6.25 | 1025.8 | 40.0 | 1041.1 | 207.8 | 0.463 | 2.32 | 4.0 | 15.8 | 51.8 | 0.40 | 19.8 |
| V6.26 | 1025.8 | 60.0 | 1041.1 | 308.3 | 0.688 | 2.52 | 4.0 | 19.8 | 62.5 | 0.30 | 22.1 |
| V6.27 | 1025.8 | 100.0 | 1041.1 | 505.3 | 1.127 | 2.87 | 4.0 | 25.1 | 74.1 | 0.23 | 24.5 |
| V7.20 | 1024.8 | 10.9 | 1036.5 | 58.3 | 0.130 | 1.74 | 4.0 | 7.9 | 34.2 | 0.81 | 17.4 |
| V7.21 | 1024.8 | 12.0 | 1036.5 | 59.4 | 0.132 | 1.75 | 4.0 | 7.9 | 34.3 | 0.80 | 17.4 |
| V7.22 | 1024.8 | 15.0 | 1036.5 | 76.0 | 0.169 | 1.86 | 4.0 | 9.0 | 37.7 | 0.68 | 17.7 |
| V7.23 | 1024.8 | 20.0 | 1036.5 | 105.3 | 0.235 | 2.02 | 4.0 | 10.6 | 42.5 | 0.56 | 18.3 |
| V7.24 | 1024.8 | 30.0 | 1036.5 | 161.4 | 0.360 | 2.21 | 4.0 | 13.5 | 52.0 | 0.42 | 20.1 |
| V7.25 | 1024.8 | 40.0 | 1036.5 | 206.8 | 0.461 | 2.32 | 4.0 | 15.7 | 59.1 | 0.35 | 21.7 |
| V7.26 | 1024.8 | 60.0 | 1036.5 | 307.3 | 0.685 | 2.52 | 4.0 | 19.8 | 71.4 | 0.27 | 24.5 |
| V7.27 | 1024.8 | 100.0 | 1036.5 | 609.7 | 1.360 | 3.08 | 4.0 | 26.3 | 85.7 | 0.18 | 27.3 |
| V8.20 | 1024.8 | 12.9 | 1030.6 | 66.5 | 0.148 | 1.80 | 4.0 | 8.4 | 50.6 | 0.53 | 21.3 |
| V8.21 | 1024.8 | 15.0 | 1030.6 | 77.8 | 0.173 | 1.88 | 4.0 | 9.0 | 53.1 | 0.48 | 21.6 |
| V8.22 | 1024.8 | 20.0 | 1030.6 | 105.9 | 0.236 | 2.02 | 4.0 | 10.6 | 60.4 | 0.39 | 22.9 |
| V8.23 | 1024.8 | 30.0 | 1030.6 | 154.8 | 0.345 | 2.19 | 4.0 | 13.2 | 72.1 | 0.30 | 25.5 |
| V8.24 | 1024.8 | 40.0 | 1030.6 | 205.3 | 0.458 | 2.32 | 4.0 | 15.6 | 82.8 | 0.25 | 28.0 |
| V8.25 | 1024.8 | 60.0 | 1030.6 | 305.8 | 0.682 | 2.52 | 4.0 | 19.7 | 100.3 | 0.19 | 32.2 |
| V8.26 | 1024.8 | 100.0 | 1030.6 | 500.8 | 1.117 | 2.86 | 4.0 | 25.0 | 119.7 | 0.14 | 36.8 |

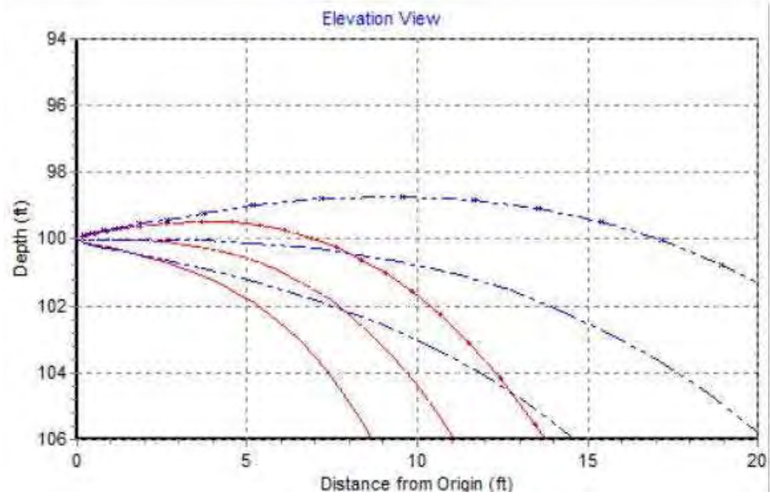



**Figure 21. Jet trajectories predicted by UM3 for flow cases V7.10 (red) and V7.14 (blue).**

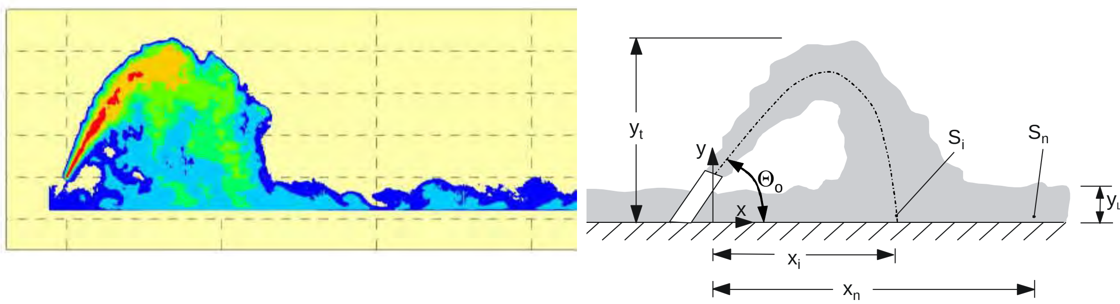
The reason for this seemingly paradoxical result is that the dilution for these cases is primarily a result of jet-induced entrainment. For a pure jet (i.e. a flow with neutral buoyancy) from a fixed orifice the flow, jet velocity, and entrained flow all increase in direct proportion to each other. The dilution at any distance from the nozzle, which is the ratio of the entrained flow to the source flow, therefore remains constant and is dependent only on the nozzle diameter (Fischer et al. 1979). In other words, increasing the flow for a pure jet does not increase dilution at a fixed point.

Dilution at the seabed does increase for the present cases as the flow increases, however, due to the longer jet trajectory before impacting the seabed as shown in Figure 21. The effect is again mitigated, however, by the variable opening of the nozzles: as the flow increases, the increase in jet velocity is much less than for a fixed orifice. Similarly, reducing the flow per port by opening closed ports does not result in a significant change in dilution. A fixed orifice would result in longer trajectories and higher dilutions than found above, but the head required would probably be prohibitive. It is clear that varying the flow per port either by pumping at a higher rate or opening or closing ports is not an effective strategy for increasing dilution.

### 7.4 Effect of Inclined Nozzles

#### 7.4.1 Introduction

Diffusers for discharging dense effluents normally consists of nozzles that are inclined upwards. The optimum angle to the horizontal is 60° (Roberts and Abessi, 2014) as this maximizes the jet path length and dilution at the impact point. Such jets have been extensively studied and a typical flow image is shown in Figure 22. As shown in the definition diagram, the jet reaches a terminal rise height $y_t$ and then falls back to the seabed. The impact dilution, $S_i$, interpreted here as the ZID dilution, is where the jet centerline intersects the seabed.




**LIF image** **Definition diagram**

**Figure 22. Laser Induced Fluorescence (LIF) image of a 60° jet and definition diagram.**

Inclined jets can be achieved either by retrofitting the existing check valves with upwardly inclined nozzles or by building a dedicated brine outfall and diffuser. The analyses are similar and both are considered below. Also discussed is the effect on dilution of positively buoyant effluents of retrofitting with inclined jets.

### 7.4.2 Diffuser Retrofit

The nozzle designs with check valves are shown in Figure A-3 in Appendix A. For the present analysis it was assumed that valves with similar hydraulic characteristics (Figure A-2) were installed but inclined upwards at 60°.

The dilution $S_i$ of a single 60° jet and the terminal rise height $y_t$ can be estimated from (Roberts et al. 1997):

$$\frac{S_i}{F_j} = 1.6 \tag{22}$$

and

$$\frac{y_t}{dF_j} = 2.2 \tag{23}$$

where $F_j$ is the jet densimetric Froude number (Eq. 2) and $d$ the effective nozzle diameter. These equations have been widely used for brine diffuser designs.

The dilutions and jet rise heights for all the base cases with dense discharges were computed and the results are summarized in Table 16, which can be compared to Table 7. The hydraulics was assumed to be the same as for the horizontal jets.

It is apparent that the inclined jets increase dilution substantially. Dilution for the base case, P2 pure brine, increases from 16:1 to 46:1. All of the required dilutions for cases V6, V7, and V8 are also met and exceeded. The rise heights of the jets are all less than 100 ft so the jets will always be submerged.

#### 7.4.3 Dedicated Diffuser

A dedicated diffuser for brine discharges would probably consist of multiple nozzles inclined upwards at 60° to the horizontal. (Not vertical as implied in the settlement agreement as vertical jets result in impaired dilution). The nozzles would be either distributed along the sides of the diffuser or clustered in rosette risers as shown in Figure 23.


**Figure 23. A brine diffuser with multiport rosettes.**

The analysis for the diffuser would be similar to that for the inclined jets above, but it is noted that the outfall and diffuser could be much shorter than the existing outfall. Assuming that the outfall is only used for brine discharges (with all secondary effluent through the MRWPCA outfall), the peak flow would be about 14 mgd, requiring an outfall diameter of around 24 inches. The outfall need not be as long as the MRWPCA outfall as shoreline impact is not a major concern and deep water is not required for dilution. For example (although further analyses would be needed to optimize the outfall and diffuser lengths and nozzle details), the rise height of the jets for the pure brine case in Table 13 is about 10 ft, so the discharge could be into relatively shallow water. Costs for similar outfalls vary widely, but Roberts et al. (2012) quote a median price range for installed outfalls of 24 inch diameter of about $3,700 per meter with a range from $1,000 to $8,000 per meter.

**Table 16. Effect of discharge through 60° nozzles**

| Case No. | Background conditions | | Effluent conditions | | Port conditions | | | | | | | Equations 4 and 5 at ZID | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | | | Dilution | Salinity | | Rise height |
| | Salinity | Density | Salinity | Density | Flow | | Diam. | Height | Velocity | Froude no. | y/dF | | At impact | Incr-ement | |
| | (ppt) | (kg/m³) | (ppt) | (kg/m³) | (gpm) | (cfs) | (in) | (ft) | (ft/s) | | | | (ppt) | (ppt) | (ft) |
| P1 | | | 0.80 | 998.8 | | | | | | | | | | | |
| P2 | 33.89 | 1025.8 | 58.23 | 1045.2 | 76.3 | 0.170 | 1.87 | 4.0 | 8.9 | 29.0 | 0.89 | 46.3 | 34.41 | 0.53 | 9.9 |
| P3 | 33.34 | 1024.8 | 53.62 | 1041.2 | 75.0 | 0.167 | 1.86 | 4.0 | 8.9 | 31.4 | 0.82 | 50.3 | 33.75 | 0.40 | 10.7 |
| P4 | 33.34 | 1024.8 | 50.32 | 1038.5 | 80.8 | 0.180 | 1.89 | 4.0 | 9.2 | 35.5 | 0.72 | 56.8 | 33.64 | 0.30 | 12.3 |
| P5 | 33.34 | 1024.8 | 35.23 | 1026.4 | 117.8 | 0.263 | 2.07 | 4.0 | 11.2 | 120.3 | 0.19 | 192.5 | 33.35 | 0.01 | 45.7 |
| P6 | 33.34 | 1024.8 | 24.24 | 1017.6 | 188.5 | 0.420 | 2.28 | 4.0 | 14.8 | 71.5 | - | - | - | - | - |
| V1 | 33.89 | 1025.8 | 58.23 | 1045.2 | 50.8 | 0.113 | 1.67 | 4.0 | 7.4 | 25.6 | 1.12 | 40.9 | 34.48 | 0.59 | 7.8 |
| V2 | 33.89 | 1025.8 | 52.48 | 1040.5 | 54.3 | 0.121 | 1.70 | 4.0 | 7.7 | 30.1 | 0.94 | 48.1 | 34.27 | 0.39 | 9.4 |
| V3 | 33.89 | 1025.8 | 47.78 | 1036.6 | 54.6 | 0.122 | 1.71 | 4.0 | 7.6 | 34.7 | 0.81 | 55.6 | 34.14 | 0.25 | 10.9 |
| V4 | 33.34 | 1024.8 | 35.20 | 1026.4 | 77.9 | 0.174 | 1.88 | 4.0 | 9.0 | 102.0 | 0.25 | 163.1 | 33.35 | 0.01 | 35.1 |
| V5 | 33.89 | 1025.8 | 18.75 | 1012.7 | 160.8 | 0.359 | 2.21 | 4.0 | 13.5 | 48.9 | - | - | - | - | - |
| V6 | 33.89 | 1025.8 | 53.27 | 1041.1 | 54.3 | 0.121 | 1.70 | 4.0 | 7.7 | 29.5 | 0.96 | 47.2 | 34.30 | 0.41 | 9.2 |
| V7 | 33.34 | 1024.8 | 47.78 | 1036.5 | 58.3 | 0.130 | 1.74 | 4.0 | 7.9 | 34.2 | 0.81 | 54.7 | 33.61 | 0.26 | 10.9 |
| V8 | 33.34 | 1024.8 | 40.52 | 1030.6 | 66.5 | 0.148 | 1.80 | 4.0 | 8.4 | 50.6 | 0.53 | 80.9 | 33.43 | 0.09 | 16.7 |
| V9 | 33.89 | 1025.8 | 35.01 | 1026.1 | 77.8 | 0.173 | 1.88 | 4.0 | 9.0 | 260.5 | 0.10 | 416.7 | 33.89 | 0.00 | 89.8 |
| V10 | 33.34 | 1024.8 | 20.67 | 1014.7 | 143.3 | 0.320 | 2.16 | 4.0 | 12.6 | 52.6 | - | - | - | - | - |

### 7.4.4 Effect of Inclined Nozzles on Buoyant Flows

Diffusers for positively buoyant discharges usually have horizontal nozzles (as in the MRWPCA diffuser) as this maximizes jet trajectory and dilution and helps promote submergence. Inclining the nozzles upwards may reduce dilution somewhat. In order to investigate this effect, dilutions for the buoyant discharge scenarios (P1, P6, V5, and V10) of Table 8 were recomputed but with 60° inclined nozzles. The same hydraulic conditions were assumed. Dilution simulations were done with the model UM3 only as NRFIELD assumes horizontal nozzles. The results are summarized in Table 17.

**Table 17. Summary of UM3 Dilution Simulations for Buoyant Effluent Scenarios with Horizontal and 60° Nozzles**

| Case No. | Flow rate (mgd) | Effluent density ($kg/m^3$) | Port diam. (in) | Ocean condition | Horizontal | | 60° | |
|---|---|---|---|---|---|---|---|---|
| | | | | | Average dilution | Rise height (center-line) (ft) | Average dilution | Rise height (center line) (ft) |
| P1 | 19.78 | 998.8 | 2.00 | Upwelling | 191 | 58 | 184 | 62 |
| P1 | 19.78 | 998.8 | 2.00 | Davidson | 327 | 100 (surface) | 310 | 100 (surface) |
| P1 | 19.78 | 998.8 | 2.00 | Oceanic | 240 | 82 | 247 | 91 |
| P6 | 33.76 | 1017.6 | 2.25 | Davidson | 154 | 86 | 142 | 93 |
| V5 | 28.77 | 1012.7 | 2.18 | Upwelling | 122 | 47 | 111 | 53 |
| V10 | 25.85 | 1014.7 | 2.13 | Davidson | 195 | 100 (surface) | 185 | 100 (surface) |

For buoyant discharges of essentially freshwater into fairly deep water the dilution is primarily effected by the buoyancy flux, so the source momentum flux, and therefore the nozzle orientation, is relatively unimportant. This effect is shown in the trajectories predicted by UM3 for case P1 in Figure 24. The trajectory lengths are similar with a slightly higher rise for the inclined jets. The results show small reductions in dilution of about 5% for this case as the trajectory reduction is offset by the increased plume rise height. For case P1 with the Oceanic density profile, the results actually imply a slight increase in dilution with the inclined nozzles due to the increased rise height. For cases P6, V5, and V10 (buoyant discharges with the density difference reduced due to blending with brine), the momentum flux is slightly more important, but even here the dilution reduction is less than 10%

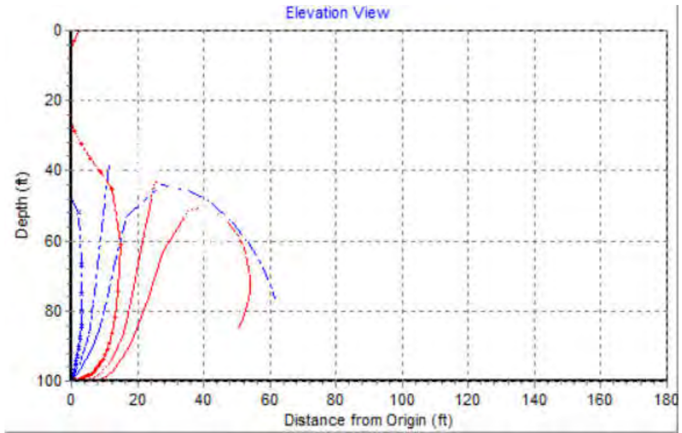



**Figure 24. UM3 predicted trajectories for horizontal (red) and 60° inclined (blue) nozzles for case P1 with upwelling density profile.**

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## APPENDIX A. DIFFUSER HYDRAULICS WITH CHECK VALVES

### 1. Introduction

The calculation procedure to predict the internal hydraulics and flow distribution for diffusers with ports equipped with check valves is described below.

### 2. Check Valves

Typical check valves similar to those installed on the MRWPCA outfall are shown in Figure A-1. As the flow though the valve increases, the opening area increases, up to some limit. The valves attached to the MRWPCA outfall are four-inch flange TideFlex TF-2, Series 35, Hydraulic Code 61. The characteristics of the valves were provided by the manufacturer, TideFlex, Inc. and are shown in Figure A-2. The main characteristics are total head loss, jet velocity, and effective opening area as functions of flow rate.

**Figure A-1. Typical "Duckbill" Check Valves**

The relationship $E' = f(Q_j)$ between the total head, $E'$ and flow $Q_j$ of Figure A2 over the flow range 50 to 300 gpm can be closely approximated by the linear relationship:

$$E' = 0.020Q_j - 0.276 \quad \text{(A1)}$$

where $E'$ is the head in feet, and $Q_j$ the flow rate in gpm. Similarly, the jet velocity (in ft/s) can be approximated by:

$$V_j = -4.71 \times 10^{-5} Q_j^2 + 6.49 \times 10^{-2} Q_j + 4.28 \quad \text{(A2)}$$

The effective nozzle area $A_j$ is then given by:

$$A_j = \frac{Q_j}{V_j}$$

and the diameter of an equivalent round nozzle, $d_e$ by:

$$d_e = \sqrt{\frac{4A_j}{\pi}} \tag{A3}$$

Therefore, only the relationship between head and flow, Eq. A1, and flow and velocity, Eq. A2, are needed and all other properties can be calculated from them. Alternatively, the equivalent diameter can be calculated from the flow and head assuming a discharge coefficient of one.

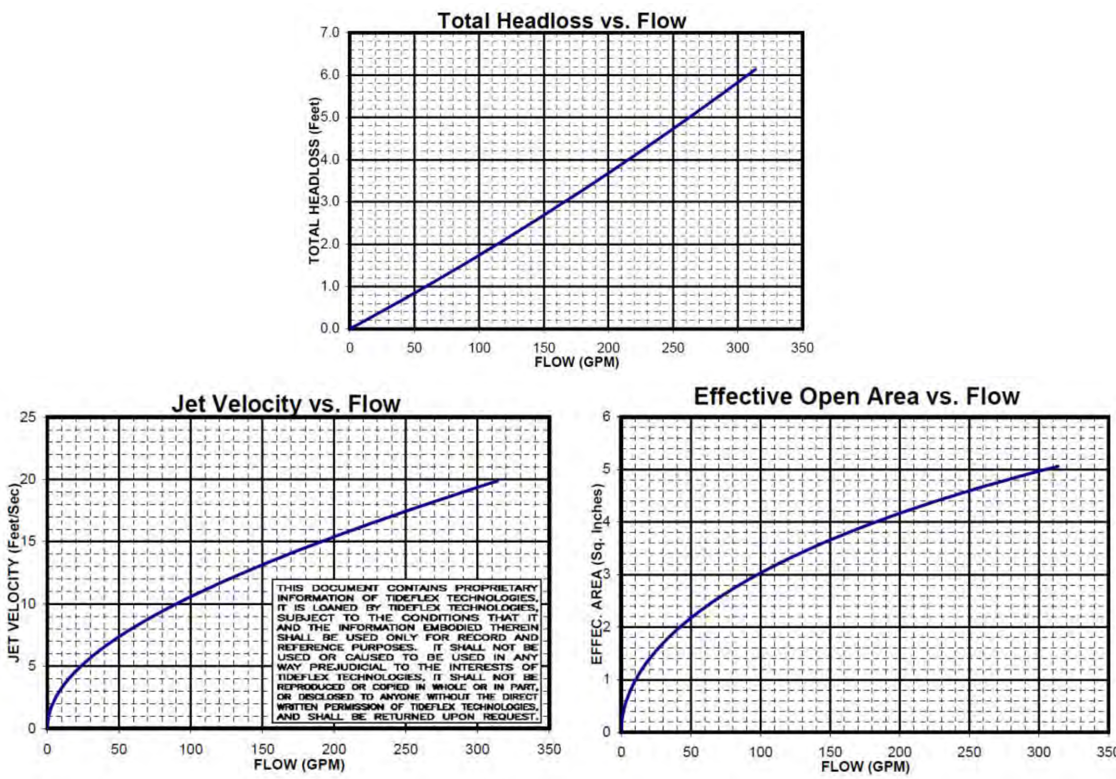



**Figure A-2. Characteristics of 4" wide bill TideFlex check valve Hydraulic Code 61**

### 3. Port Head Loss

According to the outfall design drawings (Figure A-3), the check valves are fastened over existing two-inch diameter ports. The entrances to the ports are gradually tapered bell mouths.

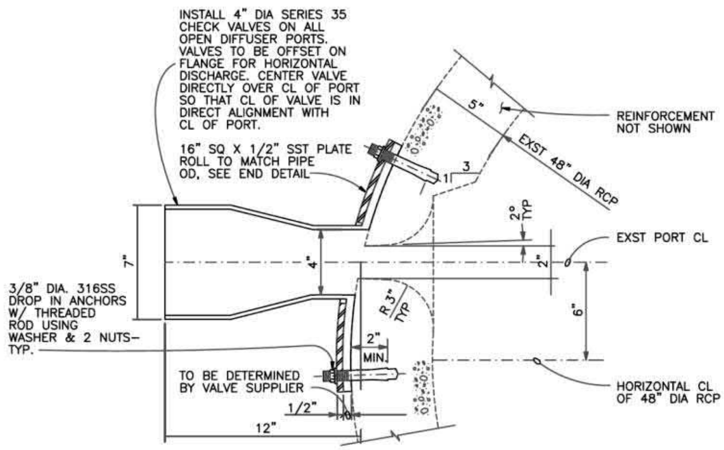



**Figure A-3. Port and check valve arrangement**

The head loss in the entrance from the diffuser to the port (entrance loss) can be approximated by:

$$h'_f = x_{en} \frac{V_d^2}{2g} \qquad \text{(A4)}$$

where $x_{en}$ is an entrance loss coefficient and $V_d$ the velocity in the diffuser pipe at the port. The value of $x_{en}$ is not known exactly, but experiments on Tee fittings reported by Ding et al. (2005) give loss coefficients for 6, 8, and 10 inch pipes with branching flows. For the larger Tees the loss coefficients ranging from about 0.43 to 0.63 depending on the ratio of flow in the branch to the main pipe. We assume a constant value of $x_{en}$ = 0.63. Because the port entrances are rounded, and most of the head loss is in the jet velocity head, however, the results are not sensitive to the value of $x_{en}$.

Applying the Bernoulli equation to the flow through the port and valve and combining Eqs. A1 and A4 yields for the head at the port:

$$\begin{aligned} E &= \text{Entrance loss} + \text{Valve loss} \\ &= x_{en} \frac{V_d^2}{2g} + 0.020 Q_j - 0.276 \end{aligned}$$

which can be rearranged as:

$$Q_j = \frac{E - x_{en}\left(V_d^2/2g\right) + 0.276}{0.02} \qquad \text{(A5)}$$

**4. End Gate Port**

The end gate of the diffuser has an opening at the bottom as shown in Figure A-4. It is approximately 2 inches high in a 48-inch diameter pipe which corresponds to an area of 25.8 in$^2$, equivalent to a round opening of 5.73 inch diameter.

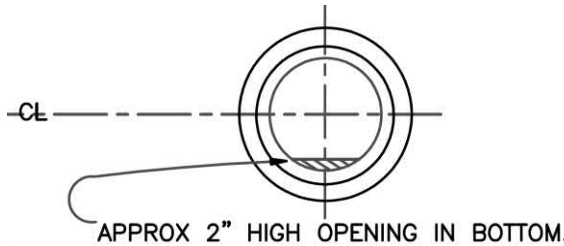



**Figure A-4. End gate opening.**

We approximate the discharge though this opening as being equivalent to a round sharp-edged orifice:

$$Q = C_D A \sqrt{2gE} \tag{A6}$$

where $C_D$ is the discharge coefficient assumed equal to 0.62, $A$ is the opening area and $E$ the total head in the pipe just upstream of the end gate.

**5. Diffuser and Pipe Head Loss**

The head loss due to friction in the diffuser and outfall pipe can be approximated by the Darcy-Weisbach equation:

$$h_f = f \frac{L}{D} \frac{V_d^2}{2g} \tag{A7}$$

where $L$ is the pipe length, $D$ the pipe diameter, and $f$ the pipe friction factor, given by:

$$f = f\left(\mathrm{Re}, \frac{k}{D}\right) \tag{A8}$$

where Re is the Reynolds number, $\mathrm{Re} = V_d D/\nu$ where $\nu$ is the kinematic viscosity and $k$ the equivalent roughness height. The friction factor can be obtained from the Moody diagram, but for computational purposes it is more convenient to estimate it from:

$$f = \frac{0.25}{\left[\log\left(\frac{k/D}{3.7} + \frac{5.74}{\mathrm{Re}^{0.9}}\right)\right]^2} \tag{A9}$$

Generally accepted values of *k* for concrete pipe range from 0.012 to 0.12 inches. We assume an average value of *k* = 0.066 inches.

**6. Calculation Procedure**

The calculation procedure is a problem in manifold hydraulics and is iterative, similar to that described in described in Fischer et al. (1979) or Roberts et al. (2010). It follows this procedure:

1. Assume a value of the head just upstream of the end gate, $E_1$. Then compute the flow $Q_1$ through the end opening from Eq. A6.
2. Compute the velocity in the diffuser pipe just upstream.
3. Compute the pipe friction factor from Eq. A9.
4. Compute the head in the diffuser pipe at the next upstream port from:

$$E_2 = E_1 + f\,\frac{s}{D}\frac{V_d^2}{2g} + \frac{\Delta\rho}{\rho}\Delta z \qquad \text{(A10)}$$

where *s* is the port spacing, $\Delta\rho = \rho_a - \rho_o$ is the density difference between the receiving water and the discharge, $\rho$ the receiving water density, and $\Delta z$ the height difference between the ports (positive if the inshore port is higher, i.e. the diffuser is sloping downwards). Note that for a dense discharge, $\Delta\rho$ is a negative number.

5. Compute the flow from the next upstream port, $Q_2$, from Eq. 1.
6. Add the flows $Q_1$ and $Q_2$ to get the flow in the diffuser just upstream of the port.
7. Repeat steps 2 through 6 for each port until the innermost port is reached.

Finally, the head loss in the rest of the outfall pipe up to the headworks is computed from

$$E = E_n + f\,\frac{L}{D}\frac{V_d^2}{2g} + \text{density head}$$

where $E_n$ is the head at the innermost port, *n,* and *L* is the outfall length (excluding the diffuser).

The total flow and head loss in the outfall are not known ahead of time, so the assumed head is Step 1 is then adjusted iteratively until the desired flow is achieved. An Excel spreadsheet was written to accomplish these calculations. A typical page from the spreadsheet for scenario P2 (pure brine) follows. For this example, the flow per port increases in the offshore direction due to the negative density head (dense brine discharge).

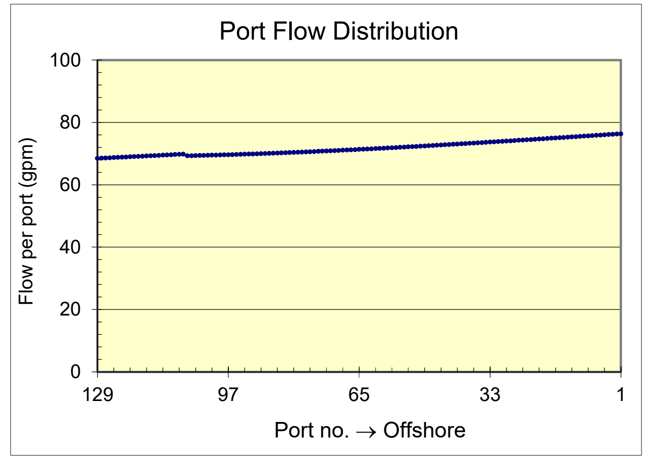
The total head for this case is essentially zero. This seemingly counterintuitive result is because the density head essentially offsets the losses due to friction and jet velocity.

**Compute port flow distribution and total headloss with check valves**
**Tideflex Series TF-2, 35**

**Inputted variables**

| | | | |
|---|---|---|---|
| No. ports per riser, Nr = | **1** | Outfall pipe length, L (ft) = | **10,274** |
| Port spacing, Sr (ft) = | **8** | Roughness height, ks (in) = | **0.066** |
| Depth of end port, Hend (ft) = | **107** | Gravity, g (ft2/s) = | **32.2** |
| Slope of diffuser, Sl = | **0.0110** | Ambient density (kg/m3) | **1025.8** |
| Entrance loss coeff, xen = | **0.63** | Effluent density (kg/m3) | **1045.2** |
| | | Density difference, Drho/rho = | **-0.019** |
| | | Kinematic viscosity, nu (ft2/s) = | **1.2E-05** |

| | | | | |
|---|---|---|---|---|
| | | Outfall friction headloss: | 0.81 | ft |
| **Head at end:** | 1.26 ft | Diffuser headloss: | 1.11 | ft |
| Target flow: | **14.0** mgd | Density head: | -1.81 | ft |
| **Computed flow:** | **14.0** mgd | **Total outfall head:** | **0.11** | ft |




| Pipe segment | Pipe ID | Port number | Distance from end | Depth | Total head | Flow | | | | Velocity | | Equivalent round port | | Reynolds no. | Friction factor | Friction loss |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | Per port | Per riser | Cumulative | | Pipe | Jet | Diam. | Froude | | | |
| | (in) | n | (ft) | (ft) | (ft) | (gpm) | (gpm) | (gpm) | (ft3/s) | (ft/s) | (ft/s) | (in) | | | | (ft) |
| End port | | | | | 1.26 | 457 | 457 | 457 | 1.0 | 0.1 | 5.7 | 5.73 | 10.5 | | | |
| 1 | 48 | 1 | 0 | 107.0 | 1.26 | 76.3 | 76 | 533 | 1.2 | 0.1 | 9.0 | 1.87 | 29.1 | 3.1E+04 | 0.027 | 0.000 |
| | | 2 | 8 | 106.9 | 1.26 | 76.3 | 76 | 609 | 1.4 | 0.1 | 9.0 | 1.87 | 29.1 | 3.6E+04 | 0.026 | 0.000 |
| | | 3 | 16 | 106.8 | 1.26 | 76.2 | 76 | 686 | 1.5 | 0.1 | 9.0 | 1.87 | 29.1 | 4.0E+04 | 0.026 | 0.000 |
| | | 4 | 24 | 106.7 | 1.26 | 76.1 | 76 | 762 | 1.7 | 0.1 | 8.9 | 1.86 | 29.1 | 4.5E+04 | 0.026 | 0.000 |
| | | 5 | 32 | 106.6 | 1.25 | 76.0 | 76 | 838 | 1.9 | 0.1 | 8.9 | 1.86 | 29.1 | 4.9E+04 | 0.025 | 0.000 |
| | | 6 | 40 | 106.6 | 1.25 | 75.9 | 76 | 914 | 2.0 | 0.2 | 8.9 | 1.86 | 29.1 | 5.4E+04 | 0.025 | 0.000 |
| | | 7 | 48 | 106.5 | 1.25 | 75.8 | 76 | 990 | 2.2 | 0.2 | 8.9 | 1.86 | 29.0 | 5.8E+04 | 0.025 | 0.000 |
| | | 8 | 56 | 106.4 | 1.25 | 75.8 | 76 | 1065 | 2.4 | 0.2 | 8.9 | 1.86 | 29.0 | 6.2E+04 | 0.025 | 0.000 |
| | | 9 | 64 | 106.3 | 1.25 | 75.7 | 76 | 1141 | 2.5 | 0.2 | 8.9 | 1.86 | 29.0 | 6.7E+04 | 0.024 | 0.000 |
| | | 10 | 72 | 106.2 | 1.25 | 75.6 | 76 | 1217 | 2.7 | 0.2 | 8.9 | 1.86 | 29.0 | 7.1E+04 | 0.024 | 0.000 |
| | | 11 | 80 | 106.1 | 1.24 | 75.5 | 76 | 1292 | 2.9 | 0.2 | 8.9 | 1.86 | 29.0 | 7.6E+04 | 0.024 | 0.000 |
| | | 12 | 88 | 106.0 | 1.24 | 75.4 | 75 | 1367 | 3.0 | 0.2 | 8.9 | 1.86 | 29.0 | 8.0E+04 | 0.024 | 0.000 |
| | | 13 | 96 | 105.9 | 1.24 | 75.3 | 75 | 1443 | 3.2 | 0.3 | 8.9 | 1.86 | 29.0 | 8.5E+04 | 0.024 | 0.000 |
| | | 14 | 104 | 105.9 | 1.24 | 75.3 | 75 | 1518 | 3.4 | 0.3 | 8.9 | 1.86 | 29.0 | 8.9E+04 | 0.024 | 0.000 |
| | | 15 | 112 | 105.8 | 1.24 | 75.2 | 75 | 1593 | 3.6 | 0.3 | 8.9 | 1.86 | 29.0 | 9.3E+04 | 0.024 | 0.000 |
| | | 16 | 120 | 105.7 | 1.24 | 75.1 | 75 | 1668 | 3.7 | 0.3 | 8.9 | 1.86 | 28.9 | 9.8E+04 | 0.024 | 0.000 |
| | | 17 | 128 | 105.6 | 1.23 | 75.0 | 75 | 1743 | 3.9 | 0.3 | 8.9 | 1.86 | 28.9 | 1.0E+05 | 0.024 | 0.000 |
| | | 18 | 136 | 105.5 | 1.23 | 74.9 | 75 | 1818 | 4.1 | 0.3 | 8.9 | 1.86 | 28.9 | 1.1E+05 | 0.023 | 0.000 |

## APPENDIX B. DENSITY PROFILES

The seasonally averaged density profiles assumed for modeling purposes are summarized below.

| Depth (m) | Density ($kg/m^3$) | | |
|---|---|---|---|
| | Upwelling | Davidson | Oceanic |
| 1 | 1025.1 | 1024.8 | 1024.8 |
| 3 | 1025.1 | 1024.8 | 1024.8 |
| 5 | 1025.1 | 1024.8 | 1024.8 |
| 7 | 1025.2 | 1024.8 | 1024.8 |
| 9 | 1025.2 | 1024.8 | 1024.8 |
| 11 | 1025.3 | 1024.8 | 1024.8 |
| 13 | 1025.4 | 1024.8 | 1024.9 |
| 15 | 1025.4 | 1024.8 | 1024.9 |
| 17 | 1025.5 | 1024.8 | 1024.9 |
| 19 | 1025.6 | 1024.9 | 1024.9 |
| 21 | 1025.6 | 1024.9 | 1025.0 |
| 23 | 1025.7 | 1024.9 | 1025.0 |
| 25 | 1025.7 | 1024.9 | 1025.0 |
| 27 | 1025.8 | 1024.9 | 1025.1 |
| 29 | 1025.8 | 1024.9 | 1025.1 |
| 31 | 1025.8 | 1024.9 | 1025.2 |
| 33 | 1025.9 | 1024.9 | 1025.2 |
| 35 | 1025.9 | 1024.9 | 1025.3 |

## APPENDIX C. TURBULENCE EFFECTS ON ORGANISMS

Summary of lab and field data (and some models) regarding the effects of turbulence on organisms (from Foster et al. 2013).

| Organism | Shear stress or turbulence | Method of generating shear/turbulence | Magnitude of critical shear/turbulence | Effect | Reference | Additional notes |
|---|---|---|---|---|---|---|
| *Sea urchin S. purpuratus larvae (3 day; prism)* | Laminar shear | Couette flow[1], short term (30 min) | No deleterious effect with $\varepsilon \leq 1$ $cm^2/s^3$ | Change in prey encounter rate | Maldonaldo and Latz (2011) | Neg eff cd be due to erosion of hydromech signal, or if local velocity faster than catch speed, reaction time. Mortality was 19% for the 0.1 $cm^2/s^3$, 22% for the 0.4 $cm^2/s^3$, and 53% for the 1 $cm^2/s^3$ flow treatments compared to 5% for the still control. |
| | | Couette flow Long term (8 days of 12 h on, 12 h off) | $\varepsilon < 0.1$ $cm^2/s^3$ | Excessive mortality | | |
| *Sea urchin L. pictus larvae (3 day, 4 arm pluteus)* | Laminar shear | Couette flow[1], short term (30 min) | No deleterious effect with $\varepsilon \leq 1$ $cm^2/s^3$ | Change in prey encounter rate | Maldonaldo and Latz (2011) | |
| | | Couette flow Long term (8 days of 12 h on, 12 h off) | No deleterious effect with $\varepsilon \leq 1$ $cm^2/s^3$ | Some mortality, but not much | | |
| *Sea urchin S. purpuratus* | Shear stress | Couette flow (short term: 2 min) | No deleterious effect with $\varepsilon < 200$ $cm^2/s^3$ | Fertilization and development to blastula | Mead and Denny 1995, Denny, Nelson and Mead 2002 | |
| *Zebra mussel Dreissena polymorpha veliger* | Turbulence | Bubble plume for 24 hours, then 24 feed before mortality measured | Mortality increases when d* > 0.9 (eddy similar in size to larva (no sig eff when d*<0.9) | Mortality | Rehmann et al. 2003 | |

| Organism | Shear stress or turbulence | Method of generating shear/turbulence | Magnitude of critical shear/turbulence | Effect | Reference | Additional notes |
|---|---|---|---|---|---|---|
| *dinoflagellate Alexandrium fundyense* | Laminar shear | Couette flow for 1-24 hours/day | Shear stress τ = 0.003 $N/m^2$ ; ε = $10^{-5}$ $cm^2/s^3$ ; only 1 level | Growth rate decreased when exposed to τ for more than 2 hours/ day | Juhl et al. 2001 | Growth rate = 0 when shear 12 h/d; negative when 16-24 h/day |
| *dinoflagellate Alexandrium fundyense* | Laminar shear and turbulence | Couette flow 1 h/d 5–8 d and shaken flasks | Shear stress τ = 0.004 $N/m^2$ (not quantified for shaken flasks | Growth rate decreased in both | Juhl et al. 2000 | Most sensitive last hour of dark phase, under lower light conditions |
| *dinoflagellate Lingulodiniu m polyedrum.* | Shear (steady and unsteady) | Couette flow; constant or changing speeds/direction; 2 h/d (change ev 2 min) | smallest ε = 0.04 $cm^2/s^3$; all had effect (very very high ) | Growth rate decreased in all cases; often catastrophicall y (near 100%) | Latz et al. 2009 | Unsteady flow had more of an effect than steady, even when mean was lower; poss mechanism: mechanical energy of the flow alters membrane biophysical properties, activates signal transduction pathway involving GTP, [ca2+]I, poss. Also involves cyclin-dep kinases, as in endothelial cells |
| *Copepod Acartia tonsa* | Turbulence | model | Starts dropping at ε = $10^{-3}$ $cm^2/s^3$ | Decrease in prey capture success | Kiørboe and Saiz 1995 | Copepods that set up feeding currents are largely independent of ambient fluid velocity for prey encounters, while ambush-preying copepods can benefit substantially |
| *Copepod Acartia tonsa* | Turbulence | Oscillating grid | | | Saiz & Kiørboe 1995 | |
| *Herring larvae* | Turbulence | model | Starts dropping at ε = $10^{-3}$ $cm^2/s^3$ | Decrease in prey capture success | Kiørboe and Saiz 1995 | |
| *Cod larvae* | Turbulence | model | Starts dropping at ε = $10^{-5}$ $cm^2/s^3$ | Decrease in prey capture success | Kiørboe and Saiz 1995 | |

| Organism | Shear stress or turbulence | Method of generating shear/turbulence | Magnitude of critical shear/turbulence | Effect | Reference | Additional notes |
|---|---|---|---|---|---|---|
| *Cod Gadus morhua (5-6 mm)* | Turbulence | Oscillating grid; observations start after 10 min shaking | ε = 7.4 x $10^{-4}$ $cm^2/s^3$) | Increase in "attack position rate" at all conc | MacKenzie and Kiørboe 1995 | Cod benefit more from turb (pause-travel) |
| *Cod Gadus morhua (8.7-12.3 mm)* | Turbulence -more intermitten t | Oscillating grid, observations start after a few min shaking | ε = .2, 2 x $10^{-4}$ $cm^2/s^3$) | While encounter rate up, pursuit success down | MacKenzie and Kiorboe 2000 | Decrease in pursuit success at higher ε; general downward trend with increased rel vel; smaller fish larvae affected more |
| *Herring Clupea harengus (8-9 mm)* | Turbulence | Oscillating grid; observations start after 10 min shaking | ε = 7.4 x $10^{-4}$ $cm^2/s^3$) | Increase in "attach position rate" only at low conc; v messy data | MacKenzie and Kiorboe 1995 | Herring benefit less (cruise) |
| *Juvenile rainbow trout and steelhead Oncorhynchus mykiss, Chinook salmon O. tshawytscha, American shad Alosa sapidissima* | Shear stress | Forced entry directly into submerged jet in flume having exit velocities of 0 to 21.3 m/s | No effect at 168/s 341/s; LC-10 estimated at 495/s | Torn opercula, missing eyes | Nietzel et al. 2004 | LC-10 =affects 10% of population Juvenile fish 83-232 mm fork length |
| *Water flea Daphnia pulex* | Turbulence | Vibrating 0.5 cm grid | ε = 0.05 $cm^2/s^3$ (as compared to calm) | Heart rate increased 5-27% | Alvarez et al. 1994 | HR reflects increase in metabolic rate? |
| *Copepod Calanus gracilis* | Turbulence | Vibrating 0.5 cm grid | ε = 0.05 $cm^2/s^3$ (as compared to calm) | Heart rate increased 93% | Alvarez et al. 1994 | Other species too including crab larvae (increase HR 9%) |
| *Copepod Acartia tonsa* | Turbulence | Oscillating grid | ε = 0.001 $cm^2/s^3$ (as compared to calm) | Decreases predator sensing ability | Gilbert and Buskey 2005 | |

| Organism | Shear stress or turbulence | Method of generating shear/turbulence | Magnitude of critical shear/turbulence | Effect | Reference | Additional notes |
|---|---|---|---|---|---|---|
| *Copepod Acartia tonsa* | Turbulence (field) | Boat wake (field); plankton tow inside/ outside wake | ε =310 $cm^2/s^3$ at a distance of 50 propeller diam. behind 20 mm diam, scale-model boat propeller running at 3000 rpm | More dead inside wake (5-25% increase, over 2-12% background) | Bickel et al. 2011 | Stain w neutral red |
| *Copepod Acartia tonsa* | | Mini stirrer w paddles (lab) | ε = 0, 0.035, 1.31, 2.24 $cm^2/s^3$ | | Bickel et al. 2011 | ε = 0.035 $cm^2/s^3$ did not show negative effect |
| *Various* | Turbulence (field) | Rapids (samples collected above and below rapids | ε = 3-742 $cm^2/s^3$ | Effects dep on species: sign. mortality in Littorina littorea, Mytilus edulis, and Aporrhais pespelicant | Jessop 2007 | Mytilus membranipora, Electra pilosa, polychaete trochophores and Lamellaria perspicua had zero mortality |

ε = energy dissipation rate ($cm^2/s^3$)

Couette flow: two concentric cylinders, outer one rotates shearing volume of fluid between cylinders at known rate

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# Appendix C. DRAFT Revised Ocean Plan Compliance Assessment

# DRAFT Revised Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant

**Technical Memorandum**

July 2016



***Prepared for:***

MRWPCA

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# DRAFT Revised Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant



## Technical Memorandum

Pure Water Monterey
A Groundwater Replenishment Project

**July 2016**

Prepared By:

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# Table of Contents

# 1 Introduction

In response to State Water Resources Control Board (SWRCB) Water Rights Orders WR 95-10 and WR 2009-0060, two proposed projects are in development on the Monterey Peninsula to provide potable water to offset pending reductions of Carmel River water diversions: (1) a seawater desalination project known as the **Monterey Peninsula Water Supply Project** (MPWSP), and (2) a groundwater replenishment project known as the **Pure Water Monterey Groundwater Replenishment Project** (GWR Project). The capacity of the MPWSP is dependent on whether the GWR Project is constructed.

If the GWR Project is not constructed, the MPWSP would entail California American Water ("CalAm") building a seawater desalination facility capable of producing 9.6 million gallons per day (mgd) of drinking water. In a variation of that project where the GWR Project is constructed, known as the **Monterey Peninsula Water Supply Project Variant** ("Variant"), CalAm would build a smaller desalination facility capable of producing 6.4 mgd of drinking water, and a partnership between the Monterey Peninsula Water Management District (MPWMD) and the Monterey Regional Water Pollution Control Agency (MRWPCA) would build an advanced water treatment facility ("AWT Facility") capable of producing up to 3,700 acre-feet per year (AFY) (3.3 mgd)[1] of highly purified recycled water to enable CalAm to extract 3,500 AFY (3.1 mgd) from the Seaside Groundwater Basin for delivery to their customers (the AWT Facility is part of the GWR Project).

The AWT Facility would purify secondary-treated wastewater (*i.e.*, secondary effluent) from MRWPCA's Regional Treatment Plant (RTP), and this highly purified recycled water would be injected into the Seaside Groundwater Basin and later extracted for municipal water supplies. Both the proposed desalination facility and the proposed AWT Facility would employ reverse osmosis (RO) membranes to purify the waters, and as a result, both projects would produce RO concentrate waste streams that would be disposed through the existing MRWPCA ocean outfall: the brine concentrate from the desalination facility ("Desal Brine"), and the RO concentrate from the AWT Facility ("GWR Concentrate").

The goal of this technical memorandum is to analyze whether the discharges from the proposed projects through the existing ocean outfall would impact marine water quality, and thus, human health, marine biological resources, or beneficial uses of the receiving waters. A similar assessment of the GWR Project on its own was previously performed (Trussell Technologies, 2015, see Appendix B), and so this document provides complementary information focused on the MPWSP and the Variant projects.

The original version of this document (Trussell Technologies, 2015b) and an addendum report to that document (Trussell Technologies, 2015c) were included in both the GWR Project Consolidated Final Environmental Impact Report (CFEIR) and the MPWSP draft Environmental Impact Report (EIR). This version has been updated to include new water quality data and flow

[1] One million gallons per day is equal to 1,121 acre-feet per year. The AWT Facility would be capable of producing up to 4 mgd of highly purified recycled water on a daily basis, but production would fluctuate throughout the year, such that the average annual production would be 3.3 mgd (3,700 AFY) in a non-drought year.

scenarios for the MPWSP and Variant to address data gaps noted in the original analyses (2015b and 2015c).

## 1.1 Treatment through the Proposed CalAm Desalination Facility

This section describes the proposed treatment train for the MPWSP and Variant desalination facility. Seawater from the Monterey Bay would be extracted through subsurface slant wells beneath the ocean floor and piped to a new CalAm-owned desalination facility. This facility would consist of granular media pressure filters, cartridge filters, a two-pass RO membrane system, RO product-water stabilization (for corrosion control), and disinfection (Figure 1). The RO process is expected to recover 42 percent of the influent seawater flow as product water, while the remainder of the concentrated influent water becomes the Desal Brine. The MPWSP and Variant product water (desalinated water) would be used for municipal drinking water, while the Desal Brine would be blended with (1) available RTP secondary effluent, (2) brine that is trucked and stored at the RTP, and (3) GWR Concentrate (for the Variant only), and discharged to the ocean through the existing MRWPCA ocean outfall. The volume of Desal Brine is dependent on the project size: 13.98 and 8.99 mgd for the MPWSP and Variant, respectively.

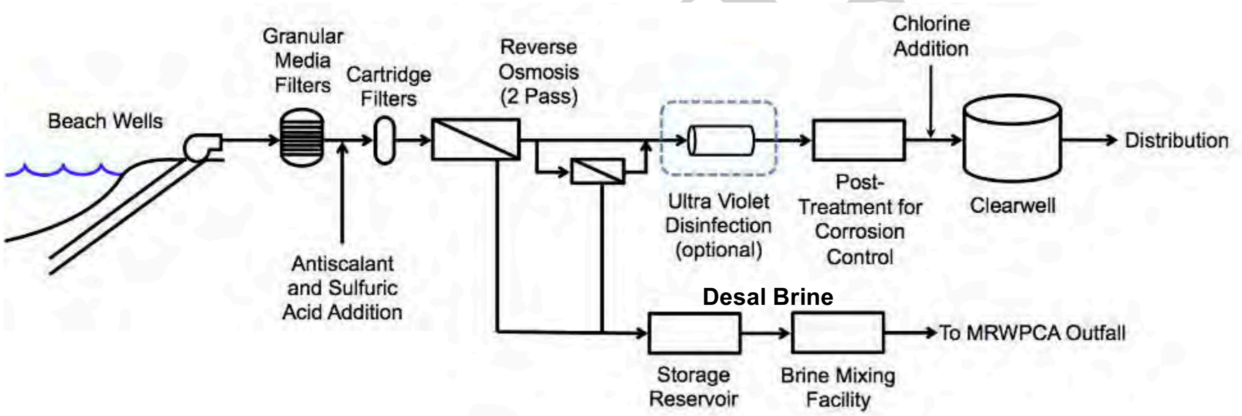


**Figure 1 – Schematic of CalAm desalination facilities**

## 1.2 Treatment through the RTP and Proposed AWT Facilities

The existing MRWPCA RTP treatment process includes screening, primary sedimentation, secondary biological treatment through trickling filters followed by a solids contactor (*i.e.*, bio-flocculation), and clarification (Figure 2). Much of the secondary effluent undergoes tertiary treatment (granular media filtration and disinfection) to produce recycled water used for agricultural irrigation. The unused secondary effluent is discharged to the Monterey Bay through the MRWPCA outfall. MRWPCA also accepts trucked brine waste for ocean disposal ("hauled brine"), which is stored in a pond and mixed with secondary effluent for disposal.

The proposed AWT Facility would include several advanced treatment technologies for purifying the secondary effluent: ozone ($O_3$), biologically active filtration (BAF) (this is an optional unit process), membrane filtration (MF), RO, and an advanced oxidation process (AOP) using ultraviolet light ("UV") and hydrogen peroxide. MRWPCA and the MPWMD conducted a pilot-scale study of the ozone, MF, and RO components of the AWT Facility from December 2013 through July 2014, successfully demonstrating the ability of the various treatment processes to produce highly purified recycled water that complies with the California

Groundwater Replenishment Water Recycling Criteria ("Groundwater Replenishment Regulations"),[2] the SWRCB's Anti-degradation and Recycled Water Policies,[3] and the Water Quality Control Plan for the Central Coastal Basin (Basin Plan)[4] standards, objectives and guidelines for groundwater. Water quality monitoring of the concentrate from the RO was also conducted during the pilot-scale study.

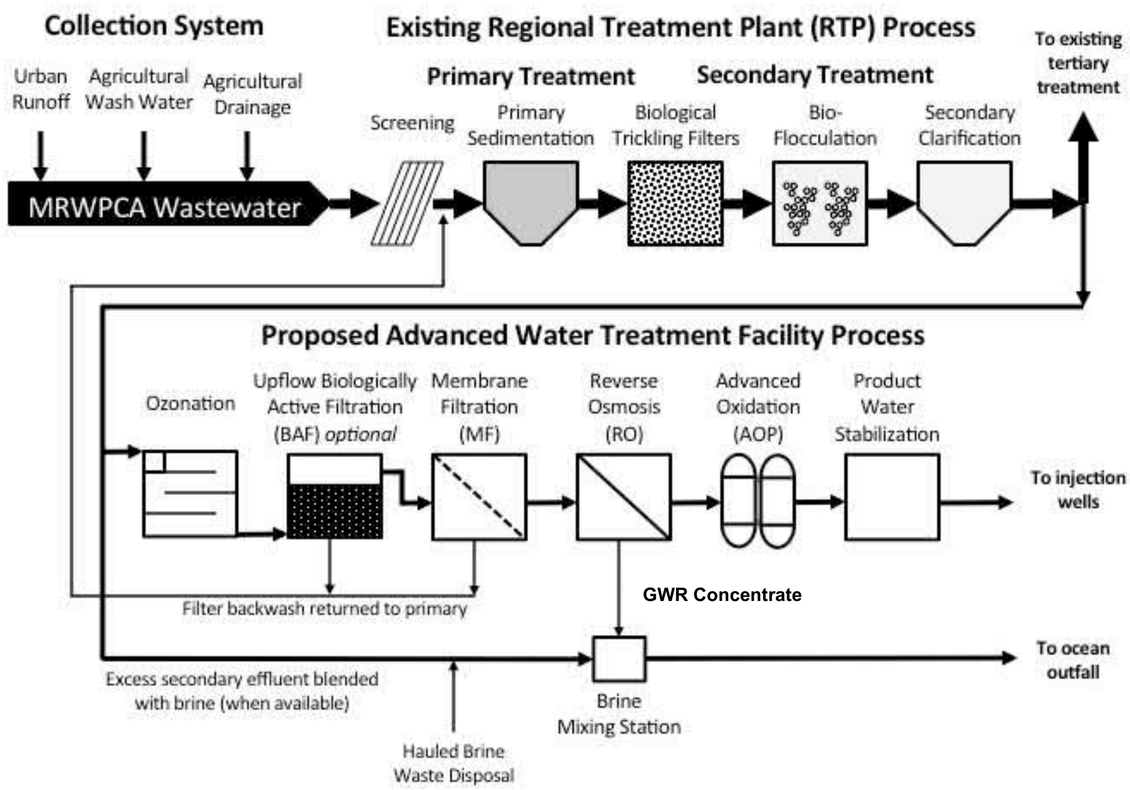


**Figure 2 – Schematic of existing MRWPCA RTP and proposed AWT Facility treatment**

## 1.3 California Ocean Plan

The SWRCB 2012 Ocean Plan ("Ocean Plan") sets forth water quality objectives for the ocean with the intent of preserving the quality of the ocean water for beneficial uses, including the protection of both human and aquatic ecosystem health (SWRCB, 2012). Regional Water Quality Control Boards utilize these objectives to develop water quality-based effluent limitations for ocean dischargers that have a reasonable potential to exceed the water quality objectives.

When municipal wastewater flows are released from an outfall, the wastewater and ocean water undergo rapid mixing due to the momentum (from specially designed diffusers) and buoyancy of

[2] SWRCB (2014) Water Recycling Criteria. Title 22, Division 4, Chapter 3, California Code of Regulations.

[3] See http://www.swrcb.ca.gov/plans_policies/

[4] See http://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/docs/basin_plan_2011.pdf

the discharge.[5] The mixing occurring in the rising plume is affected by the buoyancy and momentum of the discharge, a process referred to as initial dilution (NRC, 1993). For rising plumes, the Ocean Plan defines the initial dilution as complete when "the diluting wastewater ceases to rise in the water column and first begins to spread horizontally," (*i.e.*, when the momentum from the discharge has dissipated). For more saline discharges, a sinking plume can form when the discharge is denser than the ambient water (also known as a negatively buoyant plume). In the case of negatively buoyant plumes, the Ocean Plan defines the initial dilution as complete when "the momentum induced velocity of the discharge ceases to produce significant mixing of the waste, or the diluting plume reaches a fixed distance from the discharge to be specified by the Regional Board, whichever results in the lower estimate for initial dilution."

The Ocean Plan objectives are to be met after the initial dilution of the discharge. The initial dilution occurs in an area known as the zone of initial dilution (ZID). The extent of dilution in the ZID is quantified and referred to as the minimum probable initial dilution ($D_m$). The water quality objectives established in the Ocean Plan are adjusted by the $D_m$ to derive the National Pollutant Discharge Elimination System (NPDES) permit limits for a wastewater discharge prior to ocean dilution.

The current MRWPCA wastewater discharge is governed by NPDES permit R3-2014-0013 issued by the Central Coast Regional Water Quality Control Board ("RWQCB"). Because the existing NPDES permit for the MRWPCA ocean outfall must be amended to discharge Desal Brine, comparing future discharge concentrations to the current NPDES permit limits (that will likely change when the permit is amended) would not be an appropriate metric or threshold for determining whether the proposed projects would have a significant impact on marine water quality. Instead, compliance with the Ocean Plan objectives was selected as an appropriate threshold for determining whether or not the proposed projects would result in a significant impact requiring mitigation.

Dr. Philip Roberts, a Professor in the School of Civil and Environmental Engineering at the Georgia Institute of Technology, conducted modeling of the ocean discharge and estimated $D_m$ values for scenarios involving different flows of the proposed projects and different ambient ocean conditions. These ocean modeling results were combined with projected discharge water quality to assess compliance with the Ocean Plan.

## 1.4 Future Ocean Discharges

A summary schematic of the MPWSP and Variant is presented in Figure 3. For the MPWSP, 23.58 mgd of ocean water (design capacity) would be treated in the desalination facility; an RO recovery of 42% would lead to an MPWSP Desal Brine flow of 13.98 mgd that would be discharged through the outfall. Secondary effluent from the RTP would also be discharged through the outfall, although the flow would be variable depending on both the raw wastewater flow and the proportion being processed through the tertiary treatment system at the Salinas Valley Reclamation Plant (SVRP) to produce recycled water for agricultural irrigation. The third

[5] Municipal wastewater effluent, being effectively fresh water in terms of salinity, is less dense than seawater and thus rises (due to buoyancy) while it mixes with ocean water. GWR Concentrate, whether by itself or mixed with municipal wastewater effluent, is less dense than seawater and also rises (due to buoyancy) while it mixes with ocean water.

and final discharge component is hauled brine that is trucked to the RTP and blended with secondary effluent prior to discharge. The maximum anticipated flow of this stream is 0.1 mgd (blend of brine and secondary effluent). These three discharge components (Desal Brine, secondary effluent, and hauled brine) would be mixed at the proposed Brine Mixing Facility prior to ocean discharge.

For the Variant, 15.93 mgd of ocean water (design capacity) would be pumped to the desalination facility, and an RO recovery of 42% would result in a Variant Desal Brine flow of 8.99 mgd. The Variant would include the GWR Project, which involves the addition of new source waters to the RTP that would alter the water quality of the secondary effluent produced by the RTP. The secondary effluent in the Variant is referred to as "Variant secondary effluent," and would be different in quality from the MPWSP secondary effluent. Under the GWR Project, a portion of the secondary effluent would be fed to the AWT Facility, and the resultant GWR Concentrate (maximum 0.94 mgd) would be discharged through the outfall. The hauled brine received at the RTP would continue to be blended with secondary effluent prior to discharge, the quality of the blended brine and secondary effluent will change as a result of the change in secondary effluent quality; the hauled brine for the Variant is referred to as "Variant hauled brine." The discharge components for the MPWSP and Variant are summarized in Table 1.

**Table 1 – Discharge waters Included in each analysis**

| Project | Desal Brine | Secondary Effluent | Variant Secondary Effluent | Hauled Brine | Variant Hauled Brine [a] | GWR Concentrate |
|---|---|---|---|---|---|---|
| MPWSP | ✓ (13.98 mgd) | ✓ (flow varies) | | ✓ (0.1 mgd) | | |
| Variant | ✓ (8.99 mgd) | | ✓ (flow varies) | | ✓ (0.1 mgd) | ✓ (0.94 mgd) |

[a] This is placed in a separate category because it contains Variant secondary effluent.

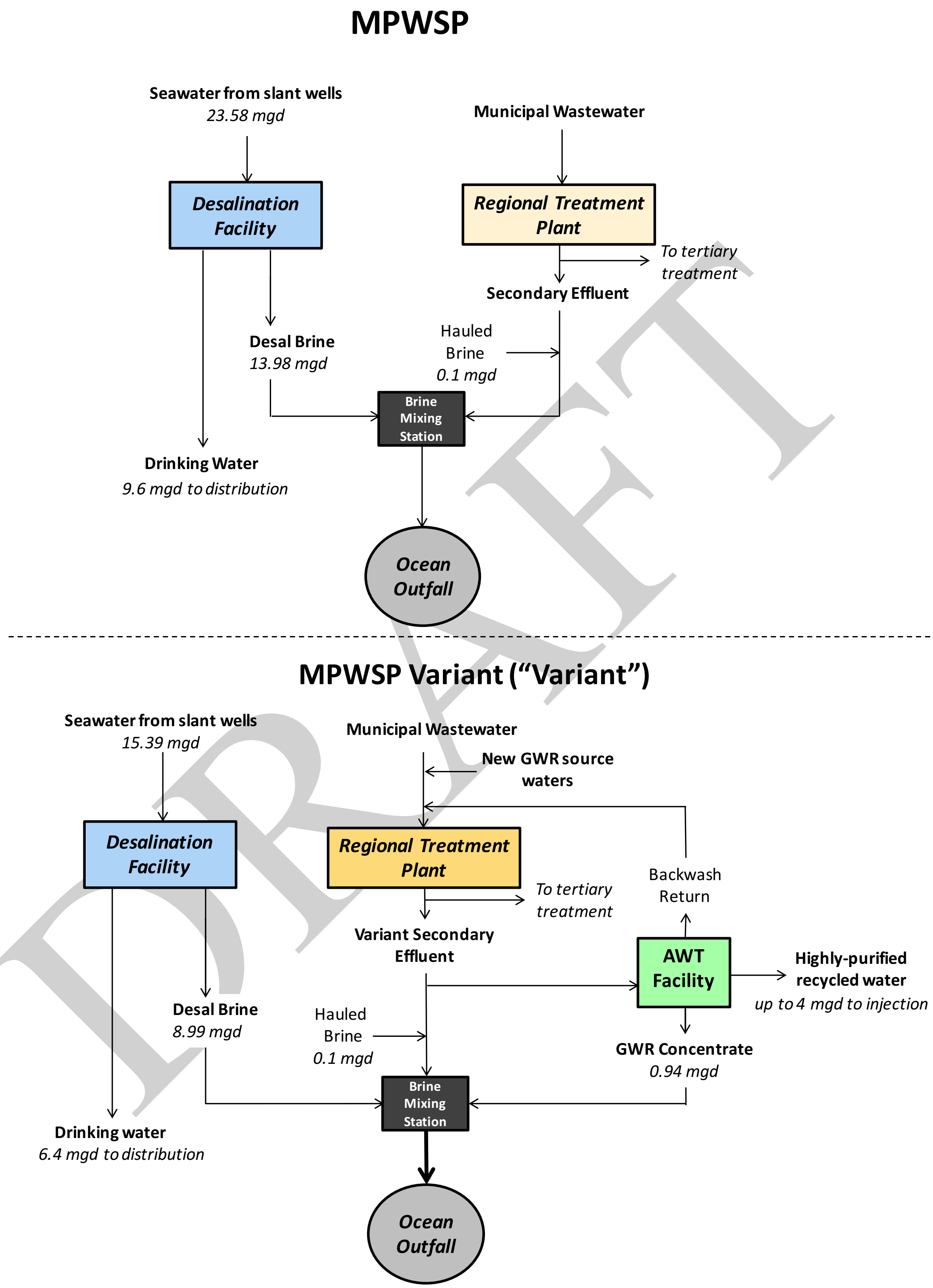




**Figure 3 – Flow schematics for the MPWSP and Variant projects (specified flow rates are at design capacity)**

## 1.5 Objective of Technical Memorandum

Trussell Technologies, Inc. ("Trussell Tech") estimated worst-case in-pipe water quality for the various ocean discharge scenarios (*i.e.*, prior to dilution through ocean mixing) for the proposed projects. Dr. Roberts' ocean discharge modeling and the results of the water quality analysis were then used to provide an assessment of whether the proposed projects would consistently meet Ocean Plan water quality objectives. The objective of this technical memorandum is to summarize the assumptions, methodology, results and conclusions of the Ocean Plan compliance assessment for the MPWSP and Variant.

# 2 Methodology for Ocean Plan Compliance Assessment

Water quality data from various sources for the different treatment process influent and waste streams were compiled. Trussell Tech combined these data for different flow scenarios and used ocean modeling results (*i.e.*, $D_m$ values) to assess compliance of different discharge scenarios with the Ocean Plan objectives. This section documents the data sources and provides further detail on the methodology used to perform this analysis. A summary of the methodology is presented in Figure 4.

## 2.1 Methodology for Determination of Discharge Water Quality

The amounts and combinations of various wastewaters that would be disposed through the MRWPCA outfall will vary depending on the capacity, seasonal and daily flow characteristics, and extent and timing of implementation of the proposed projects.

Detailed discussions about the methods used to determine the discharge water qualities related to the GWR Project were previously discussed and can be found in Appendix B. This previous analysis included water quality estimates of the secondary effluent, Variant secondary effluent, hauled brine, Variant hauled brine, and the GWR Concentrate (*i.e.,* all of the discharges except for the Desal Brine). In the previous analysis, Trussell Tech assumed that the highest observed values for the various Ocean Plan constituents within each type of water flowing to and treated at the RTP, including the AWT Facility as applicable, to be the worst-case water quality.[6] These same data and assumptions were used in the analysis described in this memorandum. Use of these worst-case water quality concentrations ensures that the analysis in this memorandum is conservative related to the Ocean Plan compliance assessment (and thus, the impact analysis for the MPWSP environmental review processes).

To determine the impact of the MPWSP and Variant, the worst-case water quality of the Desal Brine was estimated using available data from CalAm's temporary test subsurface slant well on the CEMEX mine property in Marina, California. Long-term pumping and water quality

[6] The exception to this statement is cyanide. In mid-2011, Monterey Bay Analytical Service (MBAS) began performing the cyanide analysis on the RTP secondary effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore the results were questionable. Therefore, although the cyanide concentrations reported by MBAS are presented, they are not used in the analysis for evaluating compliance with the Ocean Plan objectives.

sampling from this well began in April 2015.[7] As in the previous Ocean Plan compliance assessments, the highest observed concentrations in the slant well were used for this Ocean Plan compliance assessment.

The methodology for determining the water quality of the Desal Brine and secondary effluent is further described in this section (the methodology for all other discharge waters can be found in Appendix B). A summary of which discharge waters are considered for both the MPWSP and Variant, and which data sources were used in the determination of the water quality for each discharge stream is shown in Figure 4.

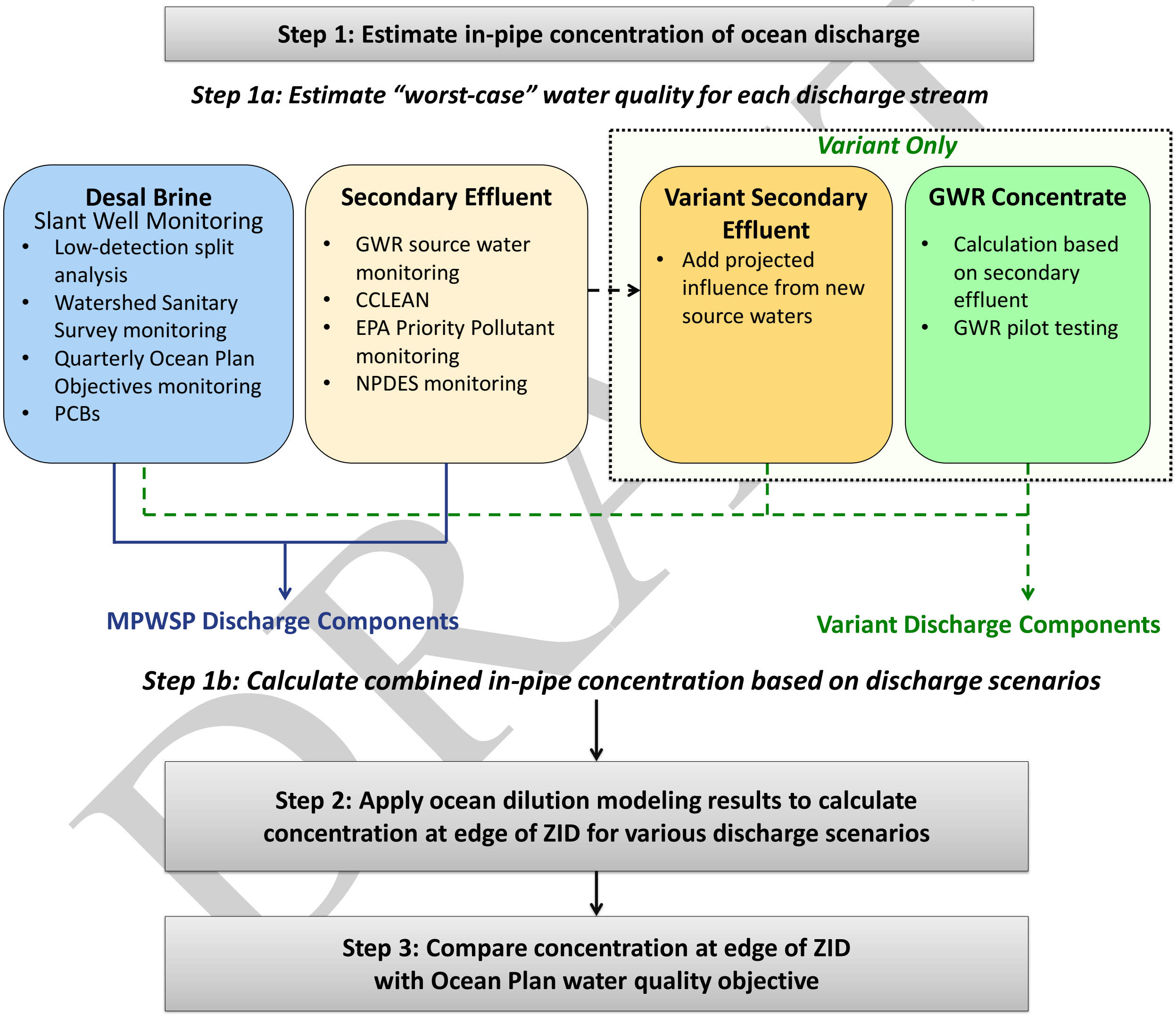


**Figure 4 – Logic flow chart for determination of MPWSP and Variant compliance with Ocean Plan objectives.**

[7] The well was shut down on June 5, 2015 to assess regional trends in aquifer water levels and resumed pumping October 27, 2015. The well was shut down again between March 4, 2016 and May 2, 2016 for discharge line repairs. No water quality data were collected during shutdown periods.

### 2.1.1 Secondary Effluent

For the MPWSP, the discharged secondary effluent would not be impacted by additional source waters that would be brought in for the Variant; therefore, the historical secondary effluent quality was used in the analysis. The following sources of data were considered for selecting a secondary effluent concentration for each constituent in the analysis:

- Secondary effluent water quality monitoring conducted for the GWR Project from July 2013 through June 2014.
- Historical NPDES compliance water quality data collected semi-annually by MRWPCA (2005-2014).
- Historical Priority Pollutant data collected annually by MRWPCA (2004-2014).
- Water quality data collected by the Central Coast Long-Term Environmental Assessment Network (CCLEAN) (2008-2015).

The secondary effluent concentration for each constituent selected for the analysis was the maximum reported value from the above sources. In some cases, constituents were not detected (ND) in any of the source waters; in these cases, the values are reported as ND(<MRL). In cases where the analysis of a constituent that was detected but not quantified, the result is reported as less than the Method Reporting Limit ND(<MRL).[8] Because the actual concentration could be any value equal to or less than the MRL, the conservative approach is to use the value of the MRL. For some ND constituents, the MRL exceeds the Ocean Plan objective, and thus no compliance determination can be made.[9] A detailed discussion of the cases where a constituent was reported as less than the MRL is included in the GWR Project technical memorandum in Appendix B (Trussell Technologies, 2015a).

### 2.1.2 Desalination Brine

Trussell Tech used the following four sources of data for the Desal Brine water quality assessment:

- A one-time 7-day composite sample from the test slant well with separate analysis of particulate and dissolved phase fractions of constituents using low-detection CCLEAN analysis techniques (February 18-25, 2016). The maximum total concentration was used in this analysis (*i.e.* the sum of the concentration in the particulate and dissolved phase



[8] The lowest amount of an analyte in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions (*i.e.*, the lower limit of quantitation). Therefore, acceptable quality control and quality assurance procedures are calibrated to the MRL, or lower. To take into account day-to-day fluctuations in instrument sensitivity, analyst performance, and other factors, the MRL is established at three times the Method Detection Limit (or greater). The Method Detection Limit is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. (40 Code of Federal Regulations Section136 Appendix B).

[9] This phenomenon is common in the implementation of the Ocean Plan where for some constituents, suitable analytical methods are not capable of measuring low enough to quantify the minimum toxicologically relevant concentrations. For these constituents, a discharge is considered compliant if the monitoring results are less than the MRL.

fractions).[10] Of the constituents analyzed with this split phase method,[11] all were detected 100% in the dissolved phase, except PCBs, which were detected 99% in the dissolved phase.
- CalAm Watershed Sanitary Survey monitoring program monthly test slant well sampling water quality results (May 2015 – February 2016).[12]
- Quarterly sampling of the test slant well for constituents specified in the Ocean Plan (November 2015 and February 2016).
- Test slant well sampling by Geoscience Support Services, Inc. ("Geoscience") every other month for polychlorinated biphenyls (PCBs) (May 2015 – February 2016).[11]

The maximum value observed in any of the data sources was assumed to be the "worst-case" water quality for the raw seawater feeding the desalination facility. If a constituent was ND in all samples, and multiple analysis methods were used with varying MRL values, the highest MRL was assumed for compliance analysis; the exception to this statement is when data was available from the low detection limit 7-day composite sample. As for the secondary effluent water quality, if the sample results of a constituent reported the concentration as less than the MRL, the MRL was assumed for compliance analysis and the concentration is reported as ND(<MRL) in this TM. Equation 1 was used to calculate a conservative estimate of the Desal Brine concentration ($C_{Brine}$) for each constituent by using a concentration factor of 1.73, which was calculated assuming complete rejection of the constituent in the feed water ($C_{Feed}$) and a 42 percent recovery ($\%_R$) through the seawater RO membranes.

$$C_{Brine} = \frac{C_{Feed}}{1 ! \%_R} \qquad (1)$$

The original Technical Memorandum (TM) (Trussell Technologies, 2015b) noted that no data were available for several Ocean Plan constituents. For constituents that lacked Desal Brine data, a concentration of zero was assumed for the previous analysis, such that the partial influence of the other discharge streams could still be assessed. Thus, a complete "worst-case" assessment for these constituents was not previously possible. The updated analysis discussed in this TM includes data for all of the constituents where no data were previously available, except for toxicity, which will be discussed in Section 2.2.

### 2.1.3 Combined Ocean Discharge Concentrations

Having estimated the worst-case concentrations for each of the discharge components, the combined concentration prior to discharge was determined as a flow-weighted average of the contributions of each of the discharge components appropriate for the MPWSP and Variant.



[10] Only method detection limits were provided for these results. When a constituent was ND in this dataset, the method detection limit was used for analysis.
[11] Hexachlorobutadiene, hexachlorobenzene, HCH, heptachlor, Aldrin, chlordane, DDT, heptachlor epoxide, dieldrin, Endrin, endosulfans, toxaphene, PCBs
[12] The well was shut down on June 5, 2015 to assess regional trends in aquifer water levels and resumed pumping October 27, 2015. The well was shut down again between March 4, 2016 and May 2, 2016 for discharge line repairs. No water quality data were collected during shutdown periods.

## 2.2 Ocean Modeling Methodology

In order to determine Ocean Plan compliance, Trussell Tech used the following information: (1) the in-pipe (*i.e.*, pre-ocean dilution) concentration of a constituent ($C_{in\text{-}pipe}$) that was developed as discussed in the previous section, (2) the minimum probable dilution for the ocean mixing ($D_m$) for the discharge flow scenarios that were modeled by Dr. Roberts[13] (Roberts, P. J. W, 2016), and (3) the background concentration of the constituent in the ocean ($C_{Background}$) that is specified in Table 3 of the Ocean Plan (SWRCB, 2012). With this information, the concentration at the edge of the zone of initial dilution ($C_{ZID}$) was calculated using the following equation:

$$C_{ZID} = \frac{C_{In-pipe} + D_m * C_{Background}}{1 + D_m} \quad (2)$$

The $C_{ZID}$ was then compared to the Ocean Plan water quality objectives[14] in Table 1 of the Ocean Plan (SWRCB, 2012). In this table, there are three categories of objectives: (1) Objectives for Protection of Marine Aquatic Life, (2) Objectives for Protection of Human Health – Non-Carcinogens, and (3) Objectives for Protection of Human Health – Carcinogens. There are three objectives for each constituent included in the first category (for marine aquatic life): six-month median, daily maximum and instantaneous maximum concentration. For the other two categories, there is one objective: 30-day average concentration. When a constituent had three objectives, the lowest objective, the six-month median, was used to estimate compliance. This approach was taken because the discharge scenarios, discussed in further detail below, could be experienced for six months, and therefore the 6-month median objective would need to be met. For the ammonia objectives (specifically, the total ammonia concentration calculated as the sum of unionized ammonia ($NH_3$) and ionized ammonia ($NH_4$), expressed in µg/L as N) the daily maximum and 6-month median objectives were evaluated.

For each discharge scenario, if the $C_{ZID}$ was below the Ocean Plan objective, then it was assumed that the discharge would comply with the Ocean Plan. However, if the $C_{ZID}$ exceeds the Ocean Plan objective, then it was concluded that the discharge scenario could violate the Ocean Plan objective. Note that this approach could not be applied for some constituents, *viz.*, acute toxicity, chronic toxicity, and radioactivity. Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of the constituents. These constituents were measured individually for the secondary effluent and GWR Concentrate, and these individual concentrations would comply with the Ocean Plan

[13] The Ocean Plan defines $D_m$ differently than Dr. Roberts. A value of 1 must be subtracted from the dilution estimates provided by Dr. Roberts prior to using Equation 1.

[14] Note that the Ocean Plan also defines effluent limitations for oil and grease, suspended solids, settleable solids, turbidity, and pH (see Ocean Plan Table 2). These parameters were not evaluated in this assessment. It is assumed that, if necessary, the pH of the water would be adjusted to be within acceptable limits prior to discharge. Oil and grease, suspended solids, settable solids, and turbidity in the GWR Concentrate and Desal Brine would be significantly lower than the secondary effluent. Prior to the AWT Facility RO treatment process, the process flow would be treated by MF, which will reduce these parameters, and the waste stream from the MF will be returned to RTP headworks. Prior to the Desalination Facility RO treatment process, the process flow would be treated by granular media filters and cartridge filters, which reduce these parameters. The waste stream from the granular media filter would be further treated in gravity thickening basins prior to any discharge of the decant through the ocean outfall. The cartridge filters will be disposed off-site and the solids will not be returned to the process.

objectives. Toxicity testing on the seawater was not included in the analysis for this TM; it will be evaluated by another method not discussed in this TM.

Dr. Roberts performed modeling of 16 discharge scenarios for the MPWSP and Variant that include combinations of Desal Brine, secondary effluent, GWR Concentrate, and hauled brine (Roberts, P. J. W, 2016). All scenarios assume the maximum flow rates for the GWR Concentrate, Desal Brine and hauled brine, which is a conservative assumption in terms of constituent loading and minimum dilution.

### 2.2.1 Ocean Modeling Scenarios

The modeled scenarios are summarized in Tables 2 and 3 for the MPWSP and the Variant, respectively. The baseline MPWSP discharge scenario in Table 2 that has no Desal Brine (*i.e.* Scenario 1) is shown for completeness, but will not be analyzed in this TM as this flow scenario would fall under MRWPCA's existing NPDES permit, for which a $D_m$ value is already established. The Variant discharge scenarios that have no Desal Brine (*i.e.* Scenarios 11 through 15) have already been analyzed and found to comply with the Ocean Plan (Trussell Tech 2015, see Appendix B); these scenarios are shown in Table 3 for completeness, but for simplicity, the analysis of these scenarios is not repeated in Section 3.

**Table 2 - Modeled flow scenarios for the MPWSP**

| No. | Discharge Scenario | Discharge Flows (mgd) | | |
|---|---|---|---|---|
| | | Secondary Effluent | Desal Brine | Hauled Brine [a] |
| 1 | Baseline - high secondary effluent [b] | 19.78 | 0 | 0.1 |
| 2 | Desal Brine with no secondary effluent | 0 | 13.98 | 0.1 |
| 3 | Desal Brine with low secondary effluent | 1 | 13.98 | 0.1 |
| 4 | Desal Brine with low secondary effluent | 2 | 13.98 | 0.1 |
| 5 | Desal Brine with moderate secondary effluent | 9 | 13.98 | 0.1 |
| 6 | Desal Brine with high secondary effluent [b] | 19.78 | 13.98 | 0.1 |

[a] Hauled brine was not included in the modeling of MPWSP flow scenarios; however, the change in both flow and TDS from the addition of hauled brine is less then 1% and thus is expected to have a negligible impact on the modeled $D_m$.
[b] Note that RTP wastewater flows have been declining in recent years as a result of water conservation; while 19.78 mgd is higher than current RTP wastewater flows, this is expected to be a conservative scenario with respect to ocean modeling, compared to using the current wastewater flows of 16 to 18 mgd.

**MPWSP Flow Scenarios:**

(1) **Baseline – high secondary effluent:** The baseline flow scenario with no Desal Brine. This scenario represents times when the desalination facility is offline, the demand for recycled water is lowest (*e.g.*, during winter months), and the SVRP is not operational.

(2) **Desal Brine with no secondary effluent:** The maximum influence of the Desal Brine on the overall discharge (*i.e.*, no secondary effluent discharged). This scenario would be representative of conditions when demand for recycled water is highest (*e.g.*,

during summer months), and all of the RTP secondary effluent is recycled through the SVRP for agricultural irrigation.

(3-4) **Desal Brine with low secondary effluent:** Desal Brine discharged with a relatively low amount of secondary effluent, resulting in a negatively buoyant plume. This scenario represents times when demand for recycled water is high, but there is excess secondary effluent that is discharged to the ocean.

(5) **Desal Brine with moderate secondary effluent:** Desal Brine discharged with a relatively moderate secondary effluent flow that results in a plume with slightly negative buoyancy. This scenario would be representative of conditions when demand for recycled water is low, and there is excess secondary effluent that is discharged to the ocean.

(6) **Desal Brine with high secondary effluent:** Desal Brine discharged with a relatively high amount of secondary effluent, resulting in a positively buoyant plume. This scenario would be representative of conditions when demand for recycled water is lowest (*e.g.*, during winter months), and the SVRP is not operational.

**Table 3 – Modeled flow scenarios for the Variant**

| No. | Discharge Scenario | Discharge Flows (mgd) | | | |
|---|---|---|---|---|---|
| | | Secondary Effluent | Desal Brine | GWR Concentrate | Hauled Brine [a] |
| 1 | Desal Brine only | 0 | 8.99 | 0 | 0.1 |
| 2 | Desal Brine with low secondary effluent | 1 | 8.99 | 0 | 0.1 |
| 3 | Desal Brine with low secondary effluent | 2 | 8.99 | 0 | 0.1 |
| 4 | Desal Brine with moderate secondary effluent | 5.8 | 8.99 | 0 | 0.1 |
| 5 | Desal Brine with high secondary effluent [b] | 19.78 | 8.99 | 0 | 0.1 |
| 6 | Desal Brine with GWR Concentrate and no secondary effluent | 0 | 8.99 | 0.94 | 0.1 |
| 7 | Desal Brine with GWR Concentrate and low secondary effluent | 1 | 8.99 | 0.94 | 0.1 |
| 8 | Desal Brine with GWR Concentrate and low secondary effluent | 3 | 8.99 | 0.94 | 0.1 |
| 9 | Desal Brine with GWR Concentrate and moderate secondary effluent | 5.3 | 8.99 | 0.94 | 0.1 |
| 10 | Desal Brine with GWR Concentrate and high secondary effluent | 15.92 | 8.99 | 0.94 | 0.1 |
| 11 | RTP design capacity with GWR Concentrate [c] | 24.7 | 0 | 0.94 | 0.1 |
| 12 | RTP capacity with GWR Concentrate with current port configuration [c] | 23.7 | 0 | 0.94 | 0.1 |
| 13 | Minimum secondary effluent flow with GWR Concentrate [c] | 0 | 0 | 0.94 | 0.1 |
| 14 | Minimum secondary effluent flow with GWR Concentrate during Davidson oceanic conditions [c] | 0.4 | 0 | 0.94 | 0.1 |
| 15 | Moderate secondary effluent flow with GWR concentrate [c] | 3 | 0 | 0.94 | 0.1 |

[a] Hauled brine was not included in the modeling of Variant scenarios involving discharge of desalination brine. However, the change in both flow and TDS from the addition of hauled brine is less than 1% and thus is expected to have a negligible impact on the modeled $D_m$.

[b] Note that RTP wastewater flows have been declining in recent years as a result of conservation; while 19.68 mgd is higher than current RTP wastewater flows, this is expected to be a conservative scenario with respect to ocean modeling, compared to using the current wastewater flows of 16 to 18 mgd.

[c] Scenarios 11 through 15 were analyzed as part of a previous analysis (see Appendix B), and based on the documented assumptions, the GWR Concentrate would comply with the Ocean Plan objectives; therefore, these scenarios are not discussed further in this memorandum.

**Variant Flow Scenarios:**

(1) **Desal Brine only:** Desal Brine discharged without secondary effluent or GWR Concentrate. This scenario would be representative of conditions when the smaller (6.4 mgd) desalination facility is in operation, but the AWT Facility is not operating

(*e.g.*, offline for maintenance), and all of the secondary effluent is recycled through the SVRP (*e.g.*, during high irrigation water demand summer months).

(2-3) **Desal Brine with low secondary effluent:** Desal Brine discharged with low secondary effluent flow, but no GWR Concentrate, which results in a negatively buoyant plume. This scenario would be representative of times when the smaller desalination facility is in operation, but the AWT Facility is not operating (*e.g.* offline for maintenance), and most of the secondary effluent is recycled through the SVRP (*e.g.*, during high irrigation water demand summer months).

(4) **Desal Brine with moderate secondary effluent:** Desal Brine discharged with a relatively moderate flow of secondary effluent, but no GWR concentrate, which results in a plume with slightly negative buoyancy. This scenario represents times when demand for recycled water is low (*e.g.*, during winter months), and the AWT Facility is not operating.

(5) **Desal Brine with high secondary effluent:** Desal Brine discharged with a relatively high flow of secondary effluent, but no GWR concentrate, resulting in a positively buoyant plume. This scenario would be representative of conditions when demand for recycled water is lowest (*e.g.*, during winter months), and neither the SVRP nor the AWT Facility are operational.

(6) **Desal Brine with GWR Concentrate and no secondary effluent:** Desal Brine discharged with GWR Concentrate and no secondary effluent. This scenario would be representative of the condition where both the desalination facility and the AWT Facility are in operation, and there is the highest demand for recycled water through the SVRP (*e.g.*, during summer months).

(7-8) **Desal Brine with GWR Concentrate and low secondary effluent:** Desal Brine discharged with low secondary effluent flow and GWR Concentrate, which results in a negatively buoyant plume. This scenario would be representative of times when both the desalination facility and the AWT Facility are in operation, and most of the secondary effluent is recycled through the SVRP (*e.g.*, during high irrigation water demand summer months).

(9) **Desal Brine with GWR Concentrate and moderate secondary effluent:** Desal Brine discharged with GWR Concentrate and a relatively moderate secondary effluent flow that results in a plume with slightly negative buoyancy. This scenario represents times when both the desalination facility and the AWT Facility are operating, but demand for recycled water is low and there is excess secondary effluent discharged to the ocean.

(10) **Desal Brine with GWR Concentrate and high secondary effluent:** Desal Brine discharged with GWR Concentrate and a relatively high flow of secondary effluent. The reduction of secondary effluent flow between Scenario 5 and this scenario is a result of the AWT Facility operation. This would be a typical discharge scenario when there is no demand for tertiary recycled water (*e.g.*, during winter months).

(11-15) **Variant conditions with no Desal Brine contribution**: These scenarios represent a range of conditions that would exist when the CalAm desalination facilities were offline for any reason. These conditions were previously evaluated (Trussell Tech, 2015) and thus are not discussed further in this technical memorandum.

### 2.2.2 Ocean Modeling Assumptions

Dr. Roberts documented the modeling assumptions and results in a technical memorandum (Roberts, P. J. W., 2016). The modeling assumptions were specific to ambient oceanic conditions: Davidson (November to March), Upwelling (April to August), and Oceanic (September to October).[15] In order to conservatively demonstrate Ocean Plan compliance, the lowest $D_m$ from the applicable ocean conditions was used for each flow scenario. For all scenarios, the ocean modeling was performed assuming all 129 operational diffuser ports were open.

Three methods were used when modeling the ocean mixing: (1) the Cederwall formula (for neutral and negatively buoyant plumes only), (2) the mathematical model $UM_3$ in the United States Environmental Protection Agency's (EPA's) Visual Plume suite, and (3) the NRFIELD model (for positively buoyant plumes only), also from the EPA's Visual Plume suite (Roberts, P. J. W., 2016). When results were provided from multiple methods, the minimum predicted $D_m$ value was used in this analysis as a conservative approach.

# 3 Ocean Plan Compliance Results

## 3.1 Water Quality of Combined Discharge

As described above, the first step in the Ocean Plan compliance analysis was to estimate the worst-case water quality for the future wastewater discharge components (*viz.*, Desal Brine, secondary effluent, hauled brine and GWR Concentrate). The estimated water quality for each type of discharge is provided in Table 4. The Desal Brine water quality previously assumed in Trussell Technologies, 2015b is also included in Table 4 for reference ("Previous Desal Brine"); only the updated Desal Brine water quality was used in this analysis ("Updated Desal Brine"). Specific assumptions and data sources for each constituent are documented in the Table 4 footnotes.



**Table 4 – Estimated worst-case water quality for the various discharge waters**

| Constituent | Units | Updated Desal Brine | Previous Desal Brine | Secondary Effluent | | Hauled Brine | | GWR Concentrate | Footnotes |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *MPWSP* | *Variant* | *MPWSP* | *Variant* | | |
| ***Objectives for protection of marine aquatic life – 6-month median limit*** | | | | | | | | | |
| Arsenic | µg/L | 17.2 | 37.9 | 45 | 45 | 45 | 45 | 12 | 2,6,16,21 |
| Cadmium | µg/L | 5.0 | 7.9 | 1 | 1.2 | 1 | 1.2 | 6.4 | 1,7,15,21 |
| Chromium (Hexavalent) | µg/L | ND(<0.03) | – | ND(<2) | 2.7 | 130 | 130 | 14 | 3,7,15,21 |
| Copper | µg/L | 0.5 | 3.07 | 10 | 10.5 | 39 | 39 | 55 | 1,7,15,21,28 |
| Lead | µg/L | ND(<0.5) | 6.4 | ND(<0.5) | 0.82 | 0.76 | 0.82 | 4.3 | 1,3,7,15,21 |
| Mercury | µg/L | 0.414 | ND(<0.3) | 0.019 | 0.089 | 0.044 | 0.089 | 0.510 | 1,10,16,21 |
| Nickel | µg/L | 11.0 | ND(<8.6) | 5.2 | 13.1 | 5.2 | 13.1 | 69 | 1,7,15,21 |
| Selenium | µg/L | ND(<0.09) | 55.2 | 3 | 6.5 | 75 | 75 | 34 | 2,7,15,21 |
| Silver | µg/L | 0.50 | 0.064 | ND(<0.19) | ND(<1.59) | ND(<0.19) | ND(<1.59) | ND(<0.19) | 3,9,18,21 |
| Zinc | µg/L | 9.5 | ND(<35) | 20 | 48.4 | 20 | 48.4 | 255 | 1,7,15,21 |
| Cyanide (MBAS data) | µg/L | -- | -- | 81 | 89.5 | 81 | 89.5 | 143 | 1,7,16,20 |
| Cyanide | µg/L | ND(<8.6) | ND(<8.6) | 7.2 | 7.2 | 46 | 46 | 38 | 1,11,15,20,21 |
| Total Chlorine Residual | µg/L | -- | ND(<200) | ND(<200) | ND(<200) | ND(<200) | ND(<200) | ND(<200) | 5 |
| Ammonia (as N) 6-mo median | µg/L | 143.1 | ND(<86.2) | 36,400 | 36,400 | 36,400 | 36,400 | 191,579 | 1,6,15,21,27 |

15 Note that these ranges assign the transitional months to the ocean condition that is typically more restrictive at relevant discharge flows.

| Constituent | Units | Updated Desal Brine | Previous Desal Brine | Secondary Effluent | | Hauled Brine | | GWR Concentrate | Footnotes |
|---|---|---|---|---|---|---|---|---|---|
| | | | | *MPWSP* | *Variant* | *MPWSP* | *Variant* | | |
| Ammonia (as N) daily max | µg/L | 143.1 | ND(<86.2) | 49,000 | 49,000 | 49,000 | 49,000 | 257,895 | 1,6,15,21,27 |
| Acute Toxicity | TUa | -- | – | 2.3 | 2.3 | 2.3 | 2.3 | 0.77 | 1,12,16,17,24 |
| Chronic Toxicity | TUc | -- | – | 40 | 40 | 80 | 40 | 100 | 1,12,16,17,24 |
| Phenolic Compounds (non-chlorinated) | µg/L | ND(<86.2) | – | 69 | 69 | 69 | 69 | 363 | 1,6,14,15,23,25 26 |
| Chlorinated Phenolics | µg/L | ND(<34.5) | – | ND(<20) | ND(<20) | ND(<20) | ND(<20) | ND(<20) | 3,9,18,23,25,26 |
| Endosulfan | µg/L | ND(<3.4E-6) | 6.7E-05 | 0.015 | 0.048 | 0.015 | 0.048 | 0.25 | 1,10,14,15,22,25 |
| Endrin | µg/L | ND(<1.6E-6) | 2.8E-05 | 0.000079 | 0.000079 | 0.000079 | 0.000079 | 0.00042 | 4,8,15,22 |
| HCH (Hexachlorocyclohexane) | µg/L | 0.000043 | 0.00068 | 0.034 | 0.060 | 0.034 | 0.060 | 0.314 | 1,15,22,25 |
| Radioactivity (Gross Beta) | pCi/L | ND(<5.17) | – | 32 | 32 | 307 | 307 | 34.8 | 1,6,12,16,17,23 |
| Radioactivity (Gross Alpha) | pCi/L | 22.4 | – | 18 | 18 | 457 | 457 | 14.4 | 1,6,12,16,17,23 |
| **Objectives for protection of human health – non carcinogens – 30-day average limit** | | | | | | | | | |
| Acrolein | µg/L | ND(<3.4) | – | ND(<5) | 9.0 | ND(<5) | 9.0 | 47 | 3,7,15,23 |
| Antimony | µg/L | 0.19 | 16.6 | 0.65 | 0.79 | 0.65 | 0.79 | 4.1 | 1,6,15,21 |
| Bis (2-chloroethoxy) methane | µg/L | ND(<16.7) | – | ND(<0.5) | ND(<4.2) | ND(<0.5) | ND(<4.2) | ND(<1) | 3,9,18,23 |
| Bis (2-chloroisopropyl) ether | µg/L | ND(<16.7) | – | ND(<0.5) | ND(<4.2) | ND(<0.5) | ND(<4.2) | ND(<1) | 3,9,18,23 |
| Chlorobenzene | µg/L | ND(<0.9) | – | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| Chromium (III) | µg/L | 17 | 106.9 | 3.0 | 7.3 | 87 | 87 | 38 | 2,6,15,21 |
| Di-n-butyl phthalate | µg/L | ND(<16.7) | – | ND(<5) | ND(<7) | ND(<5) | ND(<7) | ND(<1) | 3,9,18,23 |
| Dichlorobenzenes | µg/L | ND(<0.9) | – | 1.6 | 1.6 | 1.6 | 1.6 | 8 | 1,6,15,21 |
| Diethyl phthalate | µg/L | ND(<0.9) | – | ND(<5) | ND(<5) | ND(<5) | ND(<5) | ND(<1) | 3,9,18,23 |
| Dimethyl phthalate | µg/L | ND(<0.9) | – | ND(<2) | ND(<2) | ND(<2) | ND(<2) | ND(<0.5) | 3,9,18,23 |
| 4,6-dinitro-2-methylphenol | µg/L | ND(<84.5) | – | ND(<0.5) | ND(<20) | ND(<0.5) | ND(<20) | ND(<5) | 3,9,18,23 |
| 2,4-dinitrophenol | µg/L | ND(<86.2) | – | ND(<0.5) | ND(<13) | ND(<0.5) | ND(<13) | ND(<5) | 3,9,18,23 |
| Ethylbenzene | µg/L | ND(<0.9) | – | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| Fluoranthene | µg/L | ND(<0.2) | 0.0019 | 0.00654 | 0.00654 | 0.00654 | 0.00654 | 0.03442 | 4,9,18,23 |
| Hexachlorocyclopentadiene | µg/L | ND(<0.09) | – | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.05) | 3,9,18,23 |
| Nitrobenzene | µg/L | ND(<41.4) | – | ND(<0.5) | ND(<2.3) | ND(<0.5) | ND(<2.3) | ND(<1) | 3,9,18,23 |
| Thallium | µg/L | ND(<0.1) | ND(<1.7) | ND(<0.5) | 0.69 | ND(<0.5) | 0.69 | 3.7 | 3,7,15,21 |
| Toluene | µg/L | ND(<0.9) | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| Tributyltin | µg/L | ND(<0.08) | – | ND(<0.05) | ND(<0.05) | ND(<0.05) | ND(<0.05) | ND(<0.02) | 3,13,18,23 |
| 1,1,1-trichloroethane | µg/L | ND(<0.9) | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| **Objectives for protection of human health – carcinogens – 30-day average limit** | | | | | | | | | |
| Acrylonitrile | µg/L | ND(<3.4) | – | ND(<2) | 2.5 | ND(<2) | 2.5 | 13 | 3,7,15,23 |
| Aldrin | µg/L | ND(<6.7E-5) | – | ND(<0.005) | ND(<0.007) | ND(<0.005) | ND(<0.007) | ND(<0.01) | 3,9,18,23 |
| Benzene | µg/L | ND(<0.9) | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| Benzidine | µg/L | ND(<86.2) | – | ND(<0.5) | ND(<19.8) | ND(<0.5) | ND(<19.8) | ND(<0.05) | 3,9,18,23 |
| Beryllium | µg/L | ND(<0.9) | ND(<1.7) | ND(<0.5) | ND(<0.69) | 0.0052 | 0.0052 | ND(<0.5) | 3,9,17,18,21 |
| Bis(2-chloroethyl)ether | µg/L | ND(<41.4) | – | ND(<0.5) | ND(<4.2) | ND(<0.5) | ND(<4.2) | ND(<1) | 3,9,18,23 |
| Bis(2-ethyl-hexyl)phthalate | µg/L | ND(<1.0) | ND(<1.0) | 78 | 78 | 78 | 78 | 411 | 2,6,15,23 |
| Carbon tetrachloride | µg/L | ND(<0.9) | ND(<0.5) | ND(<0.5) | 0.50 | ND(<0.5) | 0.50 | 2.66 | 3,7,15,21 |
| Chlordane | µg/L | 1.45E-5 | 0.0002 | 0.00068 | 0.00068 | 0.00068 | 0.00068 | 0.0036 | 4,8,14,15,22,25 |
| Chlorodibromomethane | µg/L | ND(<0.9) | – | ND(<0.5) | 2.4 | ND(<0.5) | 2.4 | 13 | 3,7,15,21 |
| Chloroform | µg/L | ND(<0.9) | – | 2 | 39 | 2 | 39 | 204 | 2,7,15,21 |
| DDT | µg/L | 1.7E-6 | 0.00055 | 0.0001 | 0.0001 | 0.0012 | 0.0012 | 0.006 | 4,7,14,19,22,25 |
| 1,4-dichlorobenzene | µg/L | ND(<0.9) | ND(<0.9) | 1.6 | 1.6 | 1.6 | 1.6 | 8.4 | 1,6,15,21 |
| 3,3-dichlorobenzidine | µg/L | ND(<86.2) | – | ND(<0.025) | ND(<19) | ND(<0.025) | ND(<19) | ND(<2) | 3,9,18,23 |
| 1,2-dichloroethane | µg/L | ND(<0.9) | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| 1,1-dichloroethylene | µg/L | ND(<0.9) | ND(<0.9) | ND(<0.5) | ND(<0.5) | 0.5 | 0.5 | ND(<0.5) | 3,9,18,21 |
| Dichlorobromomethane | µg/L | ND(<0.9) | – | ND(<0.5) | 2.6 | ND(<0.5) | 2.6 | 14 | 3,7,15,21 |
| Dichloromethane | µg/L | ND(<0.9) | ND(<0.9) | 0.55 | 0.64 | 0.55 | 0.64 | 3.4 | 1,7,15,21 |
| 1,3-dichloropropene | µg/L | ND(<0.9) | ND(<0.9) | ND(<0.5) | 0.56 | ND(<0.5) | 0.56 | 3.0 | 3,7,15,21 |
| Dieldrin | µg/L | 4.7E-5 | 8.8E-05 | 0.0001 | 0.0001 | 0.0006 | 0.0006 | 0.0033 | 4,7,19,22 |
| 2,4-dinitrotoluene | µg/L | ND(<0.2) | – | ND(<2) | ND(<2) | ND(<2) | ND(<2) | ND(<0.1) | 3,9,18,23 |
| 1,2-diphenylhydrazine | µg/L | ND(<16.7) | – | ND(<0.5) | ND(<4.2) | ND(<0.5) | ND(<4.2) | ND(<1) | 3,9,18,23 |
| Halomethanes | µg/L | ND(<0.9) | – | 0.54 | 1.4 | 0.73 | 1.4 | 7.5 | 2,7,14,15,21 |
| Heptachlor | µg/L | ND(<6.9E-7) | 8.6E-06 | ND(<0.01) | ND(<0.01) | ND(<0.01) | ND(<0.01) | ND(<0.01) | 3,9,18,22 |
| Heptachlor epoxide | µg/L | ND(<1.6E-6) | ND(<0.02) | 0.000079 | 0.000079 | 0.000079 | 0.000079 | 0.000416 | 4,8,15,22 |
| Hexachlorobenzene | µg/L | ND (<6.5E-5) | ND(<0.09) | 0.000078 | 0.000078 | 0.000078 | 0.000078 | 0.000411 | 4,8,15,22,23 |
| Hexachlorobutadiene | µg/L | ND(<3.4E-7) | – | 0.000009 | 0.000009 | 0.000009 | 0.000009 | 0.000047 | 4,8,15,22 |
| Hexachloroethane | µg/L | ND(<16.7) | – | ND(<0.5) | ND(<2.3) | ND(<0.5) | ND(<2.3) | ND(<0.5) | 3,9,18,23 |
| Isophorone | µg/L | ND(<0.9) | – | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,23 |
| N-Nitrosodimethylamine | µg/L | ND(<0.003) | ND(<0.003) | 0.017 | 0.096 | 0.017 | 0.096 | 0.150 | 2,7,16,17,23 |

| Constituent | Units | Updated Desal Brine | Previous Desal Brine | Secondary Effluent | | Hauled Brine | | GWR Concentrate | Footnotes |
|---|---|---|---|---|---|---|---|---|---|
| | | | | MPWSP | Variant | MPWSP | Variant | | |
| N-Nitrosodi-N-Propylamine | µg/L | ND(<0.003) | ND(<0.003) | 0.076 | 0.076 | 0.076 | 0.076 | 0.019 | 2,6,16,17,23 |
| N-Nitrosodiphenylamine | µg/L | ND(<16.7) | – | ND(<0.5) | ND(<2.3) | ND(<0.5) | ND(<2.3) | ND(<1) | 3,9,18,23 |
| PAHs | µg/L | 2.2E-3 | 0.012 | 0.03 | 0.03 | 0.03 | 0.03 | 0.19 | 4,8,14,15,22,25 |
| PCBs | µg/L | 0.00013 | 0.002 | 0.00068 | 0.00068 | 0.00068 | 0.00068 | 0.00357 | 4,8,14,15,22,25 |
| TCDD Equivalents | µg/L | ND (<2.5E-5) | – | 1.37E-7 | 1.42E-7 | 1.37E-7 | 1.42E-7 | 7.46E-7 | 4,13,14,15,23,25 |
| 1,1,2,2-tetrachloroethane | µg/L | ND(<0.9) | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| Tetrachloroethylene | µg/L | ND(<0.9) | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| Toxaphene | µg/L | 3.97E-5 | ND(<0.0013) | 0.0071 | 0.0071 | 0.0071 | 0.0071 | 0.0373 | 4,8,15,22 |
| Trichloroethylene | µg/L | ND(<0.9) | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| 1,1,2-trichloroethane | µg/L | ND(<0.9) | ND(<0.9) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |
| 2,4,6-trichlorophenol | µg/L | ND(<16.7) | – | ND(<0.5) | ND(<2.3) | ND(<0.5) | ND(<2.3) | ND(<1) | 3,9,18,23 |
| Vinyl chloride | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | ND(<0.5) | 3,9,18,21 |

**Table 4 Footnotes:**

***MPWSP Secondary Effluent and Hauled Brine***

[1] The value reported is based on MRWPCA historical data.

[2] The value reported is based on secondary effluent data collected during the GWR Project source water monitoring programs (not impacted by the proposed new source waters), and are representative of future water quality under the MPWSP scenario.

[3] The MRL provided represents the limit from NPDES monitoring data for secondary effluent and hauled waste. In cases where constituents had varying MRLs, in general, the lowest MRL is reported.

[4] RTP effluent value presented based on CCLEAN data.

***Total Chlorine Residual***

[5] For all waters, it is assumed that dechlorination will be provided such that the total chlorine residual will be below detection.

***Variant Secondary Effluent and Hauled Brine***

[6] Existing RTP effluent exceeds concentrations observed in other proposed source waters; the value reported is the existing secondary effluent value.

[7] The proposed new source waters may increase the secondary effluent concentration; the value reported is based on predicted source water blends.

[8] RTP effluent value is based on CCLEAN data; no other source waters were considered due to MRL differences.

[9] MRL provided represents the maximum flow-weighted MRL based on the blend of source waters.

[10] The only water with a detected concentration was the RTP effluent, however the flow-weighted concentration increases due to higher MRLs for the proposed new source waters.

[11] Additional source water data are not available; the reported value is for RTP effluent.

[12] Calculation of the flow-weighted concentration was not feasible due to constituent. The maximum observed value is reported.

[13] Agricultural Wash Water data are based on an aerated sample, instead of a raw water sample.

[14] This value in the Ocean Plan is an aggregate of several congeners or compounds. Per the approach described in the Ocean Plan, for cases where the individual congeners/compounds were less than the MRL, a value of 0 is assumed in calculating the aggregate value.

***GWR Concentrate Data***

[15] The value presented represents a calculated value assuming no removal prior to RO, complete rejection through RO membrane, and an 81% RO recovery.

[16] The value represents the maximum value observed during the pilot testing study.

[17] The calculated value for the AWT Facility data (described in note 15) was not used in the analysis because it was not considered representative. It is expected that the value would increase as a result of treatment through the AWT Facility (*e.g.* formation of N-Nitrosodimethylamine as a disinfection by-product), or that it will not concentrate linearly through the RO (*e.g.* toxicity and radioactivity).

[18] The MRL provided represents the limit from the source water and pilot testing monitoring programs.

[19] The value presented represents a calculated value assuming 93% and 84% removal through primary and secondary treatment for DDT and dieldrin, respectively, and 36% and 44% removal through ozone for DDT and dieldrin, respectively, complete rejection through the RO membrane, and an 81% RO recovery. The assumed removals are based on results from ozone bench-scale testing of Blanco Drain water blended with secondary effluent and low detection sampling through the RTP.

***Cyanide Data***
[20] In mid-2011, MBAS began performing the cyanide analysis on the RTP effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore questionable. Therefore, the cyanide values as measured by MBAS are listed separately from other cyanide values, and the MBAS data were not be used in the analysis for evaluating compliance with the Ocean Plan objectives.

***Desal Brine Data***
[21] The value reported is based on test slant well data collected through the Watershed Sanitary Survey.
[22] The value reported is based on data from the one-time 7-day composite sample from the test slant well. If ND, the method detection limit was used for the analysis instead of the MRL. MRLs were not available for this data set.
[23] The value reported is based on data from the test slant well collected through the quarterly Ocean Plan constituents monitoring.
[24] Acute and chronic toxicity have not been measured or estimated
[25] This value in the Ocean Plan is an aggregate of several congeners or compounds. Per the approach described in the Ocean Plan, for cases where the individual congeners/compounds were less than the MRL, a value of 0 is assumed in calculating the aggregate value.
[26] Chlorinated phenolic compounds is the sum of the following: 4-chloro-3-methylphenol, 2-chlorophenol, pentachlorophenol, 2,4,5-trichlorophenol, and 2,4,6-trichlorophenol. Non-chlorinated phenolic compounds is the sum of the following: 2,4-dimethylphenol, 4,6-Dinitro-2-methylphenol, 2,4-dinitrophenol, 2-methylphenol, 4-methylphenol, 2-nitrophenol, 4-nitrophenol, and phenol.

***General***
[27] Ammonia (as N) represents the total ammonia concentration, *i.e.* the sum of unionized ammonia ($NH_3$) and ionized ammonia ($NH_4$).
[28] The value reported for the Variant secondary effluent was calculated using the median of the data collected for the new source waters and is an estimate of the potential increase in concentration of the secondary effluent based on predicted source water blends. The value reported for the Desal Brine was calculated with the median of the data collected from the test slant well and assuming a 42% recovery through the RO. The median values were used because the maximum values detected in both sources appear to be outliers, and because the Ocean Plan objective is a 6-month median concentration, it is reasonable to use the median value detected from these source waters.

## 3.2 Ocean Modeling Results

The estimated minimum probable dilution ($D_m$) for each discharge scenario is presented in Tables 5 and 6 (Roberts, P. J. W., 2016). For discharge scenarios that were modeled with more than one modeling method, the lowest $D_m$ (*i.e.*, most conservative) is reported in the tables below. For the MPWSP, the flow scenarios in which little or no secondary effluent was discharged (Scenarios 2, 3 and 4) resulted in the lowest $D_m$ values as a result of the discharge plume being negatively buoyant. At higher secondary effluent flows, the discharge plume would be positively buoyant, resulting in an increased $D_m$, as evidenced in Scenario 6. The same trend was observed for Variant scenarios.

**Table 5 – Flow scenarios and modeled $D_m$ values used for Ocean Plan compliance analysis for MPWSP**

| No. | Discharge Scenario (Ocean Condition) | Discharge flows (mgd) | | | $D_m$ [b] |
|---|---|---|---|---|---|
| | | Secondary effluent | Desal Brine | Hauled brine [a] | |
| 2 | Desal Brine with no secondary effluent | 0 | 13.98 | 0.1 | 14.6 |
| 3 | Desal Brine with low secondary effluent | 1 | 13.98 | 0.1 | 15.2 |
| 4 | Desal Brine with low secondary effluent | 2 | 13.98 | 0.1 | 16.0 |
| 5 | Desal Brine with moderate secondary effluent | 9 | 13.98 | 0.1 | 34.3 |
| 6 | Desal Brine with high secondary effluent [c] | 19.78 | 13.98 | 0.1 | 153 |

[a] Hauled brine was not included in the modeling of MPWSP flow scenarios; however, the change in both flow and TDS from the addition of hauled brine is less than 1% and thus is expected to have a negligible impact on the modeled $D_m$.
[b] Several models were used to predict the minimal probable dilution value ($UM_3$, Cederwall for neutral and negatively buoyant plumes, and NRFIELD for buoyant plumes). Values included here are the model results ($D_m$ values) that resulted in the lowest $D_m$. A value of 1 has also been subtracted from Dr. Roberts' values to take into account the different definition of dilution/$D_m$ provided by Dr. Roberts versus the Ocean Plan.
[c] Note that RTP wastewater flows have been declining in recent years as a result of conservation; while 19.68 mgd is higher than current RTP wastewater flows, this is expected to be a conservative scenario with respect to ocean modeling, compared to using the current wastewater flows of 16 to 18 mgd.

**Table 6 – Flow scenarios and modeled $D_m$ values used for Ocean Plan compliance analysis for Variant**

| No. | Discharge Scenario | Discharge Flows (mgd) | | | | $D_m$ [b] |
|---|---|---|---|---|---|---|
| | | Secondary Effluent | Desal Brine | GWR Concentrate | Hauled Brine [a] | |
| 1 | Desal Brine only | 0 | 8.99 | 0 | 0.1 | 14.9 |
| 2 | Desal Brine with low secondary effluent | 1 | 8.99 | 0 | 0.1 | 15.7 |
| 3 | Desal Brine with low secondary effluent | 2 | 8.99 | 0 | 0.1 | 16.7 |
| 4 | Desal Brine with moderate secondary effluent | 5.8 | 8.99 | 0 | 0.1 | 31.5 |
| 5 | Desal Brine with high secondary effluent [b] | 19.78 | 8.99 | 0 | 0.1 | 104 |
| 6 | Desal Brine with GWR Concentrate and no secondary effluent | 0 | 8.99 | 0.94 | 0.1 | 15.6 |
| 7 | Desal Brine with GWR Concentrate and low secondary effluent | 1 | 8.99 | 0.94 | 0.1 | 16.4 |
| 8 | Desal Brine with GWR Concentrate and low secondary effluent | 3 | 8.99 | 0.94 | 0.1 | 20.3 |
| 9 | Desal Brine with GWR Concentrate and moderate secondary effluent | 5.3 | 8.99 | 0.94 | 0.1 | 54.4 |
| 10 | Desal Brine with GWR Concentrate and high secondary effluent | 15.92 | 8.99 | 0.94 | 0.1 | 194 |

[a] Hauled brine was not included in the modeling of Variant scenarios involving discharge of desalination brine. However, the change in both flow and TDS from the addition of hauled brine is less than 1% and thus is expected to have a negligible impact on the modeled $D_m$.
[b] Several models were used to predict the minimal probable dilution value ($UM_3$, Cederwall for neutral and negatively buoyant plumes, and NRFIELD for buoyant plumes). Values included here are the model results ($D_m$ values) that resulted in the lowest $D_m$. A value of 1 has also been subtracted from Dr. Roberts' values to take into account the different definition of dilution/$D_m$ provided by Dr. Roberts versus the Ocean Plan.

## 3.3 Ocean Plan Compliance Results

The flow-weighted in-pipe concentration for each constituent was calculated for each modeled discharge scenario using the water quality presented in Table 4 and the discharge flows presented in Tables 2 and 3. The in-pipe concentration was then used to calculate the concentration at the edge of the ZID using the $D_m$ values presented in Tables 5 and 6. The resulting concentrations for each constituent in each scenario were compared to the Ocean Plan objectives to assess compliance. The estimated concentrations for the 15 flow scenarios (5 for the MPWSP and 10 for the Variant) for all constituents are presented as concentrations at the edge of the ZID (Appendix A, Table A1 and A3) and as a percentage of the Ocean Plan objective (Appendix A, Table A2 and A4).

It was identified that some constituents are estimated to exceed the Ocean Plan objective for some discharge scenarios. Seventeen[16] constituents were highlighted to potentially exceed the Ocean Plan water quality objectives; however, ten[17] of these constituents were never detected above the MRL in any of the source waters, and the MRLs are higher than the Ocean Plan objective.[18] Due to this insufficient analytical sensitivity, no compliance conclusion can be drawn for these constituents. This is a typical occurrence for ocean discharges since the MRL of the approved compliance analysis method is higher than the Ocean Plan objective for certain constituents.

Of the constituents detected in the source waters, seven were identified as having potential to exceed the Ocean Plan objective in the Variant. Within this subset, acrylonitrile, beryllium and TCDD equivalents were detected in some of the source waters, but not in the others. For these analyses, the MRLs themselves were above the Ocean Plan objective. To assess the blended concentrations for these constituents, a value of zero was assumed for any sources when the concentration was below the MRL.[19] This approach is a "best-case" scenario because it assumes the lowest possible concentration—namely, a value of zero—for any constituent below the reporting limit. This approach is still useful, however, to bracket the analysis and assess the potential for Ocean Plan compliance issues under best-case conditions. Through this method, TCDD equivalents shows potential to exceed the Ocean Plan objective for the Variant. The predicted concentration of acrylonitrile[20] and beryllium at the edge of the ZID is less than the Ocean Plan objective and therefore did not show exceedances through this "best-case" analysis.

A list of the constituents that may exceed the Ocean Plan are shown at their estimated concentration at the edge of the ZID in Table 7 for the MPWSP and Table 8 for the Variant, and as the concentration at the edge of the ZID as a percentage of the Ocean Plan objective in Table 9 and 10 for the MPWSP and Variant, respectively. The "best-case" scenario compliance assessment results for TCDD equivalents is also included in these tables.

[16] Ammonia, chlorinated phenolics, 2,4-dinitrophenol, tributyltin, acrylonitrile, aldrin, benzidine, beryllium, bis(2-chloroethyl)ether, chlordane, 3,3-dichlorobenzidine, 1,2-diphenylhydrazine, heptachlor, PCBs, TCDD equivalents, toxaphene, 2,4,6-trichlorophenol

[17] Chlorinated phenolics, 2,4-dinitrophenol, tributyltin, aldrin, benzidine, bis(2-chloroethyl)ether, 3,3-dichlorobenzidine, 1,2-diphenylhydrazine, heptachlor, 2,4,6-trichlorophenol

[18] The exceptions to this statement are: 2,4-dinitrophenol was ND in the MPWSP Secondary Effluent, and this MRL is lower than the Ocean Plan objective (*i.e.*, MRL = 0.5 ug/L versus 4 ug/L = objective); heptachlor was not detected above the MRL in the slant well, and this MRL is lower than the Ocean Plan objective (*i.e.*, MRL = 0.00000069 ug/L versus 0.00005 ug/L).

[19] Additionally, the Ocean Plan states that for constituents that are made up of an aggregate of constituents, a concentration of 0 can be assumed for the individual constituents that are not detected above the MRL, such as TCDD equivalents.

[20] Acrylonitrile was only detected in one potential source water for the Variant. It was not detected in any potential source waters for the MPWSP Project; therefore, a compliance determination cannot be made for the MPWSP Project and only partial determination can be made for the Variant.

**Table 7 – Predicted concentrations at the edge of the ZID for Ocean Plan constituents of concern in the MPWSP [a]**

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | MPWSP | | | | |
| | | | 2 | 3 | 4 | 5 | 6 |
| *Objectives for protection of marine aquatic life* - 6-month median limit | | | | | | | |
| Ammonia (as N) – 6-mo median [b] | µg/L | 600 | 25.7 | 172.1 | 287 | 409.0 | 139.2 |
| *Objectives for protection of human health - carcinogens* - 30-day average limit [c d] | | | | | | | |
| Chlordane | µg/L | 2.3E-05 | 1.23E-06 | 3.91E-06 | 6.00E-06 | 7.89E-06 | 2.65E-06 |
| PCBs | µg/L | 1.9E-05 | 8.76E-06 | 1.07E-05 | 1.20E-05 | 9.86E-06 | 2.94E-06 |
| TCDD Equivalents [d] | µg/L | 3.9E-09 | 6.23E-11 | 6.17E-10 | 1.05E-09 | 1.53E-09 | 5.22E-10 |
| Toxaphene [e] | µg/L | 2.1E-04 | 5.75E-06 | 3.42E-05 | 5.65E-05 | 7.99E-05 | 2.71E-05 |

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.
[b] Ammonia (as N) represents the total ammonia concentration, *i.e.* the sum of unionized ammonia ($NH_3$) and ionized ammonia ($NH_4$).
[c] Acrylonitrile was only detected in one potential source water for the Variant Project. It was not detected in any potential source waters for the MPWSP Project; therefore, a compliance determination cannot be made for the MPWSP Project and only partial determination can be made for the Variant Project.
[d] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

**Table 8 – Predicted concentrations at the edge of the ZID for Ocean Plan constituents of concern in the Variant [a]**

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Variant | | | | | | | | | |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| *Objectives for protection of marine aquatic life* - 6-month median limit | | | | | | | | | | | | |
| Ammonia (as N) – 6-mo median [b] | µg/L | 600 | 34 | 245 | 396 | 446 | 239 | 1111 | 1154 | 1060 | 445 | 151 |
| *Objectives for protection of human health - carcinogens* - 30-day average limit [c] | | | | | | | | | | | | |
| Chlordane | µg/L | 2.3E-05 | 1.37E-6 | 5.24E-6 | 7.98E-6 | 8.61E-6 | 4.53E-6 | 2.15E-5 | 2.22E-5 | 2.03E-5 | 8.49E-6 | 2.86E-6 |
| PCBs | µg/L | 1.9E-05 | 8.72E-6 | 1.15E-5 | 1.33E-5 | 1.07E-5 | 4.85E-6 | 2.77E-5 | 2.76E-5 | 2.40E-5 | 9.68E-6 | 3.05E-6 |
| TCDD Equivalents [c] | µg/L | 3.9E-09 | 9.81E-11 | 9.26E-10 | 1.52E-9 | 1.73E-9 | 9.30E-10 | 4.30E-9 | 4.47E-9 | 4.11E-9 | 1.73E-9 | 5.87E-10 |
| Toxaphene [d] | µg/L | 2.1E-04 | 7.37E-6 | 4.84E-5 | 7.77E-5 | 8.72E-5 | 4.66E-5 | 2.17E-4 | 2.25E-4 | 2.07E-4 | 8.68E-5 | 2.94E-5 |

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Ammonia (as N) represents the total ammonia concentration, *i.e.* the sum of unionized ammonia ($NH_3$) and ionized ammonia ($NH_4$).

[c] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.

[d] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

**Table 9 – Predicted concentrations at the edge of the ZID expressed as percentage of Ocean Plan Objective for constituents of in the MPWSP [a]**

| Constituent | Units | Ocean Plan Objective | Est. Percentage of Ocean Plan objective at Edge of ZID by Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | MPWSP | | | | |
| | | | 2 | 3 | 4 | 5 | 6 |
| *Objectives for protection of marine aquatic life* - 6-month median limit | | | | | | | |
| Ammonia (as N) – 6-mo median [b] | µg/L | 600 | 4% | 29% | 48% | 68% | 23% |
| *Objectives for protection of human health – carcinogens – 30-day average limit [c d]* | | | | | | | |
| Chlordane | µg/L | 2.3E-05 | 5% | 17% | 26% | 34% | 12% |
| PCBs | µg/L | 1.9E-05 | 46% | 56% | 63% | 52% | 15% |
| TCDD Equivalents [d] | µg/L | 3.9E-09 | 2% | 16% | 27% | 39% | 13% |
| Toxaphene [e] | µg/L | 2.1E-04 | 3% | 16% | 27% | 38% | 13% |

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Ammonia (as N) represents the total ammonia concentration, *i.e.* the sum of unionized ammonia ($NH_3$) and ionized ammonia ($NH_4$).

[c] Acrylonitrile was only detected in one potential source water for the Variant Project. It was not detected in any potential source waters for the MPWSP Project; therefore, a compliance determination cannot be made for the MPWSP Project and only partial determination can be made for the Variant Project.

[d] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.

[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

**Table 10 – Predicted concentrations at the edge of the ZID expressed as percentage of Ocean Plan Objective for constituents of in the Variant [a]**

| Constituent | Units | Ocean Plan Objective | Est. Percentage of Ocean Plan objective at Edge of ZID by Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Variant | | | | | | | | | |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| *Objectives for protection of marine aquatic life* - 6-month median limit | | | | | | | | | | | | |
| Ammonia (as N) – 6-mo median [b] | µg/L | 600 | 5.7% | 41% | 66% | 74% | 40% | 185% | 192% | 177% | 74% | 25% |
| *Objectives for protection of human health - carcinogens* - 30-day average limit [c] | | | | | | | | | | | | |
| Chlordane | µg/L | 2.3E-05 | 6% | 23% | 35% | 37% | 20% | 94% | 97% | 88% | 37% | 12% |
| PCBs | µg/L | 1.9E-05 | 46% | 61% | 70% | 57% | 26% | 146% | 145% | 126% | 51% | 16% |
| TCDD Equivalents [c] | µg/L | 3.9E-09 | 3% | 24% | 39% | 44% | 24% | 110% | 115% | 105% | 44% | 15% |
| Toxaphene [d] | µg/L | 2.1E-04 | 4% | 23% | 37% | 42% | 22% | 103% | 107% | 99% | 41% | 14% |

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.
[b] Ammonia (as N) represents the total ammonia concentration, *i.e.* the sum of unionized ammonia ($NH_3$) and ionized ammonia ($NH_4$).
[c] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[d] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

Potential issues were identified to occur when there is no, or relatively low, secondary effluent flow mixed with hauled brine, GWR Concentrate and Desal Brine, as in Variant Scenarios 6, 7 and 8. The constituents of interest related to these scenarios are ammonia, chlordane, PCBs, TCDD equivalents, and toxaphene. Ammonia is expected to be the constituent with the highest exceedance, being 1.92 times the Ocean Plan objective in Scenario 7 (1 mgd secondary effluent with hauled brine, GWR Concentrate and Desal Brine). This scenario is problematic because constituents that have relatively high loadings in the secondary effluent are concentrated in the GWR Concentrate. This scenario assumes the GWR Concentrate flow is much smaller than the Desal Brine flow, such that the resulting discharge plume is negatively buoyant and achieves poor ocean dilution. Based on this analysis, Scenarios 6, 7 and 8 have been identified as having constituents that may exceed the Ocean Plan objective.

Chlordane, PCBs, and toxaphene were only detected when analyzed with low-detection methods, which have far greater sensitivity than standard methods. These results were used to investigate potential to exceed Ocean Plan objectives because these objectives are orders of magnitude below detection limits of methods currently used for discharge compliance.

# 4 Conclusions

The purpose of this analysis was to assess the ability of the MPWSP and Variant to comply with the Ocean Plan objectives. Trussell Tech used a conservative approach to estimate the water qualities of the secondary effluent, GWR Concentrate, Desal Brine and hauled brine for these projects. These water quality data were then combined for various discharge scenarios, and a concentration at the edge of the ZID was calculated for each constituent and scenario. Seventeen constituents showed potential to exceed the Ocean Plan objectives. These constituents can be divided into three categories:

- Detected concentrations exceed Ocean Plan objectives (Category I): four constituents were detected in all source waters and the blended concentration at the edge of the ZID exceeded the Ocean Plan objective
- Insufficient analytical sensitivity to determine compliance (Category II): ten constituents were not detected above the MRL in any of the source waters, but the MRL was not sensitive enough to demonstrate compliance with the Ocean Plan objective
- Combination of Categories I and II: discharge blends contain sources with exceedances of Ocean Plan objectives (Category I) and sources whose compliance is indeterminate (Category II).

Based on the data, assumptions, modeling, and analytical methodology presented in this technical memorandum, the Variant shows a potential to exceed certain Ocean Plan objectives under specific discharge scenarios. In particular, potential issues were identified for the Variant discharge scenarios involving low secondary effluent flows with Desal Brine and GWR Concentrate: discharges are predicted to exceed or come close to exceeding multiple Ocean Plan objectives, specifically those for ammonia, chlordane, PCBs, TCDD equivalents, and toxaphene. Ammonia clearly exceeds the Ocean Plan objective and must be resolved for the Variant. TCDD equivalents shows a potential to exceed the Ocean Plan objective through a best-case analysis. Chlordane, PCBs and toxaphene, which were predicted to exceed the objectives, were detected at concentrations that are orders of magnitude below detection limits of methods currently used for discharge compliance.

# 5 References

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# Appendix A

**Table A1 – Complete list of predicted concentrations of Ocean Plan constituents at the edge of the ZID for the MPWSP**

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | MPWSP | | | | |
| | | | 2 | 3 | 4 | 5 | 6 |
| *Objectives for protection of marine aquatic life* - 6-month median limit | | | | | | | |
| Arsenic | µg/L | 8 | 3.9 | 4.0 | 4.1 | 3.7 | 3.2 |
| Cadmium | µg/L | 1 | 0.3 | 0.3 | 0.3 | 0.1 | 0.02 |
| Chromium (Hexavalent) | µg/L | 2 | 0.1 | 0.1 | 0.1 | 0.04 | 0.01 |
| Copper | µg/L | 3 | 1.9 | 2.0 | 2.0 | 2.1 | 2.0 |
| Lead | µg/L | 2 | 0.03 | 0.03 | 0.03 | 0.01 | 0.003 |
| Mercury | µg/L | 0.04 | 0.03 | 0.02 | 0.02 | 0.01 | 0.002 |
| Nickel | µg/L | 5 | 0.7 | 0.7 | 0.6 | 0.2 | 0.05 |
| Selenium | µg/L | 15 | 0.04 | 0.05 | 0.05 | 0.04 | 0.01 |
| Silver | µg/L | 0.7 | 0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| Zinc | µg/L | 20 | 8.1 | 8.1 | 8.2 | 8.2 | 8.0 |
| Cyanide | µg/L | 1 | 0.6 | 0.5 | 0.5 | 0.2 | 0.1 |
| Total Chlorine Residual | µg/L | 2 | – | – | – | – | – |
| Ammonia (as N) - 6-mo median | µg/L | 600 | 25.7 | 172.1 | 287 | 409.0 | 139.2 |
| Ammonia (as N) - Daily Max | µg/L | 2,400 | 31.4 | 228.8 | 384 | 549.8 | 187.2 |
| Acute Toxicity [a] | TUa | 0.3 | | | | | |
| Chronic Toxicity [a] | TUc | 1 | | | | | |
| Phenolic Compounds (non-chlorinated) | µg/L | 30 | 5.5 | 5.2 | 4.9 | 2.2 | 0.5 |
| Chlorinated Phenolics [b] | µg/L | 1 | <2.20 | <2.06 | <1.92 | <0.82 | <0.17 |
| Endosulfan | µg/L | 0.009 | 7.05E-06 | 6.77E-05 | 1.15E-04 | 1.68E-04 | 5.72E-05 |
| Endrin | µg/L | 0.002 | 1.35E-07 | 4.45E-07 | 6.86E-07 | 9.09E-07 | 3.05E-07 |
| HCH (Hexachlorocyclohexane) | µg/L | 0.004 | 1.82E-05 | 1.56E-04 | 2.63E-04 | 3.81E-04 | 1.30E-04 |
| Radioactivity (Gross Beta) [a] | pCi/L | 0.0 | | | | | |
| Radioactivity (Gross Alpha) [a] | pCi/L | 0.0 | | | | | |
| *Objectives for protection of human health – non carcinogens – 30-day average limit* | | | | | | | |
| Acrolein | µg/L | 220 | <0.2 | <0.2 | <0.2 | <0.1 | <0.03 |
| Antimony | µg/L | 1200 | 0.01 | 0.01 | 0.01 | 0.01 | 0.003 |
| Bis (2-chloroethoxy) methane | µg/L | 4.4 | <1.1 | <1.0 | <0.9 | <0.3 | <0.05 |
| Bis (2-chloroisopropyl) ether | µg/L | 1200 | <1.1 | <1.0 | <0.9 | <0.3 | <0.05 |
| Chlorobenzene | µg/L | 570 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| Chromium (III) | µg/L | 190000 | 1.1 | 1.0 | 0.9 | 0.3 | 0.1 |
| Di-n-butyl phthalate | µg/L | 3500 | <1.1 | <1.0 | <0.9 | <0.3 | <0.1 |
| Dichlorobenzenes | µg/L | 5100 | <0.1 | 0.1 | 0.1 | 0.03 | 0.01 |
| Diethyl phthalate | µg/L | 33000 | <0.1 | <0.1 | <0.1 | <0.1 | <0.02 |
| Dimethyl phthalate | µg/L | 820000 | <0.1 | <0.1 | <0.1 | <0.04 | <0.01 |
| 4,6-dinitro-2-methylphenol | µg/L | 220 | <5.4 | <4.8 | <4.3 | <1.5 | <0.2 |
| 2,4-Dinitrophenol [b] | µg/L | 4.0 | <5.5 | <4.9 | <4.4 | <1.5 | <0.2 |
| Ethylbenzene | µg/L | 4100 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| Fluoranthene | µg/L | 15 | <0.01 | 0.01 | 0.01 | 0.003 | 0.0005 |
| Hexachlorocyclopentadiene | µg/L | 58 | <0.01 | <0.01 | <0.01 | <0.01 | <0.002 |
| Nitrobenzene | µg/L | 4.9 | <2.6 | <2.4 | <2.1 | <0.7 | <0.1 |
| Thallium | µg/L | 2 | <0.01 | <0.01 | <0.01 | <0.01 | <0.002 |
| Toluene | µg/L | 85000 | <0.06 | <0.05 | <0.05 | <0.02 | <0.004 |
| Tributyltin [b] | µg/L | 0.0014 | <0.01 | <0.005 | <0.005 | <0.002 | <0.0004 |
| 1,1,1-Trichloroethane | µg/L | 540000 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| *Objectives for protection of human health – carcinogens – 30-day average limit* | | | | | | | |
| Acrylonitrile [c d] | µg/L | 0.10 | -- | -- | -- | -- | -- |
| Aldrin [b] | µg/L | 0.000022 | <6.51E-06 | <2.63E-05 | <4.18E-05 | <5.70E-05 | <1.92E-05 |

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | MPWSP | | | | |
| | | | 2 | 3 | 4 | 5 | 6 |
| Benzene | µg/L | 5.9 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| Benzidine [b] | µg/L | 0.000069 | <5.5 | <4.9 | <4.4 | <1.5 | <0.2 |
| Beryllium [d] | µg/L | 0.033 | 2.38E-6 | 2.14E-6 | 1.91E-6 | 6.41E-7 | 1.00E-7 |
| Bis(2-chloroethyl)ether [b] | µg/L | 0.045 | <2.6 | <2.4 | <2.1 | <0.7 | <0.1 |
| Bis(2-ethyl-hexyl)phthalate | µg/L | 3.5 | 0.1 | 0.4 | 0.7 | 0.9 | 0.3 |
| Carbon tetrachloride | µg/L | 0.90 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| Chlordane | µg/L | 0.000023 | 1.23E-6 | 3.91E-6 | 6.00E-6 | 7.89E-6 | 2.65E-6 |
| Chlorodibromomethane | µg/L | 8.6 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| Chloroform | µg/L | 130 | 0.1 | 0.1 | 0.1 | 0.04 | 0.01 |
| DDT | µg/L | 0.00017 | 1.53E-7 | 5.28E-7 | 8.21E-7 | 1.09E-6 | 3.68E-7 |
| 1,4-Dichlorobenzene | µg/L | 18 | 0.1 | 0.1 | 0.1 | 0.03 | 0.01 |
| 3,3-Dichlorobenzidine [b] | µg/L | 0.0081 | <5.5 | <4.9 | <4.4 | <1.5 | <0.2 |
| 1,2-Dichloroethane | µg/L | 28 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| 1,1-Dichloroethylene | µg/L | 0.9 | 0.1 | 0.1 | 0.05 | 0.02 | 0.004 |
| Dichlorobromomethane | µg/L | 6.2 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| Dichloromethane | µg/L | 450 | <0.1 | 0.1 | 0.05 | 0.02 | 0.004 |
| 1,3-dichloropropene | µg/L | 8.9 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| Dieldrin | µg/L | 0.00004 | 3.01E-6 | 3.15E-6 | 3.21E-6 | 2.01E-6 | 5.37E-7 |
| 2,4-Dinitrotoluene | µg/L | 2.6 | <0.01 | <0.02 | <0.02 | <0.03 | <0.01 |
| 1,2-Diphenylhydrazine [b] | µg/L | 0.16 | <1.1 | <1.0 | <0.9 | <0.3 | <0.05 |
| Halomethanes | µg/L | 130 | 0.1 | 0.1 | 0.05 | 0.02 | 0.004 |
| Heptachlor [b] | µg/L | 0.00005 | <4.60E-06 | <4.51E-05 | <7.69E-05 | <1.12E-04 | <3.81E-05 |
| Heptachlor Epoxide | µg/L | 0.00002 | 1.35E-07 | 4.45E-07 | 6.86E-07 | 9.09E-07 | 3.05E-07 |
| Hexachlorobenzene | µg/L | 0.00021 | 4.18E-06 | 4.08E-06 | 3.93E-06 | 1.99E-06 | 4.72E-07 |
| Hexachlorobutadiene | µg/L | 14 | 2.60E-08 | 6.03E-08 | 8.68E-08 | 1.06E-07 | 3.52E-08 |
| Hexachloroethane | µg/L | 2.5 | <1.1 | <1.0 | <0.9 | <0.3 | <0.05 |
| Isophorone | µg/L | 730 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| N-Nitrosodimethylamine | µg/L | 7.3 | 0.0002 | 0.0003 | 0.0003 | 0.0002 | 0.0001 |
| N-Nitrosodi-N-Propylamine | µg/L | 0.38 | 0.0003 | 0.001 | 0.001 | 0.001 | 0.0003 |
| N-Nitrosodiphenylamine | µg/L | 2.5 | <1.1 | <1.0 | <0.9 | <0.3 | <0.05 |
| PAHs | µg/L | 0.0088 | 1.51E-04 | 2.48E-04 | 3.23E-04 | 3.45E-04 | 1.11E-04 |
| PCBs | µg/L | 0.000019 | 8.76E-06 | 1.07E-05 | 1.20E-05 | 9.86E-06 | 2.94E-06 |
| TCDD Equivalents [d] | µg/L | 3.9E-09 | 6.23E-11 | 6.17E-10 | 1.05E-09 | 1.53E-09 | 5.22E-10 |
| 1,1,2,2-Tetrachloroethane | µg/L | 2.3 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| Tetrachloroethylene | µg/L | 2.0 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| Toxaphene [e] | µg/L | 2.1E-04 | 5.75E-06 | 3.42E-05 | 5.65E-05 | 7.99E-05 | 2.71E-05 |
| Trichloroethylene | µg/L | 27 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| 1,1,2-Trichloroethane | µg/L | 9.4 | <0.1 | <0.1 | <0.05 | <0.02 | <0.004 |
| 2,4,6-Trichlorophenol [b] | µg/L | 0.29 | <1.1 | <1.0 | <0.9 | <0.3 | <0.05 |
| Vinyl chloride | µg/L | 36 | <0.03 | <0.03 | <0.03 | <0.01 | <0.003 |

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent.

[b] All observed values from some data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[c] Acrylonitrile was only detected in one potential source water for the Variant Project. It was not detected in any potential source waters for the MPWSP Project; therefore, a compliance determination cannot be made for the MPWSP Project and only partial determination can be made for the Variant Project.

[d] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance

determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

**Table A2 – Complete list of predicted concentrations at the edge of the ZID expressed as a percentage of Ocean Plan[a]**

| Constituent | Units | Ocean Plan Objective | Percentage of Ocean Plan Objective at Edge of ZID by Scenario [a] | | | | |
|---|---|---|---|---|---|---|---|
| | | | MPWSP | | | | |
| | | | 2 | 3 | 4 | 5 | 6 |
| *Objectives for protection of marine aquatic life* - 6-month median limit | | | | | | | |
| Arsenic | μg/L | 8 | 49% | 50% | 51% | 46% | 40% |
| Cadmium | μg/L | 1 | 32% | 29% | 26% | 10% | 2% |
| Chromium (Hexavalent) | μg/L | 2 | 3% | 3% | 3% | 2% | 1% |
| Copper | μg/L | 3 | 64% | 65% | 67% | 69% | 68% |
| Lead | μg/L | 2 | 2% | 2% | 2% | 1% | 0.2% |
| Mercury | μg/L | 0.04 | 67% | 61% | 54% | 20% | 4% |
| Nickel | μg/L | 5 | 14% | 13% | 12% | 5% | 1% |
| Selenium | μg/L | 15 | 0.3% | 0.3% | 0.4% | 0.3% | 0.1% |
| Silver | μg/L | 0.7 | 26% | <26% | <25% | <24% | <23% |
| Zinc | μg/L | 20 | 40% | 41% | 41% | 41% | 40% |
| Cyanide | μg/L | 1 | 57% | 54% | 51% | 23% | 5% |
| Total Chlorine Residual | μg/L | 2 | – | – | – | – | – |
| Ammonia (as N) - 6-mo median | μg/L | 600 | 4% | 29% | 48% | 68% | 23% |
| Ammonia (as N) - Daily Max | μg/L | 2,400 | 1% | 10% | 16% | 23% | 8% |
| Acute Toxicity [b] | TUa | 0.3 | | | | | |
| Chronic Toxicity [b] | TUc | 1 | | | | | |
| Phenolic Compounds (non-chlorinated) | μg/L | 30 | 18% | 17% | 16% | 7% | 2% |
| Chlorinated Phenolics [c] | μg/L | 1 | -- | -- | -- | -- | -- |
| Endosulfan | μg/L | 0.009 | 0.1% | 1% | 1% | 2% | 1% |
| Endrin | μg/L | 0.002 | 0.01% | 0.02% | 0.03% | 0.05% | 0.02% |
| HCH (Hexachlorocyclohexane) | μg/L | 0.004 | 0.5% | 4% | 7% | 10% | 3% |
| Radioactivity (Gross Beta) [b] | pci/L | 0.0 | | | | | |
| Radioactivity (Gross Alpha) [b] | pci/L | 0.0 | | | | | |
| *Objectives for protection of human health – non carcinogens – 30-day average limit* | | | | | | | |
| Acrolein | μg/L | 220 | <0.1% | <0.1% | <0.1% | <0.1% | <0.01% |
| Antimony | μg/L | 1200 | 0.0010% | 0.0011% | 0.0012% | 0.0009% | 0.0002% |
| Bis (2-chloroethoxy) methane | μg/L | 4.4 | <24% | <22% | <20% | <7% | <1% |
| Bis (2-chloroisopropyl) ether | μg/L | 1200 | <0.09% | <0.08% | <0.07% | <0.02% | <0.01% |
| Chlorobenzene | μg/L | 570 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Chromium (III) | μg/L | 190000 | 0.0006% | 0.0005% | 0.0005% | 0.0002% | 0.00003% |
| Di-n-butyl phthalate | μg/L | 3500 | <0.03% | <0.03% | <0.03% | <0.01% | <0.01% |
| Dichlorobenzenes | μg/L | 5100 | 0.001% | 0.001% | 0.001% | 0.001% | 0.0002% |
| Diethyl phthalate | μg/L | 33000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dimethyl phthalate | μg/L | 820000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 4,6-dinitro-2-methylphenol | μg/L | 220 | <2% | <2% | <2% | <1% | <0.1% |
| 2,4-Dinitrophenol [c] | μg/L | 4.0 | -- | -- | -- | -- | -- |
| Ethylbenzene | μg/L | 4100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Fluoranthene | μg/L | 15 | 0.1% | 0.1% | 0.1% | 0.02% | 0.003% |
| Hexachlorocyclopentadiene | μg/L | 58 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Nitrobenzene | μg/L | 4.9 | <54% | <48% | <43% | <15% | <2% |
| Thallium | μg/L | 2 | <0.3% | <0.4% | <0.4% | <0.4% | <0.1% |
| Toluene | μg/L | 85000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Tributyltin [c] | μg/L | 0.0014 | -- | -- | -- | -- | -- |
| 1,1,1-Trichloroethane | μg/L | 540000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |

| Constituent | Units | Ocean Plan Objective | Percentage of Ocean Plan Objective at Edge of ZID by Scenario [a] | | | | |
|---|---|---|---|---|---|---|---|
| | | | MPWSP | | | | |
| | | | 2 | 3 | 4 | 5 | 6 |
| *Objectives for protection of human health – carcinogens – 30-day average limit* | | | | | | | |
| Acrylonitrile [d e] | µg/L | 0.10 | -- | -- | -- | -- | -- |
| Aldrin [c] | µg/L | 0.000022 | -- | -- | -- | -- | -- |
| Benzene | µg/L | 5.9 | <1% | <1% | <1% | <0.3% | <0.1% |
| Benzidine [c] | µg/L | 0.000069 | -- | -- | -- | -- | -- |
| Beryllium [e] | µg/L | 0.033 | 0% | 0% | 0% | 0% | 0% |
| Bis(2-chloroethyl)ether [c] | µg/L | 0.045 | -- | -- | -- | -- | -- |
| Bis(2-ethyl-hexyl)phthalate | µg/L | 3.5 | 3% | 12% | 19% | 25% | 9% |
| Carbon tetrachloride | µg/L | 0.90 | <6% | <6% | <5% | <2% | <0.5% |
| Chlordane | µg/L | 0.000023 | 5% | 17% | 26% | 34% | 12% |
| Chlorodibromomethane | µg/L | 8.6 | <1% | <1% | <1% | <0.2% | <0.05% |
| Chloroform | µg/L | 130 | 0.04% | 0.04% | 0.05% | 0.03% | 0.01% |
| DDT | µg/L | 0.00017 | 0.09% | 0.31% | 0.48% | 0.64% | 0.22% |
| 1,4-Dichlorobenzene | µg/L | 18 | 0.3% | 0.3% | 0.3% | 0.2% | 0.05% |
| 3,3-Dichlorobenzidine [c] | µg/L | 0.0081 | -- | -- | -- | -- | -- |
| 1,2-Dichloroethane | µg/L | 28 | <0.2% | <0.2% | <0.2% | <0.1% | <0.02% |
| 1,1-Dichloroethylene | µg/L | 0.9 | 6% | 6% | 5% | 2% | 0.5% |
| Dichlorobromomethane | µg/L | 6.2 | <1% | <1% | <1% | <0.3% | <0.1% |
| Dichloromethane | µg/L | 450 | 0.01% | 0.01% | 0.01% | 0.005% | 0.001% |
| 1,3-dichloropropene | µg/L | 8.9 | <1% | <1% | <1% | <0.2% | <0.05% |
| Dieldrin | µg/L | 0.00004 | 8% | 8% | 8% | 5% | 1% |
| 2,4-Dinitrotoluene | µg/L | 2.6 | <0.5% | <1% | <1% | <1% | <0.3% |
| 1,2-Diphenylhydrazine [c] | µg/L | 0.16 | -- | -- | -- | -- | -- |
| Halomethanes | µg/L | 130 | 0.04% | 0.04% | 0.04% | 0.02% | 0.003% |
| Heptachlor [c] | µg/L | 0.00005 | -- | -- | -- | -- | -- |
| Heptachlor Epoxide | µg/L | 0.00002 | 1% | 2% | 3% | 5% | 2% |
| Hexachlorobenzene | µg/L | 0.00021 | 2% | 2% | 2% | 1% | 0.2% |
| Hexachlorobutadiene | µg/L | 14 | 1.86E-7% | 4.30E-7% | 6.20E-7% | 7.60E-7% | 2.52E-7% |
| Hexachloroethane | µg/L | 2.5 | <43% | <38% | <35% | <12% | <2% |
| Isophorone | µg/L | 730 | <0.008% | <0.007% | <0.007% | <0.003% | <0.001% |
| N-Nitrosodimethylamine | µg/L | 7.3 | 0.003% | 0.004% | 0.004% | 0.003% | 0.001% |
| N-Nitrosodi-N-Propylamine | µg/L | 0.38 | 0.1% | 0.1% | 0.2% | 0.2% | 0.1% |
| N-Nitrosodiphenylamine | µg/L | 2.5 | <43% | <38% | <34% | <12% | <2% |
| PAHs | µg/L | 0.0088 | 2% | 3% | 4% | 4% | 1% |
| PCBs | µg/L | 0.000019 | 46% | 56% | 63% | 52% | 15% |
| TCDD Equivalents [e] | µg/L | 3.9E-09 | 2% | 16% | 27% | 38% | 13% |
| 1,1,2,2-Tetrachloroethane | µg/L | 2.3 | <2% | <2% | <2% | <1% | <0.2% |
| Tetrachloroethylene | µg/L | 2.0 | <3% | <3% | <2% | <1% | <0.2% |
| Toxaphene [e] | µg/L | 2.1E-04 | 3% | 16% | 27% | 38% | 13% |
| Trichloroethylene | µg/L | 27 | <0.2% | <0.2% | <0.2% | <0.1% | <0.02% |
| 1,1,2-Trichloroethane | µg/L | 9.4 | <1% | <1% | <1% | <0.2% | <0.04% |
| 2,4,6-Trichlorophenol [c] | µg/L | 0.29 | -- | -- | -- | -- | -- |
| Vinyl chloride | µg/L | 36 | <0.1% | <0.1% | <0.1% | <0.04% | <0.01% |

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%). Also, shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

**Table A3 – Complete list of predicted concentrations of Ocean Plan constituents at the edge of the ZID for the Variant**

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Variant | | | | | | | | | |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| *Objectives for protection of marine aquatic life* - 6-month median limit | | | | | | | | | | | | |
| Arsenic | µg/L | 8 | 3.9 | 4.0 | 4.1 | 3.8 | 3.3 | 3.8 | 4.0 | 4.0 | 3.4 | 3.2 |
| Cadmium | µg/L | 1 | 0.3 | 0.3 | 0.2 | 0.1 | 0.02 | 0.3 | 0.3 | 0.2 | 0.1 | 0.01 |
| Chromium (Hexavalent) | µg/L | 2 | 0.09 | 0.09 | 0.09 | 0.06 | 0.02 | 0.16 | 0.2 | 0.1 | 0.05 | 0.01 |
| Copper | µg/L | 3 | 1.9 | 2.0 | 2.0 | 2.1 | 2.1 | 2.2 | 2.3 | 2.2 | 2.1 | 2.0 |
| Lead | µg/L | 2 | 0.03 | 0.03 | 0.03 | 0.02 | 0.01 | 0.1 | 0.05 | 0.04 | 0.02 | 0.004 |
| Mercury | µg/L | 0.04 | 0.03 | 0.02 | 0.02 | 0.01 | 0.002 | 0.03 | 0.02 | 0.02 | 0.01 | 0.002 |
| Nickel | µg/L | 5 | 0.7 | 0.7 | 0.6 | 0.4 | 0.1 | 1.0 | 0.9 | 0.7 | 0.3 | 0.1 |
| Selenium | µg/L | 15 | 0.1 | 0.1 | 0.1 | 0.1 | 0.05 | 0.2 | 0.2 | 0.2 | 0.1 | 0.03 |
| Silver | µg/L | 0.7 | 0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| Zinc | µg/L | 20 | 8.1 | 8.3 | 8.5 | 8.5 | 8.3 | 9.5 | 9.5 | 9.3 | 8.5 | 8.2 |
| Cyanide | µg/L | 1 | 0.6 | 0.6 | 0.5 | 0.3 | 0.1 | 0.7 | 0.7 | 0.5 | 0.2 | 0.05 |
| Total Chlorine Residual | µg/L | 2 | – | – | – | – | – | – | – | – | – | – |
| Ammonia (as N) - 6-mo median | µg/L | 600 | 34 | 245 | 396 | 446 | 239 | 1111 | 1154 | 1060 | 445 | 151 |
| Ammonia (as N) - Daily Max | µg/L | 2,400 | 43 | 328 | 531 | 600 | 322 | 1493 | 1551 | 1425 | 598 | 203 |
| Acute Toxicity [a] | TUa | 0.3 | | | | | | | | | | |
| Chronic Toxicity [a] | TUc | 1 | | | | | | | | | | |
| Phenolic Compounds (non-chlorinated) | µg/L | 30 | 5.4 | 5.0 | 4.7 | 2.4 | 0.7 | 6.7 | 6.2 | 4.8 | 1.8 | 0.4 |
| Chlorinated Phenolics [b] | µg/L | 1 | <2.2 | <2.0 | <1.8 | <0.9 | <0.2 | <2.0 | <1.8 | <1.4 | <0.5 | <0.1 |
| Endosulfan | µg/L | 0.009 | 3.3E-05 | 3.1E-04 | 5.1E-04 | 5.9E-04 | 3.2E-04 | 1.5E-03 | 1.4E-03 | 1.4E-03 | 5.9E-04 | 2.0E-04 |
| Endrin | µg/L | 0.002 | 1.5E-07 | 6.0E-07 | 9.2E-07 | 9.9E-07 | 5.2E-07 | 2.5E-06 | 2.6E-06 | 2.3E-06 | 9.8E-07 | 3.3E-07 |
| HCH (Hexachlorocyclohexane) | µg/L | 0.004 | 4.4E-05 | 3.9E-04 | 6.4E-04 | 7.3E-04 | 3.9E-04 | 1.8E-03 | 1.9E-03 | 1.7E-03 | 7.3E-04 | 2.5E-04 |
| Radioactivity (Gross Beta) [a] | pci/L | 0.0 | | | | | | | | | | |
| Radioactivity (Gross Alpha) [a] | pci/L | 0.0 | | | | | | | | | | |
| *Objectives for protection of human health – non carcinogens – 30-day average limit* | | | | | | | | | | | | |
| Acrolein | µg/L | 220 | 0.2 | 0.2 | 0.3 | 0.2 | 0.1 | 0.5 | 0.4 | 0.4 | 0.1 | 0.04 |
| Antimony | µg/L | 1200 | 0.01 | 0.02 | 0.02 | 0.01 | 0.01 | 0.03 | 0.03 | 0.03 | 0.01 | 0.004 |
| Bis (2-chloroethoxy) methane | µg/L | 4.4 | <1.0 | <0.9 | <0.8 | <0.4 | <0.1 | <0.9 | <0.8 | <0.6 | <0.2 | <0.04 |
| Bis (2-chloroisopropyl) ether | µg/L | 1200 | <1.0 | <0.9 | <0.8 | <0.4 | <0.1 | <0.9 | <0.8 | <0.6 | <0.2 | <0.04 |
| Chlorobenzene | µg/L | 570 | <0.1 | <0.05 | <0.04 | <0.02 | <0.01 | <0.05 | <0.05 | <0.04 | <0.01 | <0.003 |
| Chromium (III) | µg/L | 190000 | 1.1 | 1.0 | 0.9 | 0.4 | 0.1 | 1.2 | 1.1 | 0.8 | 0.3 | 0.1 |
| Di-n-butyl phthalate | µg/L | 3500 | <1.0 | <0.9 | <0.8 | <0.4 | <0.1 | <0.9 | <0.8 | <0.6 | <0.2 | <0.1 |
| Dichlorobenzenes | µg/L | 5100 | 0.1 | 0.1 | 0.1 | 0.04 | 0.01 | 0.1 | 0.1 | 0.1 | 0.03 | 0.01 |
| Diethyl phthalate | µg/L | 33000 | <0.1 | <0.1 | <0.1 | <0.1 | <0.04 | <0.1 | <0.1 | <0.1 | <0.04 | <0.02 |
| Dimethyl phthalate | µg/L | 820000 | <0.1 | <0.1 | <0.1 | <0.04 | <0.02 | <0.1 | <0.1 | <0.05 | <0.02 | <0.01 |

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Scenario | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Variant | | | | | | | | | |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| 4,6-dinitro-2-methylphenol | µg/L | 220 | <5.3 | <4.6 | <4.1 | <1.8 | <0.4 | <4.6 | <4.1 | <3.0 | <1.0 | <0.2 |
| 2,4-Dinitrophenol [b] | µg/L | 4.0 | <5.4 | <4.7 | <4.1 | <1.8 | <0.3 | <4.7 | <4.1 | <3.0 | <1.0 | <0.2 |
| Ethylbenzene | µg/L | 4100 | <0.1 | <0.05 | <0.04 | <0.02 | <0.01 | <0.05 | <0.05 | <0.04 | <0.01 | <0.003 |
| Fluoranthene | µg/L | 15 | 0.01 | 0.01 | 0.01 | 0.003 | 0.001 | 0.01 | 0.01 | 0.01 | 0.002 | 0.0003 |
| Hexachlorocyclopentadiene | µg/L | 58 | <0.01 | <0.01 | <0.01 | <0.01 | <0.004 | <0.01 | <0.01 | <0.01 | <0.004 | <0.002 |
| Nitrobenzene | µg/L | 4.9 | <2.6 | <2.2 | <1.9 | <0.8 | <0.1 | <2.2 | <2.0 | <1.4 | <0.5 | <0.1 |
| Thallium | µg/L | 2 | 0.01 | 0.01 | 0.01 | 0.01 | 0.005 | 0.03 | 0.03 | 0.02 | 0.01 | 0.003 |
| Toluene | µg/L | 85000 | <0.1 | <0.05 | <0.04 | <0.02 | <0.01 | <0.05 | <0.05 | <0.04 | <0.01 | <0.003 |
| Tributyltin [b] | µg/L | 0.0014 | <0.01 | <0.005 | <0.004 | <0.002 | <0.001 | <0.005 | <0.004 | <0.003 | <0.001 | <0.0003 |
| 1,1,1-Trichloroethane | µg/L | 540000 | <0.05 | <0.05 | <0.04 | <0.02 | <0.01 | <0.05 | <0.05 | <0.04 | <0.01 | <0.003 |
| *Objectives for protection of human health – carcinogens – 30-day average limit* | | | | | | | | | | | | |
| Acrylonitrile [c] | µg/L | 0.10 | 0.001 | 0.007 | 0.011 | 0.012 | 0.007 | 0.034 | 0.035 | 0.031 | 0.013 | 0.004 |
| Aldrin [b] | µg/L | 0.000022 | <9.0E-06 | <4.9E-05 | <7.8E-05 | <8.7E-05 | <4.6E-05 | <6.4E-05 | <9.2E-05 | <1.1E-04 | <5.6E-05 | <2.4E-05 |
| Benzene | µg/L | 5.9 | <0.1 | <0.05 | <0.04 | <0.02 | <0.01 | <0.05 | <0.05 | <0.04 | <0.01 | <0.003 |
| Benzidine [b] | µg/L | 0.000069 | <5.4 | <4.7 | <4.2 | <1.8 | <0.4 | <4.7 | <4.2 | <3.0 | <1.0 | <0.2 |
| Beryllium [c] | µg/L | 0.033 | 3.61E-6 | 3.10E-6 | 2.66E-6 | 1.08E-6 | 1.72E-7 | 3.14E-6 | 2.72E-6 | 1.88E-6 | 6.15E-7 | 1.03E-7 |
| Bis(2-chloroethyl)ether [b] | µg/L | 0.045 | <2.6 | <2.2 | <1.9 | <0.8 | <0.2 | <2.2 | <2.0 | <1.4 | <0.5 | <0.1 |
| Bis(2-ethyl-hexyl)phthalate | µg/L | 3.5 | 0.1 | 0.6 | 0.9 | 1.0 | 0.5 | 2.4 | 2.5 | 2.3 | 1.0 | 0.3 |
| Carbon tetrachloride | µg/L | 0.90 | 0.1 | 0.05 | 0.04 | 0.02 | 0.01 | 0.1 | 0.1 | 0.04 | 0.02 | 0.004 |
| Chlordane | µg/L | 0.000023 | 1.4E-06 | 5.2E-06 | 8.0E-06 | 8.6E-06 | 4.5E-06 | 2.2E-05 | 2.2E-05 | 2.0E-05 | 8.5E-06 | 2.9E-06 |
| Chlorodibromomethane | µg/L | 8.6 | 0.1 | 0.1 | 0.1 | 0.05 | 0.02 | 0.1 | 0.1 | 0.1 | 0.04 | 0.01 |
| Chloroform | µg/L | 130 | 0.1 | 0.3 | 0.5 | 0.5 | 0.3 | 1.2 | 1.3 | 1.2 | 0.5 | 0.2 |
| DDT | µg/L | 0.00017 | 9.6E-07 | 8.1E-06 | 1.3E-05 | 1.5E-05 | 8.1E-06 | 3.7E-05 | 3.9E-05 | 3.6E-05 | 1.5E-05 | 5.1E-06 |
| 1,4-Dichlorobenzene | µg/L | 18 | 0.1 | 0.1 | 0.1 | 0.04 | 0.01 | 0.1 | 0.1 | 0.1 | 0.03 | 0.01 |
| 3,3-Dichlorobenzidine [b] | µg/L | 0.0081 | <5.4 | <4.7 | <4.2 | <1.8 | <0.4 | <4.7 | <4.2 | <3.0 | <1.0 | <0.2 |
| 1,2-Dichloroethane | µg/L | 28 | <0.1 | <0.05 | <0.04 | <0.02 | <0.01 | <0.05 | <0.05 | <0.04 | <0.01 | <0.003 |
| 1,1-Dichloroethylene | µg/L | 0.9 | 0.1 | 0.05 | 0.04 | 0.02 | 0.01 | 0.05 | 0.05 | 0.04 | 0.01 | 0.003 |
| Dichlorobromomethane | µg/L | 6.2 | 0.1 | 0.1 | 0.1 | 0.05 | 0.02 | 0.1 | 0.1 | 0.1 | 0.04 | 0.01 |
| Dichloromethane | µg/L | 450 | 0.1 | 0.05 | 0.05 | 0.02 | 0.01 | 0.1 | 0.1 | 0.05 | 0.02 | 0.004 |
| 1,3-dichloropropene | µg/L | 8.9 | 0.1 | 0.05 | 0.05 | 0.02 | 0.01 | 0.1 | 0.1 | 0.04 | 0.02 | 0.004 |
| Dieldrin | µg/L | 0.00004 | 3.3E-06 | 6.6E-06 | 8.8E-06 | 8.5E-06 | 4.2E-06 | 2.1E-05 | 2.2E-05 | 2.0E-05 | 8.1E-06 | 2.7E-06 |
| 2,4-Dinitrotoluene | µg/L | 2.6 | <0.01 | <0.02 | <0.03 | <0.03 | <0.01 | <0.01 | <0.02 | <0.03 | <0.01 | <0.01 |
| 1,2-Diphenylhydrazine [b] | µg/L | 0.16 | <1.0 | <0.9 | <0.8 | <0.4 | <0.1 | <0.9 | <0.8 | <0.6 | <0.2 | <0.04 |
| Halomethanes | µg/L | 130 | 0.1 | 0.1 | 0.1 | 0.03 | 0.01 | 0.1 | 0.1 | 0.1 | 0.03 | 0.01 |
| Heptachlor [b] | µg/L | 0.00005 | <7.0E-6 | <6.5E-5 | <1.1E-4 | <1.2E-4 | <6.6E-05 | <6.3E-05 | <1.1E-04 | <1.5E-04 | <7.5E-05 | <3.4E-05 |
| Heptachlor Epoxide | µg/L | 0.00002 | 1.5E-7 | 6.0E-7 | 9.2E-7 | 9.9E-7 | 5.2E-7 | 2.5E-6 | 2.6E-6 | 2.3E-6 | 9.8E-7 | 3.3E-7 |
| Hexachlorobenzene | µg/L | 0.00021 | 4.1E-6 | 4.0E-6 | 3.8E-6 | 2.2E-6 | 7.0E-7 | 5.9E-6 | 5.5E-6 | 4.4E-6 | 1.6E-6 | 4.4E-7 |
| Hexachlorobutadiene | µg/L | 14 | 2.8E-8 | 7.7E-8 | 1.1E-7 | 1.2E-7 | 6.0E-8 | 2.9E-7 | 3.0E-7 | 2.7E-7 | 1.1E-7 | 3.8E-8 |
| Hexachloroethane | µg/L | 2.5 | <1.0 | <0.9 | <0.8 | <0.3 | <0.1 | <0.9 | <0.8 | <0.6 | <0.2 | <0.04 |
| Isophorone | µg/L | 730 | <0.1 | <0.05 | <0.04 | <0.02 | <0.01 | <0.05 | <0.05 | <0.04 | <0.01 | <0.003 |
| N-Nitrosodimethylamine | µg/L | 7.3 | 0.0003 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.001 | 0.002 | 0.001 | 0.0003 |
| N-Nitrosodi-N-Propylamine | µg/L | 0.38 | 0.0003 | 0.001 | 0.001 | 0.001 | 0.001 | 0.0003 | 0.001 | 0.001 | 0.001 | 0.0003 |
| N-Nitrosodiphenylamine | µg/L | 2.5 | <1.0 | <0.9 | <0.8 | <0.3 | <0.1 | <0.9 | <0.8 | <0.6 | <0.2 | <0.04 |
| PAHs | µg/L | 0.0088 | 0.0002 | 0.0003 | 0.0004 | 0.0004 | 0.0002 | 0.0012 | 0.0012 | 0.0010 | 0.0004 | 0.0001 |
| PCBs | µg/L | 0.000019 | 8.7E-6 | 1.2E-5 | 1.3E-5 | 1.1E-5 | 4.8E-6 | 2.8E-5 | 2.8E-5 | 2.4E-5 | 9.7E-6 | 3.0E-6 |
| TCDD Equivalents [c] | µg/L | 3.9E-09 | 9.8E-11 | 9.3E-10 | 1.5E-9 | 1.7E-9 | 9.3E-10 | 4.3E-9 | 4.5E-9 | 4.1E-9 | 1.7E-9 | 5.9E-10 |
| 1,1,2,2-Tetrachloroethane | µg/L | 2.3 | <0.1 | <0.05 | <0.04 | <0.02 | <0.01 | <0.05 | <0.05 | <0.04 | <0.01 | <0.003 |
| Tetrachloroethylene | µg/L | 2.0 | <0.1 | <0.05 | <0.04 | <0.02 | <0.01 | <0.05 | <0.05 | <0.04 | <0.01 | <0.003 |
| Toxaphene [e] | µg/L | 2.1E-04 | 7.4E-06 | 4.8E-05 | 7.8E-05 | 8.7E-05 | 4.7E-05 | 2.2E-04 | 2.3E-04 | 2.1E-04 | 8.7E-05 | 2.9E-05 |
| Trichloroethylene | µg/L | 27 | <0.1 | <0.05 | <0.04 | <0.02 | <0.01 | <0.05 | <0.05 | <0.04 | <0.01 | <0.003 |
| 1,1,2-Trichloroethane | µg/L | 9.4 | <0.1 | <0.05 | <0.04 | <0.02 | <0.01 | <0.05 | <0.05 | <0.04 | <0.01 | <0.003 |
| 2,4,6-Trichlorophenol [b] | µg/L | 0.29 | <1.0 | <0.9 | <0.8 | <0.3 | <0.1 | <0.9 | <0.8 | <0.6 | <0.2 | <0.04 |
| Vinyl chloride | µg/L | 36 | <0.03 | <0.03 | <0.03 | <0.02 | <0.005 | <0.03 | <0.03 | <0.02 | <0.01 | <0.003 |

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR concentrate, and these individual concentrations would comply with the Ocean Plan objectives.
[b] All observed values from some data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.
[c] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

**Table A4 – Complete list of predicted concentrations at the edge of the ZID expressed as a percentage of Ocean Plan[a]**

| Constituent | Units | Ocean Plan Objective | Percentage of Ocean Plan Objective at Edge of ZID by Scenario [a] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Variant | | | | | | | | | |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| *Objectives for protection of marine aquatic life - 6-month median limit* | | | | | | | | | | | | |
| Arsenic | µg/L | 8 | 49% | 50% | 51% | 47% | 41% | 48% | 49% | 50% | 43% | 39% |
| Cadmium | µg/L | 1 | 31% | 27% | 24% | 11% | 2% | 31% | 27% | 20% | 7% | 1% |
| Chromium (Hexavalent) | µg/L | 2 | 5% | 5% | 5% | 3% | 1% | 8% | 8% | 6% | 2% | 1% |
| Copper | µg/L | 3 | 64% | 66% | 68% | 69% | 68% | 75% | 75% | 75% | 70% | 68% |
| Lead | µg/L | 2 | 2% | 2% | 2% | 1% | 0.3% | 3% | 2% | 2% | 1% | 0.2% |
| Mercury | µg/L | 0.04 | 66% | 58% | 51% | 23% | 6% | 64% | 57% | 42% | 15% | 4% |
| Nickel | µg/L | 5 | 14% | 13% | 13% | 7% | 2% | 20% | 19% | 15% | 6% | 1% |
| Selenium | µg/L | 15 | 0.4% | 1% | 1% | 1% | 0.3% | 2% | 2% | 1% | 1% | 0.2% |
| Silver | µg/L | 0.7 | 26% | <27% | <27% | <26% | <24% | <26% | <26% | <27% | <25% | <24% |
| Zinc | µg/L | 20 | 41% | 42% | 43% | 43% | 41% | 47% | 48% | 47% | 43% | 41% |
| Cyanide | µg/L | 1 | 57% | 53% | 49% | 26% | 7% | 71% | 65% | 50% | 18% | 5% |
| Total Chlorine Residual | µg/L | 2 | – | – | – | – | – | – | – | – | – | – |
| Ammonia (as N) - 6-mo median | µg/L | 600 | 6% | 41% | 66% | 74% | 40% | 185% | 192% | 177% | 74% | 25% |
| Ammonia (as N) - Daily Max | µg/L | 2,400 | 2% | 14% | 22% | 25% | 13% | 62% | 65% | 59% | 25% | 8% |
| Acute Toxicity [b] | TUa | 0.3 | | | | | | | | | | |
| Chronic Toxicity [b] | TUc | 1 | | | | | | | | | | |
| Phenolic Compounds (non-chlorinated) | µg/L | 30 | <18% | <17% | <16% | <8% | <2% | <22% | <21% | <16% | <6% | <1% |
| Chlorinated Phenolics [c] | µg/L | 1 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Endosulfan | µg/L | 0.009 | 0.4% | 3% | 6% | 7% | 4% | 16% | 17% | 15% | 7% | 2% |
| Endrin | µg/L | 0.002 | 0.01% | 0.03% | 0.05% | 0.05% | 0.03% | 0.1% | 0.1% | 0.1% | 0.05% | 0.02% |
| HCH (Hexachlorocyclohexane) | µg/L | 0.004 | 1% | 10% | 16% | 18% | 10% | 45% | 47% | 43% | 18% | 6% |
| Radioactivity (Gross Beta) [b] | pci/L | 0.0 | | | | | | | | | | |
| Radioactivity (Gross Alpha) [b] | pci/L | 0.0 | | | | | | | | | | |
| *Objectives for protection of human health – non carcinogens – 30-day average limit* | | | | | | | | | | | | |
| Acrolein | µg/L | 220 | 0.1% | 0.1% | 0.1% | 0.1% | 0.03% | 0.2% | 0.2% | 0.2% | 0.1% | 0.02% |
| Antimony | µg/L | 1200 | 0.001% | 0.001% | 0.001% | 0.001% | 0.0005% | 0.003% | 0.003% | 0.002% | 0.001% | 0.0003% |
| Bis (2-chloroethoxy) methane | µg/L | 4.4 | <24% | <21% | <18% | <8% | <2% | <21% | <18% | <13% | <5% | <1% |

| Constituent | Units | Ocean Plan Objective | Percentage of Ocean Plan Objective at Edge of ZID by Scenario [a] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Variant | | | | | | | | | |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Bis (2-chloroisopropyl) ether | µg/L | 1200 | <0.1% | <0.1% | <0.1% | <0.03% | <0.01% | <0.1% | <0.1% | <0.05% | <0.02% | <0.004% |
| Chlorobenzene | µg/L | 570 | <0.01% | <0.01% | <0.01% | <0.004% | <0.001% | <0.01% | <0.01% | <0.01% | <0.002% | <0.001% |
| Chromium (III) | µg/L | 190000 | 0.001% | 0.001% | 0.0005% | 0.0002% | 0.0001% | 0.001% | 0.001% | 0.0004% | 0.0001% | 0.00003% |
| Di-n-butyl phthalate | µg/L | 3500 | <0.03% | <0.03% | <0.02% | <0.01% | <0.003% | <0.03% | <0.02% | <0.02% | <0.01% | <0.001% |
| Dichlorobenzenes | µg/L | 5100 | 0.001% | 0.001% | 0.001% | 0.001% | 0.0003% | 0.002% | 0.002% | 0.001% | 0.001% | 0.0002% |
| Diethyl phthalate | µg/L | 33000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dimethyl phthalate | µg/L | 820000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 4,6-dinitro-2-methylphenol | µg/L | 220 | <2% | <2% | <2% | <1% | <0.2% | <2% | <2% | <1% | <0.5% | <0.1% |
| 2,4-Dinitrophenol [c] | µg/L | 4.0 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Ethylbenzene | µg/L | 4100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Fluoranthene | µg/L | 15 | 0.1% | 0.1% | 0.1% | 0.02% | 0.004% | 0.1% | 0.1% | 0.04% | 0.01% | 0.002% |
| Hexachlorocyclopentadiene | µg/L | 58 | <0.01% | <0.01% | <0.02% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Nitrobenzene | µg/L | 4.9 | <53% | <45% | <39% | <16% | <3% | <46% | <40% | <28% | <9% | <2% |
| Thallium | µg/L | 2 | 0.3% | 0.5% | 1% | 0.5% | 0.2% | 1% | 1% | 1% | 0.5% | 0.2% |
| Toluene | µg/L | 85000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Tributyltin [c] | µg/L | 0.0014 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,1,1-Trichloroethane | µg/L | 540000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| *Objectives for protection of human health – carcinogens – 30-day average limit* | | | | | | | | | | | | |
| Acrylonitrile [d] | µg/L | 0.10 | 1% | 7% | 11% | 12% | 7% | 34% | 35% | 31% | 13% | 4% |
| Aldrin [c] | µg/L | 0.000022 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Benzene | µg/L | 5.9 | <1% | <1% | <1% | <0.4% | <0.1% | <1% | <1% | <1% | <0.2% | <0.1% |
| Benzidine [c] | µg/L | 0.000069 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Beryllium [d] | µg/L | 0.033 | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| Bis(2-chloroethyl)ether [c] | µg/L | 0.045 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Bis(2-ethyl-hexyl)phthalate | µg/L | 3.5 | 3% | 16% | 25% | 28% | 15% | 69% | 72% | 66% | 27% | 9% |
| Carbon tetrachloride | µg/L | 0.90 | 6% | 5% | 5% | 2% | 1% | 7% | 6% | 5% | 2% | 0.4% |
| Chlordane | µg/L | 0.000023 | 6% | 23% | 35% | 37% | 20% | 94% | 97% | 88% | 37% | 12% |
| Chlorodibromomethane | µg/L | 8.6 | 1% | 1% | 1% | 0.5% | 0.2% | 1% | 1% | 1% | 0.4% | 0.1% |
| Chloroform | µg/L | 130 | 0.1% | 0.2% | 0.3% | 0.4% | 0.2% | 1% | 1% | 1% | 0.4% | 0.1% |
| DDT | µg/L | 0.00017 | 1% | 5% | 8% | 9% | 5% | 22% | 23% | 21% | 9% | 3% |
| 1,4-Dichlorobenzene | µg/L | 18 | 0.3% | 0.3% | 0.3% | 0.2% | 0.1% | 1% | 0.5% | 0.4% | 0.2% | 0.05% |
| 3,3-Dichlorobenzidine [c] | µg/L | 0.0081 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| 1,2-Dichloroethane | µg/L | 28 | <0.2% | <0.2% | <0.2% | <0.1% | <0.02% | <0.2% | <0.2% | <0.1% | <0.05% | <0.01% |
| 1,1-Dichloroethylene | µg/L | 0.9 | 6% | 5% | 5% | 2% | 1% | 6% | 5% | 4% | 1% | 0.4% |
| Dichlorobromomethane | µg/L | 6.2 | 1% | 1% | 1% | 1% | 0.3% | 2% | 2% | 2% | 1% | 0.2% |
| Dichloromethane | µg/L | 450 | 0.01% | 0.01% | 0.01% | 0.005% | 0.002% | 0.01% | 0.01% | 0.01% | 0.004% | 0.001% |
| 1,3-dichloropropene | µg/L | 8.9 | 1% | 1% | 1% | 0.3% | 0.1% | 1% | 1% | 0.5% | 0.2% | 0.04% |
| Dieldrin | µg/L | 0.00004 | 8% | 16% | 22% | 21% | 11% | 54% | 55% | 49% | 20% | 7% |
| 2,4-Dinitrotoluene | µg/L | 2.6 | <0.5% | <1% | <1% | <1% | <1% | <0.4% | <1% | <1% | <1% | <0.3% |
| 1,2-Diphenylhydrazine [c] | µg/L | 0.16 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Halomethanes | µg/L | 130 | 0.04% | 0.04% | 0.04% | 0.03% | 0.01% | 0.1% | 0.1% | 0.1% | 0.02% | 0.01% |
| Heptachlor [c] | µg/L | 0.00005 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Heptachlor Epoxide | µg/L | 0.00002 | 1% | 3% | 5% | 5% | 3% | 12% | 13% | 12% | 5% | 2% |
| Hexachlorobenzene | µg/L | 0.00021 | 2% | 2% | 2% | 1% | 0.3% | 3% | 3% | 2% | 1% | 0.2% |
| Hexachlorobutadiene | µg/L | 14 | 2E-7% | 6E-7% | 8E-7% | 8E-7% | 4E-7% | 2E-6% | 2E-6% | 2E-6% | 8E-7% | 3E-7% |
| Hexachloroethane | µg/L | 2.5 | <42% | <36% | <32% | <14% | <3% | <36% | <32% | <23% | <8% | <1% |
| Isophorone | µg/L | 730 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| N-Nitrosodimethylamine | µg/L | 7.3 | 0.004% | 0.01% | 0.02% | 0.01% | 0.01% | 0.01% | 0.02% | 0.02% | 0.01% | 0.005% |
| N-Nitrosodi-N-Propylamine | µg/L | 0.38 | 0.1% | 0.2% | 0.3% | 0.3% | 0.1% | 0.1% | 0.2% | 0.3% | 0.1% | 0.1% |
| N-Nitrosodiphenylamine | µg/L | 2.5 | <42% | <36% | <32% | <14% | <3% | <36% | <32% | <23% | <8% | <1% |

| Constituent | Units | Ocean Plan Objective | Percentage of Ocean Plan Objective at Edge of ZID by Scenario [a] | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Variant | | | | | | | | | |
| | | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| PAHs | µg/L | 0.0088 | 2% | 3% | 4% | 4% | 2% | 14% | 14% | 12% | 5% | 1% |
| PCBs | µg/L | 0.000019 | 46% | 61% | 70% | 57% | 26% | 146% | 145% | 126% | 51% | 16% |
| TCDD Equivalents [d] | µg/L | 3.9E-09 | 3% | 24% | 39% | 44% | 24% | 110% | 115% | 105% | 44% | 15% |
| 1,1,2,2-Tetrachloroethane | µg/L | 2.3 | <2% | <2% | <2% | <1% | <0.3% | <2% | <2% | <2% | <1% | <0.1% |
| Tetrachloroethylene | µg/L | 2.0 | <3% | <2% | <2% | <1% | <0.3% | <2% | <2% | <2% | <1% | <0.2% |
| Toxaphene [e] | µg/L | 2.1E-04 | 4% | 23% | 37% | 42% | 22% | 103% | 107% | 99% | 41% | 14% |
| Trichloroethylene | µg/L | 27 | <0.2% | <0.2% | <0.2% | <0.1% | <0.02% | <0.2% | <0.2% | <0.1% | <0.05% | <0.01% |
| 1,1,2-Trichloroethane | µg/L | 9.4 | <1% | <1% | <0.5% | <0.2% | <0.1% | <1% | <0.5% | <0.4% | <0.1% | <0.03% |
| 2,4,6-Trichlorophenol [c] | µg/L | 0.29 | -- | -- | -- | -- | -- | -- | -- | -- | -- | -- |
| Vinyl chloride | µg/L | 36 | <0.1% | <0.1% | <0.1% | <0.04% | <0.01% | <0.1% | <0.1% | <0.1% | <0.03% | <0.01% |

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%). Also, shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.

[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

# Appendix B

Trussell Technologies, Inc (Trussell Tech), 2015. "Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project." *Technical Memorandum prepared for MRWPCA and MPWMD*. Feb.

# Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project

**Technical Memorandum**
February 2015

***Prepared for:***

Partners for Pure Water Solutions
MRWPCA
Monterey Peninsula Water Management District

Trussell Technologies Inc
1939 Harrison Street, Suite 600
Oakland, CA 94612

# Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project

## Technical Memorandum

Pure Water Monterey
A Groundwater Replenishment Project

**February 2015**

Prepared By:

**Trussell Technologies, Inc.**
Gordon Williams, Ph.D., P.E.

# Table of Contents

# 1 Introduction

The Monterey Regional Water Pollution Control Agency (MRWPCA) and the Monterey Peninsula Water Management District ("Project Partners") are in the process of developing the Pure Water Monterey Groundwater Replenishment Project ("Proposed Project"). The Proposed Project involves treating secondary effluent from the MRWPCA Regional Treatment Plant (RTP) through the proposed Advanced Water Treatment Facility (AWT Facility) and then injecting this highly purified recycled water into the Seaside Groundwater Basin, later extracting it for replacement of existing municipal water supplies. The Proposed Project will also provide additional tertiary recycled water for agricultural irrigation in northern Salinas Valley as part of the Castroville Seawater Intrusion Project (CISP). A waste stream, known as the reverse osmosis concentrate ("RO concentrate"), would be generated by the AWT Facility and discharged through the existing MRWPCA ocean outfall. The goal of this technical memorandum is to analyze whether the discharge of the Proposed Project's RO concentrate to the ocean through the existing outfall would impact marine water quality, and thus, human health, marine biological resources, or beneficial uses of the receiving waters.

## 1.1 Treatment through the RTP and AWT Facility

The existing MRWPCA RTP treatment process includes screening, primary sedimentation, secondary biological treatment through trickling filters (TFs), followed by a solids contactor (*i.e.*, bio-flocculation), and then clarification (Figure 1). Much of the secondary effluent undergoes tertiary treatment (granular media filtration and disinfection) to produce recycled water used for agricultural irrigation. The unused secondary effluent is discharged to the Monterey Bay through the MRWPCA Outfall. MRWPCA also accepts trucked brine waste for ocean disposal, which is stored in a pond and mixed with secondary effluent for disposal.

The proposed AWT Facility would include several advanced treatment technologies for purifying the secondary effluent water: ozone ($O_3$), biologically active filtration (BAF) (this is an optional unit process), membrane filtration (MF), reverse osmosis (RO), and an advanced oxidation process (AOP) using UV-hydrogen peroxide. The Project Partners conducted a pilot-scale study of the ozone, MF, and RO elements of the AWT Facility from December 2013 through July 2014, successfully demonstrating the ability of the various treatment processes to produce highly-purified recycled water that complies with the California Groundwater Replenishment Using Recycled Water Regulations (Groundwater Replenishment Regulations) and Central Coast Water Quality Control Plan (Basin Plan) standards, objectives and guidelines for groundwater.

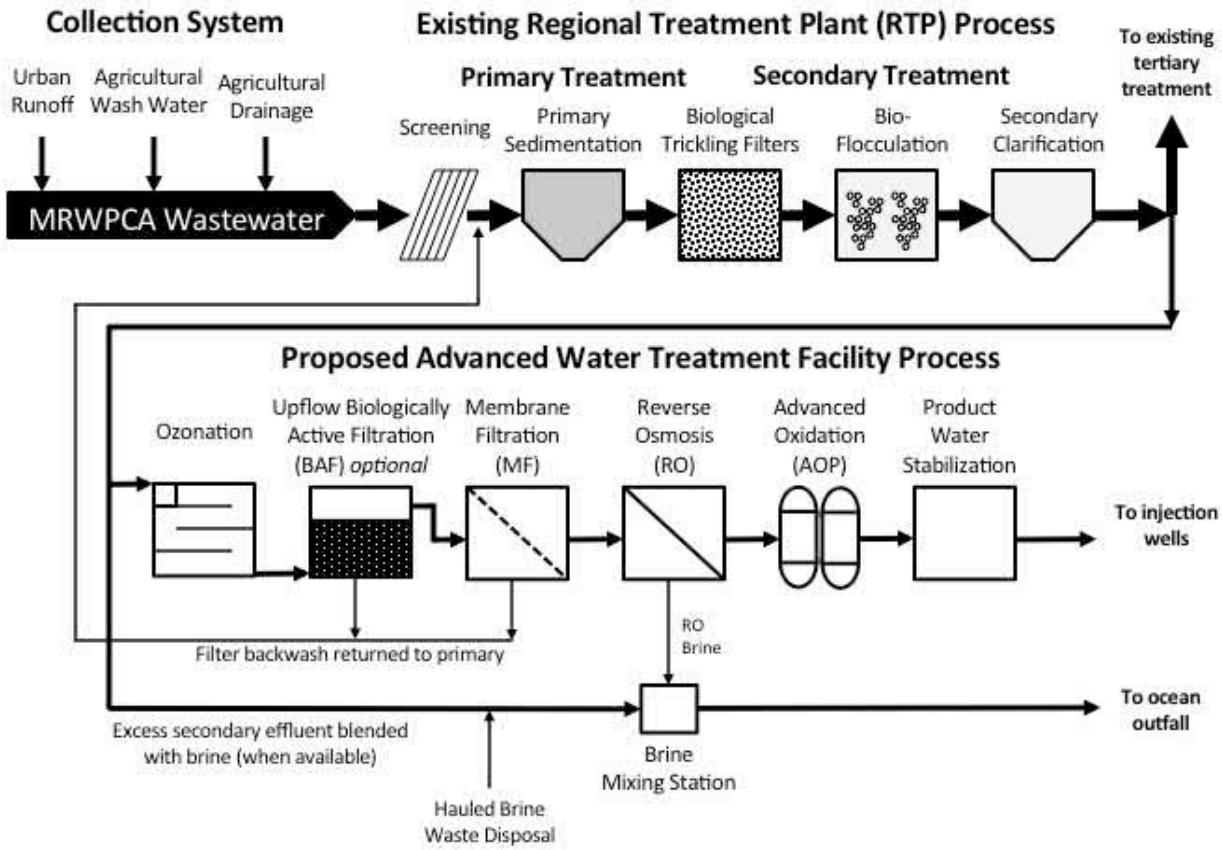


**Figure 1 – Simplified diagram of existing MRWPCA RTP and proposed AWT Facility treatment**

Reverse osmosis is an excellent removal process, separating out most dissolved constituents from the recycled water. The dissolved constituents removed through RO are concentrated into a waste stream known as the RO concentrate. Unlike the waste streams from the BAF and MF, the RO concentrate cannot be recycled back to the RTP headworks and would be discharged through the MRWPCA Outfall. Discharges through the outfall are subject to National Pollution Discharge Elimination System (NPDES) permitting, which is based on the California State Water Resources Control Board 2012 Ocean Plan ("Ocean Plan"). Monitoring of the RO concentrate was conducted during the Proposed Project's pilot-scale study.

## 1.2 California Ocean Plan

The Ocean Plan sets forth water quality objectives for ocean discharges with the intent of preserving the quality of the ocean water for beneficial uses, including the protection of both human and aquatic ecosystem health (SWRCB, 2012). For typical wastewater discharges, when released from an outfall, the wastewater and ocean water undergo rapid mixing due to the momentum and buoyancy of the discharge.[1] The mixing occurring in the rising plume is affected

[1] Municipal wastewater effluent, being effectively fresh water, is less dense than seawater and thus rises (due to buoyancy) while it mixes with ocean water.

by the buoyancy and momentum of the discharge, a process referred to as initial dilution (NRC, 1993). The Ocean Plan objectives are to be met after the initial dilution of the discharge into the ocean. The initial dilution occurs in an area known as the zone of initial dilution (ZID). The extent of dilution in the ZID is quantified as the minimum probable initial dilution ($D_m$). The water quality objectives established in the Ocean Plan are adjusted by the $D_m$ to derive the NPDES ocean discharge limits for a wastewater discharge prior to ocean dilution.

The current MRWPCA wastewater discharge is governed by NPDES permit R3-2014-0013 issued by the Central Coast Regional Water Quality Control Board (RWQCB). Because the existing NPDES permit for the MRWPCA ocean outfall must be amended to discharge the RO concentrate, comparing future discharge concentrations to current NPDES permit limits would not be an appropriate metric or threshold for determining whether the Proposed Project would have a significant impact on marine water quality. Instead, compliance with the Ocean Plan objectives was selected as an appropriate threshold for determining whether or not the Proposed Project would result in a significant impact requiring mitigation. Modeling of the Proposed Project ocean discharge was conducted by FlowScience, Inc. to determine $D_m$ values for the various discharge scenarios. The ocean modeling results were combined with projected discharge water quality to assess compliance with the Ocean Plan.

## 1.3 Objective of Technical Memorandum

Trussell Technologies, Inc. (Trussell Tech) estimated worst-case water quality for the Proposed Project ocean discharge water in-pipe (*i.e.*, prior to being discharged through the outfall and diluted in the ocean) and used the FlowScience ocean discharge modeling results to provide an assessment of whether the Proposed Project would consistently meet Ocean Plan water quality objectives. The purpose of this technical memorandum is to summarize the assumptions, methodology, results and conclusions of the Ocean Plan compliance assessment.

# 2 Methodology for Ocean Plan Compliance

To analyze impacts due to ocean discharge of RO concentrate, the Proposed Project technical team (Trussell Tech with MRWPCA staff) conducted a thorough water quality and flow characterization of the proposed sources of water to be diverted into the wastewater collection system that, after primary and secondary treatment, will be used as influent to the AWT Facility. The team collected all available water quality data for secondary effluent and water quality monitoring results for the Proposed Project new source waters.[2] Using the full suite of data, the team was able to estimate the future worst-case water quality of the combined ocean discharge. With the results of ocean modeling, concentrations at the edge of the ZID were estimated to determine the ability of the Proposed Project to comply with the Ocean Plan. The purpose of this section is to outline the methodology used to make this determination. A summary of the methodology is presented in Figure 2.

## 2.1 Methodology for Determination of Discharge Water Quality

Water quality data for three types of discharge waters were used to estimate the future combined water quality in the ocean outfall discharge under Proposed Project conditions: (1) the RTP secondary effluent, (2) hauled brine waste (discussed in Section 2.1.3), and (3) the Proposed Project RO concentrate. First, Trussell Tech estimated the potential influence of the new source waters (*e.g.*, agricultural wash water and agricultural drainage waters) on the worst-case water quality for each of the three types of discharge water. The volumetric contribution of each new source water would change under the different flow scenarios that could occur under the Proposed Project. MRWPCA staff estimated the volume that would be collected from source water for each month of the different types of operational years for the Proposed Project (Bob Holden, Source Water Scenarios Spreadsheet, October 16, 2014)[3]. All of the different flow scenarios were considered in developing the assumed worst-case concentrations for the Ocean Plan constituents in the secondary effluent. This conservative approach used the highest observed concentrations from all data sources for each source water in the analysis[4]. Once the estimated worst-case water quality was determined for the RTP secondary effluent, these values were used in estimating the worst-case water qualities for the hauled brine waste and the

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[2] A one-year monitoring program from July 2013 to June 2014 was conducted for five of the potential source waters. Regular monthly and quarterly sampling was carried out for the RTP secondary effluent, agricultural wash water, and Blanco Drain drainage water. Limited sampling of stormwater from Lake El Estero was performed due to seasonal availability, and there was one sampling event for the Tembladero Slough drainage water.

[3] The monthly flows for each source water were estimated by MRWPCA staff for three types of operational years: (1) wet/normal years where a drought reserve is being built, (2) wet/normal years where the drought reserve has been met, and (3) a drought year. Further, two phases of the Proposed Project have been defined for each of these types of years (Phase A and Phase B).

[4] The exception to this statement is cyanide. Only cyanide data collected from April 2005 through January 2011, as part of the NPDES monitoring program, were used in the analysis. In mid-2011, Monterey Bay Analytical Service (MBAS) began performing the cyanide analysis on the RTP effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore the results were questionable. Therefore, although the cyanide concentrations reported by MBAS are presented separately; they are not used in the analysis for evaluating compliance with the Ocean Plan objectives for the EIR.

Proposed Project RO concentrate, as appropriate. The methodology for each type of water is further described in this section.

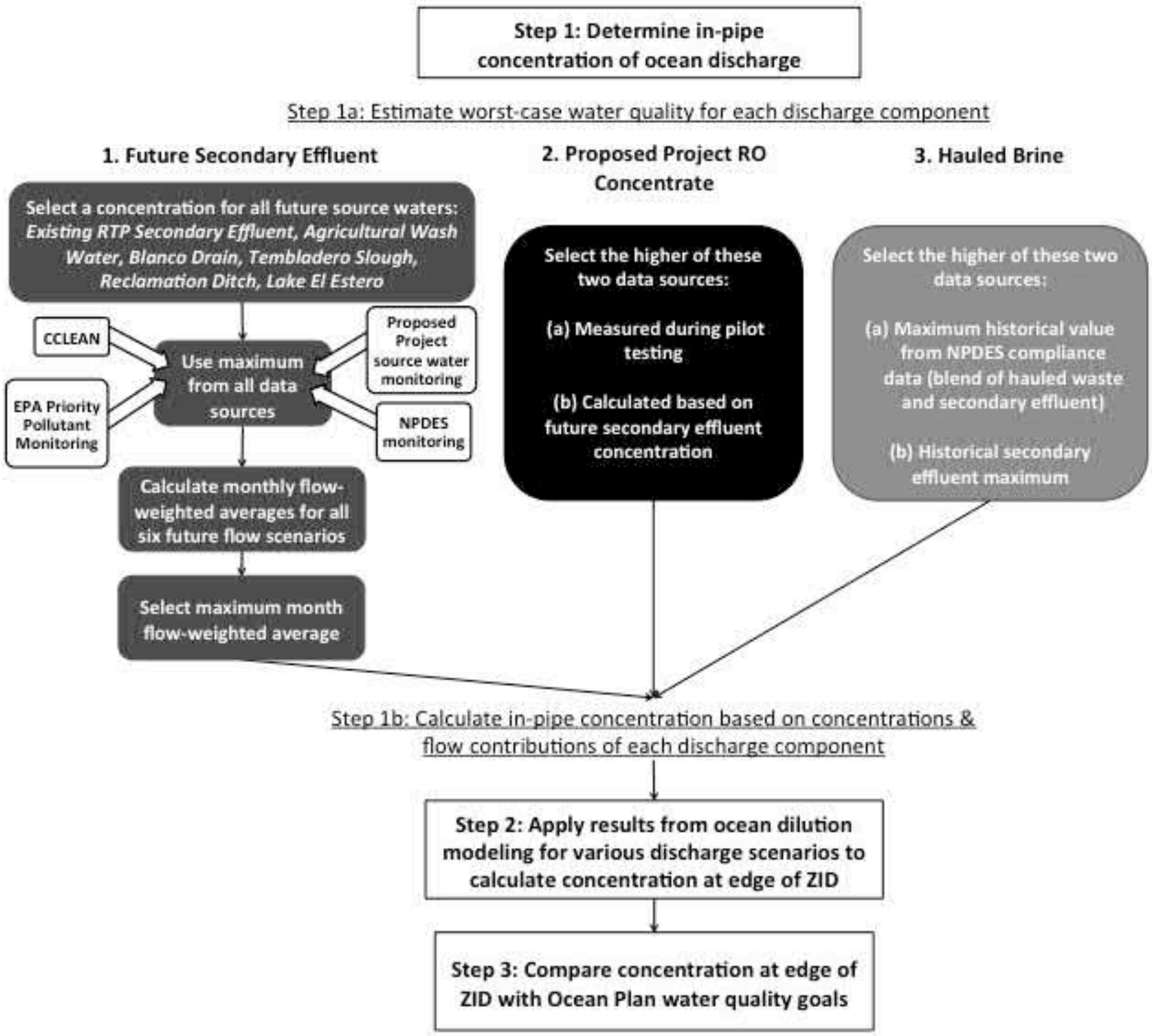


**Figure 2 – Logic flow-chart for determination of project compliance with the Ocean Plan objectives**

### 2.1.1 Future Secondary Effluent

Because the Proposed Project involves bringing new source waters into the RTP, the water quality of those source waters as well as the existing secondary effluent needed to be taken into account to estimate the water quality of the future secondary effluent. The following sources of data were considered for selecting an existing secondary effluent concentration for each constituent in the analysis:

- Source water monitoring conducted for the Proposed Project from July 2013 through June 2014
- Historical NPDES compliance data collected semi-annually by MRWPCA (2005-2014)

- Historical Priority Pollutant data collected annually by MRWPCA (2004-2014)
- Data collected by the Central Coast Long-Term Environmental Assessment Network (CCLEAN) (2008-2013)

The existing secondary effluent concentration for each constituent selected for the analysis was the maximum reported value from the above sources.

Only one data source was available for several of the new source waters (*i.e.*, agricultural wash water, Blanco Drain, Tembladero Slough, and the Reclamation Ditch[5]), namely, data collected during the source water monitoring conducted for the Proposed Project. From these data, the maximum observed concentration was selected for each source water.

Source water flows used for calculation of blended future secondary effluent concentrations were taken from the six projected operational conditions prepared by MRWPCA staff – Phase A and B for the three conditions: (a) normal/wet year, building reserve, (b) normal/wet year, full reserve, and (c) drought year[6]. For each constituent, a total of 72 future concentrations were calculated – 12 months of the year for the 6 projected future source water flow contributions. Of these concentrations, a maximum monthly flow-weighted concentration was selected for each constituent to be used for the Ocean Plan compliance analysis.

When a constituent cannot be quantified or is not detected, it is reported as less than the Method Reporting Limit (<MRL).[7] Because the actual concentration could be any value equal to or less than the MRL, the conservative approach is to use the value of the MRL in the flow-weighting calculations. In some cases, constituents were not detected in any of the source waters; in this case, the values are reported as ND(<X), where X is the MRL. For some non-detected constituents, the MRL exceeds the Ocean Plan objective, and thus no compliance determination can be made[8].

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[5] For the Reclamation Ditch, water quality data related to the Ocean Plan were not available. Concentrations for the Reclamation Ditch were conservatively assumed to be the higher of either the Blanco Drain or Tembladero Slough concentration.

[6] An alternative scenario exists in which all reasonably available source waters are diverted to the RTP regardless of whether there is demand for recycled water (spreadsheet provided by Larry Hampson, October 17, 2014). This scenario was not evaluated here because it would represent an unlikely flow scenario in which there would be RTP effluent discharged to the ocean in the summer months. Trussell Technologies performed an analysis using this alternative scenario and estimated that the concentrations of the Ocean Plan constituents would be less than or equal to the estimated concentrations of the primary scenarios used in this memorandum, and thus further analysis of the alternative scenario is not included.

[7] The lowest amount of an analyte in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions (*i.e.*, the lower limit of quantitation). Therefore, acceptable quality control and quality assurance procedures are calibrated to the MRL, or lower. To take into account day-to-day fluctuations in instrument sensitivity, analyst performance, and other factors, the MRL is established at three times the Method Detection Limit (or greater). The Method Detection Limit is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. (40 Code of Federal Regulations Section136 Appendix B).

[8] This phenomenon is common in the implementation of the Ocean Plan where for some constituents, suitable analytical methods are not capable of measuring low enough to quantify the minimum toxicologically relevant concentrations. For these constituents, a discharge is considered compliant if the monitoring results are less than the MRL.

The following approaches were used for addressing the cases where a constituent was reported as less than the MRL:

- **Aggregate constituents with multiple congeners or sub-components:** Some Ocean Plan constituents are a combination of multiple congeners or sub-components (*e.g.*, chlordane, PAHs, PCBs, and TCDD equivalents). Per the Ocean Plan, if individual congeners or sub-components are below the MRL, they are assumed to be zero for the purposes of calculating the aggregate parameter.
- **Combining different types of waters:** The same approach to constituents that were below the MRL was used for both combining different source waters (*i.e.*, predicting future secondary effluent concentrations based on source water contributions) *and* for combining the different discharge components (*i.e.*, RTP secondary effluent, hauled brine, and RO concentrate). For each constituent:
    - ***When all waters had maximum values reported above the MRL*:** The flow-weighted average of the maximum detected concentrations was used when all water had values reported above the MRL.
    - ***When some waters had maximum values reported as less than the MRL*:**
        - When the MRL was *more* than two orders of magnitude greater (*i.e.*, more than 100 times greater) than the highest detected value from the other waters, the waters with maximum concentrations below the MRL were ignored (*i.e.* treated as having a concentration of zero). This case is exclusive to times when CCLEAN data were reported as detections for the RTP secondary effluent, and all of the other source waters were below the MRL[9]. The analytical methods used for CCLEAN are capable of detecting concentrations many orders of magnitude below the detection limits for traditional methods, and thus to include the <MRL from the other methods would overshadow the CCLEAN data. Additionally, in cases where the traditional analytical method had an MRL greater than the Ocean Plan objective, performing the analysis using the high MRL from the non-CCLEAN methods would result in an inability to make a compliance determination for these constituents.
        - When the MRL was *within* two orders of magnitude or less (*i.e.*, less than 100 times greater) than the highest detected value from the other waters, the constituents that were reported as less than the MRL and were assumed to have a concentration at the MRL for the purposes of calculating a flow-weighted average.
    - ***All waters had maximum values reported as less than the MRL*:** A flow-weighted average MRL was calculated for the constituent and the result was reported as less than this combined MRL. For constituents where multiple MRLs exist for the same water (due to different laboratory analysis methods or dilutions), the lowest MRL was used.

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[9] Specifically, this case applies to endrin, chlordane, heptachlor epoxide, hexachlorobenzene, hexachlorobutadiene, PCBs, and toxaphene.

### 2.1.2 GWR RO Concentrate

Two potential worst-case concentrations were available for the Proposed Project RO concentrate:

- Measured in the concentrate during pilot testing
- Calculated from the blended future secondary effluent concentration, using the following treatment assumptions[10]:
  - No removal prior to the RO process (*i.e.,* at the RTP or AWT Facility ozone or MF)
  - 81% RO recovery (*i.e.,* of the water feeding into the RO system, 81% is product water, also known as permeate, and 19% is the RO concentrate)
  - Complete rejection of each constituent by the RO membrane

The higher of these two values was selected as the final concentration of the RO concentrate for all constituents, except as noted in the Appendix footnotes.

### 2.1.3 Hauled Brine

Currently, small volumes of brine water are trucked to the RTP and blended with secondary effluent in a brine pond. The waste from this pond ("hauled brine") is then discharged along with the secondary effluent bound for ocean discharge (if there is any). For the Proposed Project, the hauled brine would be discharged with both secondary effluent and RO concentrate (see Figure 1). The point at which the hauled brine is added to the ocean discharge water is downstream of the AWT Facility intake, and thus it would not impact the quality of the Proposed Project product water or the RO concentrate. Currently, all sampling of the hauled brine takes place after dilution by secondary effluent in the brine pond, and so the data represent a mix of secondary effluent and brine water. It is appropriate to use these data for the hauled brine quality since the practice of diluting with secondary effluent will continue in the future. Two potential values were available for the hauled brine concentration:

- Historical NPDES compliance data collected semi-annually by MRWPCA (2005-2013) of hauled brine water diluted with existing secondary effluent
- Future secondary effluent concentration, as previously described

The higher of these two values was selected for all constituents; because the hauled brine is diluted by secondary effluent prior to discharge, it is also appropriate to use future secondary effluent concentrations to represent the concentration within hauled brine. Even if a constituent were not present in the hauled brine, if it is present in the secondary effluent it would be present in the combined discharge.

### 2.1.4 Combined Ocean Discharge Concentrations

Having calculated the worst-case future concentrations for each of the three discharge components, the combined concentration prior to discharge was determined as a flow-weighted average of the contributions of each of the three discharge components. As discussed in Section 3.1, a range of secondary effluent flow conditions was considered.

[10] Based on the treatment assumptions, the RO concentrate would equal 5.3 times the AWT Facility influent (*i.e.*, blended future secondary effluent) concentration.

## 2.2 Ocean Modeling and Ocean Plan Compliance Analysis Methodology

In order to determine Ocean Plan compliance, Trussell Tech used the following information: (1) the in-pipe (*i.e.*, pre-ocean dilution) concentration of a constituent ($C_{in\text{-}pipe}$) that was developed as discussed in the previous section, (2) the minimum probable dilution for the ocean mixing ($D_m$) for the relevant discharge flow scenarios that was modeled by FlowScience (FlowScience, 2014), and (3) the background concentration of the constituent in the ocean ($C_{Background}$) that is specified in the Ocean Plan's "Table 3". With this information the concentration at the edge of the zone of initial dilution ($C_{ZID}$) was calculated using the following equation:

$$C_{ZID} = \frac{C_{In-pipe} + D_m * C_{Background}}{1 + D_m} \qquad (1)$$

The $C_{ZID}$ was then compared to the Ocean Plan objectives[11] in the Ocean Plan's "Table 1" (SWRCB, 2012). As described previously, the in-pipe concentration was estimated as a flow-weighted average of the future secondary effluent, Proposed Project RO concentrate, and hauled brine with the concentrations determined as discussed above. The $D_m$ values for various flow scenarios were determined by modeling (see FlowScience, 2014). Note that this approach could not be applied for some constituents (*e.g.*, acute toxicity, chronic toxicity, and radioactivity[12]). The assumptions used by FlowScience for the ocean discharge dilution modeling are as follows:

- **Flow**: A sensitivity analysis of relationship between $D_m$ and flow rate was performed for the various discharges types. The greatest $D_m$ sensitivity to flow changes was to variations in the RTP secondary effluent flow. To simplify the analysis, the flow scenarios used in the compliance analysis only considered the maximum flows for the hauled brine and the RO concentrate, because these flows result in the lowest $D_m$, thus making the analysis conservative. The flows considered for each discharge type are as follows:
  - ***Secondary effluent*:** a range of conditions was modeled that reflect realistic future discharge scenarios (minimum flow, moderate flow, and maximum flow).
  - ***Proposed Project RO concentrate*:** 0.94 million gallons per day (mgd), which would be the resulting RO concentrate flow when the AWT Facility is producing

[11] Note that the Ocean Plan (see Ocean Plan Table 2) also defines effluent limitations for oil and grease, suspended solids, settable solids, turbidity, and pH; however, it was not necessary to evaluate these parameters in this assessment. If necessary, the pH of the water would be adjusted to be within acceptable limits prior to discharge. Oil and grease, suspended solids, settable solids, and turbidity do not need to be considered in this analysis as the RO concentrate would be significantly better than the secondary effluent with regards to these parameters. Prior to the RO treatment, the process flow would be treated by MF, which will reduce these parameters, and the waste stream from the MF will be returned to RTP headworks.

[12] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of the constituent. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives (Trussell Technologies, 2014 and 2015). See section 3.4.

4.0 mgd of highly-purified recycled water (corresponds to treating 5.49 mgd of RTP secondary effluent); although the AWT Facility will not be operated at this influent flowrate year round, this is the highest potential RO concentrate flow
    - ***Hauled brine:*** 0.1 mgd, which is the maximum anticipated value (blend of secondary effluent and hauled brine) anticipated by MRWPCA.
- **Total Dissolved Solids (TDS)**: the greatest dilution is achieved when the salinity of the discharge water is the most different from the ambient salinity; therefore, the most conservative TDS will be the highest (*i.e.*, closest to ambient salinity) of:
    - ***Secondary effluent:*** 1,100 milligram per liter (mg/L), which is the maximum expected future TDS, taking into account the flow contribution of each source water and the maximum observed TDS value from each source water
    - ***Proposed Project RO concentrate*:** 5,800 mg/L, which is the maximum expected future TDS based on the maximum expected future secondary effluent TDS and the RO treatment assumptions listed in the section above (*i.e.* in a drought year).
    - ***Hauled brine***: 40,000 mg/L, which is the maximum anticipated value (blend of secondary effluent and hauled brine) from MRWPCA.
- **Ambient salinity**: 33,500 mg/L
- **Temperature**: 20°C

An additional consideration of the ocean dilution modeling is the variation in ocean conditions throughout the year. Three conditions were modeled for all flow scenarios: Davidson (November to March), Upwelling (April to August), and Oceanic (September to October)[13]. In order to conservatively demonstrate Ocean Plan compliance, the lowest $D_m$ from the applicable ocean conditions was used for each flow scenario.

Ocean dilution modeling covered a range of secondary effluent flowrates between 0 and 24.7 mgd[14], and the results showed that Ocean Plan compliance would be achieved when considering all potential secondary effluent flowrates. To simplify the calculation and presentation of these results, representative flowrate ranges were chosen. In order to select the representative flow scenarios to use for the compliance assessment, the balance between in-pipe dilution and dilution through the outfall needed to be taken into account. In general, higher secondary effluent flows being discharged to the ocean would provide dilution of the Proposed Project RO concentrate; however, greater dilution due to ocean water mixing would be provided at lower wastewater discharge flows. The balance of these influences was considered in determining compliance under the five representative discharge conditions that are described in Section 3.2 for the Proposed Project.

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[13] Note that these ranges assign the transitional months to the ocean condition that is typically more restrictive at relevant discharge flows.

[14] The 24.7 mgd represents the secondary effluent flow if the RTP is operating at its design capacity of 29.6 mgd, and there is a net flow of 4.9 mgd to the AWT Facility (a total flow of approximately 5.46 mgd would be sent to the AWT Facility, but 0.55 mgd of MF backwash water is returned to the RTP headworks from the AWT Facility).

# 3 Ocean Plan Compliance Results

## 3.1 Water Quality of Combined Discharge

As described above, the first step in the Ocean Plan compliance analysis was to estimate the worst-case water quality for each of the three future discharge components: future RTP effluent, Proposed Project RO concentrate, and hauled brine waste. A summary of the estimated water qualities of these components is given in Table 1. Additional considerations and assumptions for each constituent are documented in the Table 1 notes section.

**Table 1 – Summary of estimated worst-case water quality for the three waters that would be discharged through the ocean outfall**

| Constituent | Units | Secondary Effluent | Hauled Brine | RO Concentrate | Notes |
|---|---|---|---|---|---|
| *Ocean Plan water quality objectives for protection of marine aquatic life* | | | | | |
| Arsenic | µg/L | 45 | 45 | 12 | 1,12 |
| Cadmium | µg/L | 1.2 | 1.2 | 6.4 | 2,11 |
| Chromium (Hexavalent) | µg/L | 2.7 | 130 | 14 | 2,11 |
| Copper | µg/L | 25.9 | 39 | 136 | 2,11 |
| Lead | µg/L | 0.82 | 0.82 | 4.3 | 2,11 |
| Mercury | µg/L | 0.089 | 0.089 | 0.510 | 5,12 |
| Nickel | µg/L | 13.1 | 13.1 | 69 | 2,11 |
| Selenium | µg/L | 6.5 | 75 | 34 | 2,11 |
| Silver | µg/L | *ND(<1.59)* | ND(<1.59) | ND(<0.19) | 4,14 |
| Zinc | µg/L | 48.4 | 48.4 | 255 | 2,11 |
| Cyanide (MBAS data) | µg/L | 89.5 | 89.5 | 143 | 2,12,13,16 |
| Cyanide | µg/L | 7.2 | 46 | 38 | 6,11,16 |
| Total Chlorine Residual | µg/L | *ND(<200)* | *ND(<200)* | *ND(<200)* | 10 |
| Ammonia (as N), 6-month median | µg/L | 36,400 | 36,400 | 191,579 | 1,11 |
| Ammonia (as N), daily maximum | µg/L | 49,000 | 49,000 | 257,895 | 1,11 |
| Acute Toxicity | TUa | 2.3 | 2.3 | 0.77 | 7,12,13 |
| Chronic Toxicity | TUc | 40 | 40 | 100 | 7,12,13 |
| Phenolic Compounds (non-chlorinated) | µg/L | 69 | 69 | 363 | 1,9,11 |
| Chlorinated Phenolics | µg/L | *ND(<20)* | *ND(<20)* | ND(<20) | 4,14 |
| Endosulfan | µg/L | 0.048 | 0.048 | 0.25 | 5,9,11 |
| Endrin | µg/L | 0.000079 | 0.000079 | 0.00 | 3,11 |
| HCH (Hexachlorocyclohexane) | µg/L | 0.060 | 0.060 | 0.314 | 11 |
| Radioactivity (Gross Beta) | pCi/L | 32 | 307 | 34.8 | 1,7,12,13 |
| Radioactivity (Gross Alpha) | pCi/L | 18 | 457 | 14.4 | 1,7,12,13 |
| *Objectives for protection of human health - noncarcinogens* | | | | | |
| Acrolein | µg/L | 9.0 | 9.0 | 47 | 2,11 |
| Antimony | µg/L | 0.79 | 0.79 | 4 | 1,11 |
| Bis (2-chloroethoxy) methane | µg/L | *ND(<4.2)* | *ND(<4.2)* | *ND(<1)* | 4,14 |
| Bis (2-chloroisopropyl) ether | µg/L | *ND(<4.2)* | *ND(<4.2)* | *ND(<1)* | 4,14 |
| Chlorobenzene | µg/L | *ND(<0.5)* | *ND(<0.5)* | *ND(<0.5)* | 4,14 |
| Chromium (III) | µg/L | 7.3 | 87 | 38 | 1,11 |
| Di-n-butyl phthalate | µg/L | *ND(<7)* | ND(<7) | *ND(<1)* | 4,14 |
| Dichlorobenzenes | µg/L | *1.6* | *1.6* | *8* | 1,11 |
| Diethyl phthalate | µg/L | *ND(<5)* | *ND(<5)* | *ND(<1)* | 4,14 |
| Dimethyl phthalate | µg/L | *ND(<2)* | *ND(<2)* | *ND(<0.5)* | 4,14 |
| 4,6-dinitro-2-methylphenol | µg/L | *ND(<20)* | *ND(<20)* | *ND(<5)* | 4,14 |
| 2,4-dinitrophenol | µg/L | *ND(<13)* | *ND(<13)* | *ND(<5)* | 4,14 |

| Constituent | Units | Secondary Effluent | Hauled Brine | RO Concentrate | Notes |
|---|---|---|---|---|---|
| Ethylbenzene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Fluoranthene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.1) | 4,14 |
| Hexachlorocyclopentadiene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.05) | 4,14 |
| Nitrobenzene | µg/L | ND(<2.3) | ND(<2.3) | ND(<1) | 4,14 |
| Thallium | µg/L | 0.69 | 0.69 | 3.7 | 2,11 |
| Toluene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Tributyltin | µg/L | ND(<0.05) | ND(<0.05) | ND(<0.02) | 8,14 |
| 1,1,1-trichloroethane | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| *Objectives for protection of human health - carcinogens* | | | | | |
| Acrylonitrile | µg/L | 2.5 | 2.5 | 13 | 2,11 |
| Aldrin | µg/L | ND(<0.007) | ND(<0.007) | ND(<0.01) | 4,14 |
| Benzene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Benzidine | µg/L | ND(<19.8) | ND(<19.8) | ND(<0.05) | 4,14 |
| Beryllium | µg/L | ND(<0.69) | 0.0052 | ND(<0.5) | 4,14 |
| Bis(2-chloroethyl)ether | µg/L | ND(<4.2) | ND(<4.2) | ND(<1) | 4,14 |
| Bis(2-ethyl-hexyl)phthalate | µg/L | 78 | 78 | 411 | 1,11 |
| Carbon tetrachloride | µg/L | 0.5 | 0.5 | 2.7 | 2,11 |
| Chlordane | µg/L | 0.000735 | 0.000735 | 0.00387 | 3,9,11 |
| Chlorodibromomethane | µg/L | 2.4 | 2.4 | 13 | 2,11 |
| Chloroform | µg/L | 39 | 39 | 204 | 2,11 |
| DDT | µg/L | 0.0011 | 0.022 | 0.035 | 2,9,11 |
| 1,4-dichlorobenzene | µg/L | 1.6 | 1.6 | 8.4 | 1,11 |
| 3,3-dichlorobenzidine | µg/L | ND(<19) | ND(<19) | ND(<2) | 4,14 |
| 1,2-dichloroethane | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| 1,1-dichloroethylene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Dichlorobromomethane | µg/L | 2.6 | 2.6 | 14 | 2,11 |
| Dichloromethane (methylenechloride) | µg/L | 0.64 | 0.64 | 3.4 | 2,11 |
| 1,3-dichloropropene | µg/L | 0.56 | 0.56 | 3.0 | 2,11 |
| Dieldrin | µg/L | 0.0005 | 0.0056 | 0.0029 | 2,11 |
| 2,4-dinitrotoluene | µg/L | ND(<2) | ND(<2) | ND(<0.1) | 4,14 |
| 1,2-diphenylhydrazine (azobenzene) | µg/L | ND(<4.2) | ND(<4.2) | ND(<1) | 4,14 |
| Halomethanes | µg/L | 1.4 | 1.4 | 7.5 | 2,9,11 |
| Heptachlor | µg/L | ND(<0.01) | ND(<0.01) | ND(<0.01) | 4,14 |
| Heptachlor epoxide | µg/L | 0.000059 | 0.000059 | 0.000311 | 3,11 |
| Hexachlorobenzene | µg/L | 0.000078 | 0.000078 | 0.000411 | 3,11 |
| Hexachlorobutadiene | µg/L | 0.000009 | 0.000009 | 0.000047 | 3,11 |
| Hexachloroethane | µg/L | ND(<2.3) | ND(<2.3) | ND(<0.5) | 4,14 |
| Isophorone | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| N-Nitrosodimethylamine | µg/L | 0.096 | 0.096 | 0.150 | 2,12,13 |
| N-Nitrosodi-N-Propylamine | µg/L | 0.076 | 0.076 | 0.019 | 1,12,13 |
| N-Nitrosodiphenylamine | µg/L | ND(<2.3) | ND(<2.3) | ND(<1) | 4,14 |
| PAHs | µg/L | 0.0529 | 0.0529 | 0.278 | 3,9,11 |
| PCBs | µg/L | 0.000679 | 0.000679 | 0.00357 | 3,9,11 |
| TCDD Equivalents | µg/L | 1.54E-07 | 1.54E-07 | 8.09E-07 | 8,9,11 |
| 1,1,2,2-tetrachloroethane | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Tetrachloroethylene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| Toxaphene | µg/L | 0.00709 | 0.00709 | 3.73E-02 | 3,11 |
| Trichloroethylene | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| 1,1,2-trichloroethane | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |
| 2,4,6-trichlorophenol | µg/L | ND(<2.3) | ND(<2.3) | ND(<1) | 4,14 |
| Vinyl chloride | µg/L | ND(<0.5) | ND(<0.5) | ND(<0.5) | 4,14 |

**Table 1 Notes:**

***RTP Effluent and Hauled Brine Data***
[1] Existing RTP effluent exceeds concentrations observed in other proposed source waters; the value reported is the existing secondary effluent value.
[2] The proposed new source waters may increase the secondary effluent concentration; the value reported is based on predicted source water blends.
[3] RTP effluent value is based on CCLEAN data; no other source waters were considered due to MRL differences.
[4] MRL provided represents the maximum flow-weighted MRL based on the blend of source waters.
[5] The only water with a detected concentration was the RTP effluent, however the flow-weighted concentration increases due to higher MRLs for the proposed new source waters.
[6] Additional source water data are not available; the reported value is for RTP effluent.
[7] Calculation of the flow-weighted concentration was not feasible due to constituent and the maximum observed value reported.
[8] Agricultural Wash Water data are based on an aerated sample, instead of a raw water sample.
[9] This value in the Ocean Plan is an aggregate of several congeners or compounds. Per the approach described in the Ocean Plan, for cases where the individual congeners/compounds were less than the MRL, a value of 0 is assumed in calculating the aggregate value, as the MRLs span different orders of magnitude.
[10] For all waters, it is assumed that dechlorination will be provided when needed such that the total chlorine residual will be below detection.

***RO Concentrate Data***
[11] The value presented represents a calculated value assuming no removal prior to RO, complete rejection through RO membrane, and an 81% RO recovery.
[12] The value represents the maximum value observed during the pilot testing study.
[13] The calculated value for the RO concentrate data (described in note 11) was not used in the analysis because it was not considered representative. It is expected that the value would increase as a result of treatment through the AWT Facility (*e.g.* formation of N-Nitrosodimethylamine as a disinfection by-product), or that it will not concentrate linearly through the RO (*e.g.* toxicity and radioactivity).
[14] The MRL provided represents the limit from the source water and pilot testing monitoring programs.
[15] The value presented represents a calculated value assuming 20% removal through primary and secondary treatment, 70% and 90% removal through ozone for DDT and dieldrin, respectively (based on Oram, 2008), complete rejection through the RO membrane, and an 81% RO recovery. The assumed RTP concentrations for Dieldrin and DDT do not include contributions from the agricultural drainage waters. This is because in all but one flow scenario (Scenario 4, described later), either the agricultural drainage waters are not being brought into the RTP because there is sufficient water from other sources (*e.g.* during wet and normal precipitation years), or the RTP effluent is not being discharged to the outfall (*e.g.,* summer months). In this one scenario (Scenario 4), there is a minimal discharge of secondary effluent to the ocean during a drought year under Davidson ocean conditions; for this flow scenario only, different concentrations are assumed for the RTP effluent. DDT and dieldrin concentrations of 0.022 µg/L and 0.0056 µg/L were used for Scenario 4 in the analysis.

***Cyanide Data***
[16] In mid-2011, MBAS began performing the cyanide analysis on the RTP effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore questionable. Therefore, the cyanide values as measured by MBAS are listed separately from other cyanide values, and the MBAS data were not be used in the analysis for evaluating compliance with the Ocean Plan objectives for the EIR.

## 3.2 Ocean Modeling Results

FlowScience performed modeling of various discharges that include combinations of RTP secondary effluent, hauled brine waste, and Proposed Project RO concentrate (FlowScience, 2014). Year-round compliance with the Ocean Plan objectives was assessed through the evaluation of five representative discharge scenarios. All scenarios assume the maximum flow rates for the RO concentrate and hauled brine waste, which is a conservative assumption in terms of constituent loading and minimum dilution. Various secondary effluent flows were used in the compliance analysis, which represent the different types of future discharge compositions.

The five scenarios used for the compliance assessment in terms of secondary effluent flows to be discharged with the other discharges are shown in Table 2, and include:

(1) **RTP Design Capacity:** maximum flows for the Proposed Project with all 172 discharge ports open[15]. The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario. This scenario represents the maximum (NPDES) permitted wastewater flow (with the Proposed Project in operation).

(2) **Maximum Flow under Current Port Configuration:** the maximum flow that can be discharged with the current ports configuration (130 of the 172 ports open)[16]. The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario. This scenario was chosen as it represents the maximum wastewater flow under the existing diffuser conditions.

(3) **Minimum Wastewater Flow (Oceanic/Upwelling):** the maximum influence of the Proposed Project RO concentrate on the ocean discharge under Oceanic/Upwelling ocean conditions (*i.e.*, no secondary effluent discharged). The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario.

(4) **Minimum Wastewater Flow (Davidson):** the maximum influence of the Proposed Project RO concentrate on the ocean discharge under Davidson ocean condition (*i.e.*, the minimum wastewater flow). Observed historic wastewater flows generally exceed 0.4 mgd during Davidson oceanic conditions. Additional source waters would be brought into the RTP if necessary to maintain the 0.4 mgd minimum.

(5) **Moderate Wastewater Flow:** conditions with a moderate wastewater flow when the Proposed Project RO concentrate has a greater influence to the water quality than in Scenarios 1 and 2, but where the ocean dilution ($D_m$) is reduced due to the higher overall discharge flow (*i.e.*, compared to Scenarios 2 and 3). The Davidson ocean condition was used as it represents the worst-case dilution for this flow scenario.

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[15] Note that this scenario would only apply if wastewater flows increased to the point that MRWPCA took action to open the 42 discharge ports that are currently closed. Scenario 2 is the maximum discharge flow under the current port configuration.

[16] For Scenarios 2 through 5, ocean modeling was performed assuming 120 ports open, which would yield more conservative $D_m$ values than 130 ports, as dilution increases with increasing numbers of open ports.

**Table 2 – Flow scenarios and modeled $D_m$ values used for Ocean Plan compliance analysis**

| No. | Discharge Scenario (Ocean Condition) | Flows (mgd) | | | $D_m$ |
|---|---|---|---|---|---|
| | | Secondary effluent | RO concentrate | Hauled brine | |
| 1 | RTP Design Capacity (Oceanic) | 24.7 | 0.94 | 0.1 | 150 |
| 2 | RTP Capacity with Current Port Configuration (Oceanic) | 23.7 | 0.94 | 0.1 | 137 |
| 3 | Minimum Wastewater Flow (Oceanic) | 0 | 0.94 | 0.1 | 523 |
| 4 | Minimum Wastewater Flow (Davidson) | 0.4 | 0.94 | 0.1 | 285 |
| 5 | Moderate Wastewater Flow Condition (Davidson) | 3 | 0.94 | 0.1 | 201 |

## 3.3 Ocean Plan Compliance Results

The flow-weighted in-pipe concentration for each constituent was then calculated for each discharge scenario using the water quality presented in Table 1 and the flows presented in Table 2. The in-pipe concentration was then used to calculate the concentration at the edge of the ZID using the $D_m$ values presented in Table 2. The resulting concentrations for each constituent in each scenario were compared to the Ocean Plan objective to assess compliance. The estimated concentrations for all five flow-scenarios are presented as concentrations at the edge of the ZID (Table 3) and as a percentage of the Ocean Plan objective (Table 4). As shown, none of the constituents are expected to exceed 80% of their Ocean Plan objective[17].

**Table 3 – Predicted concentrations of Ocean Plan constituents at the edge of the ZID**

| Constituent | Units | Ocean Plan Objective | Estimated Concentrations at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| *Objectives for protection of marine aquatic life* | | | | | | | |
| Arsenic | ug/L | 8 | 3.3 | 3.3 | 3.0 | 3.1 | 3.2 |
| Cadmium | ug/L | 1 | 0.009 | 0.01 | 0.01 | 0.02 | 0.01 |
| Chromium (Hexavalent) | ug/L | 2 | 0.02 | 0.03 | 0.05 | 0.07 | 0.04 |
| Copper | ug/L | 3 | 2.2 | 2.2 | 2.2 | 2.3 | 2.2 |
| Lead | ug/L | 2 | 0.006 | 0.007 | 0.008 | 0.011 | 0.008 |
| Mercury | ug/L | 0.04 | 0.006 | 0.006 | 0.006 | 0.006 | 0.006 |
| Nickel | ug/L | 5 | 0.1 | 0.1 | 0.1 | 0.2 | 0.1 |
| Selenium | ug/L | 15 | 0.05 | 0.06 | 0.07 | 0.10 | 0.07 |
| Silver | ug/L | 0.7 | <0.17 | <0.17 | <0.16 | <0.16 | <0.17 |
| Zinc | ug/L | 20 | 8.3 | 8.3 | 8.4 | 8.6 | 8.4 |
| Cyanide (MBAS data) | ug/L | 1 | 0.61 | 0.66 | 0.26 | 0.44 | 0.50 |
| Cyanide | ug/L | 1 | 0.056 | 0.062 | 0.074 | 0.105 | 0.076 |
| Total Chlorine Residual | ug/L | 2 | <1.3 | <1.4 | <0.4 | <0.7 | <1.0 |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 279 | 306 | 337 | 481 | 359 |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 375 | 413 | 454 | 648 | 483 |

[17] Aldrin, benzidine, 3,3-dichlorobenzidine and heptachlor were not detected in any source waters, however their MRLs are greater than the Ocean Plan objective. Therefore, no percentages are presented Table 4 as no compliance conclusions can be drawn for these constituents. This is a typical occurrence for ocean discharges since the MRL is higher than the ocean plan objective for some constituents.

| Constituent | Units | Ocean Plan Objective | Estimated Concentrations at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| Acute Toxicity[a] | TUa | 0.3 | | | | | |
| Chronic Toxicity[a] | TUc | 1 | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 0.53 | 0.58 | 0.64 | 0.91 | 0.68 |
| Chlorinated Phenolics | ug/L | 1 | <0.13 | <0.14 | <0.04 | <0.07 | <0.10 |
| Endosulfan | ug/L | 0.009 | 0.00037 | 0.00040 | 0.00045 | 0.00064 | 0.00047 |
| Endrin | ug/L | 0.002 | 6.0E-07 | 6.7E-07 | 7.3E-07 | 1.0E-06 | 7.8E-07 |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 0.00046 | 0.00050 | 0.00055 | 0.00079 | 0.00059 |
| Radioactivity (Gross Beta)[a] | pci/L | – | | | | | |
| Radioactivity (Gross Alpha)[a] | pci/L | – | | | | | |
| *Objectives for protection of human health - noncarcinogens* | | | | | | | |
| Acrolein | ug/L | 220 | 0.07 | 0.08 | 0.08 | 0.1 | 0.09 |
| Antimony | ug/L | 1200 | 0.0060 | 0.0066 | 0.0073 | 0.010 | 0.0078 |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.03 | <0.03 | <0.002 | <0.007 | <0.02 |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.03 | <0.03 | <0.002 | <0.007 | <0.02 |
| Chlorobenzene | ug/L | 570 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Chromium (III) | ug/L | 190000 | 0.058 | 0.064 | 0.082 | 0.116 | 0.082 |
| Di-n-butyl phthalate | ug/L | 3500 | <0.04 | <0.05 | <0.003 | <0.01 | <0.03 |
| Dichlorobenzenes | ug/L | 5100 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 |
| Diethyl phthalate | ug/L | 33000 | <0.03 | <0.04 | <0.003 | <0.008 | <0.02 |
| Dimethyl phthalate | ug/L | 820000 | <0.01 | <0.01 | <0.001 | <0.004 | <0.008 |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.1 | <0.1 | <0.01 | <0.04 | <0.08 |
| 2,4-Dinitrophenol | ug/L | 4.0 | <0.08 | <0.09 | <0.01 | <0.03 | <0.06 |
| Ethylbenzene | ug/L | 4100 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Fluoranthene | ug/L | 15 | <0.003 | <0.004 | <0.0003 | <0.001 | <0.002 |
| Hexachlorocyclopentadiene | ug/L | 58 | <0.003 | <0.003 | <0.0002 | <0.001 | <0.002 |
| Nitrobenzene | ug/L | 4.9 | <0.01 | <0.02 | <0.002 | <0.005 | <0.01 |
| Thallium | ug/L | 2 | 0.005 | 0.006 | 0.006 | 0.009 | 0.007 |
| Toluene | ug/L | 85000 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Tributyltin | ug/L | 0.0014 | <0.0003 | <0.0004 | <0.00004 | <0.0001 | <0.0002 |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| *Objectives for protection of human health - carcinogens* | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 |
| Aldrin[b] | ug/L | 0.000022 | <0.00005 | <0.00005 | <0.00002 | <0.00003 | <0.00004 |
| Benzene | ug/L | 5.9 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Benzidine[b] | ug/L | 0.000069 | <0.1 | <0.1 | <0.004 | <0.02 | <0.08 |
| Beryllium | ug/L | 0.033 | 0.005 | 0.005 | 0.001 | 0.002 | 0.003 |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <0.03 | <0.03 | <0.002 | <0.007 | <0.02 |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 0.60 | 0.66 | 0.72 | 1.03 | 0.77 |
| Carbon tetrachloride | ug/L | 0.90 | 0.004 | 0.004 | 0.005 | 0.007 | 0.005 |
| Chlordane | ug/L | 0.000023 | 5.6E-06 | 6.2E-06 | 6.8E-06 | 9.7E-06 | 7.2E-06 |
| Chlorodibromomethane | ug/L | 8.6 | 0.02 | 0.02 | 0.02 | 0.03 | 0.02 |
| Chloroform | ug/L | 130 | 0.3 | 0.3 | 0.4 | 0.5 | 0.4 |
| DDT | ug/L | 0.00017 | 1.6E-05 | 1.8E-05 | 6.4E-05 | 1.1E-04 | 4.7E-05 |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.01 | 0.01 | 0.01 | 0.02 | 0.02 |
| 3,3-Dichlorobenzidine[b] | ug/L | 0.0081 | <0.1 | <0.1 | <0.01 | <0.03 | <0.1 |
| 1,2-Dichloroethane | ug/L | 28 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.003 | 0.004 | 0.001 | 0.002 | 0.002 |
| Dichlorobromomethane | ug/L | 6.2 | 0.02 | 0.02 | 0.02 | 0.03 | 0.03 |
| Dichloromethane (methylenechloride) | ug/L | 450 | 0.005 | 0.01 | 0.01 | 0.01 | 0.01 |
| 1,3-dichloropropene | ug/L | 8.9 | 0.004 | 0.005 | 0.01 | 0.01 | 0.01 |
| Dieldrin | ug/L | 0.00004 | 4.0E-06 | 4.5E-06 | 6.1E-06 | 1.3E-05 | 5.9E-06 |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <0.01 | <0.01 | <0.001 | <0.003 | <0.01 |
| 1,2-Diphenylhydrazine (azobenzene) | ug/L | 0.16 | <0.03 | <0.03 | <0.002 | <0.01 | <0.02 |

| Constituent | Units | Ocean Plan Objective | Estimated Concentrations at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| Halomethanes | ug/L | 130 | 0.011 | 0.012 | 0.013 | 0.019 | 0.014 |
| Heptachlor[b] | ug/L | 0.00005 | <0.0001 | <0.0001 | <0.00002 | <0.00003 | <0.00005 |
| Heptachlor Epoxide | ug/L | 0.00002 | 4.5E-07 | 5.0E-07 | 5.5E-07 | 7.8E-07 | 5.8E-07 |
| Hexachlorobenzene | ug/L | 0.00021 | 6.0E-07 | 6.6E-07 | 7.2E-07 | 1.0E-06 | 7.7E-07 |
| Hexachlorobutadiene | ug/L | 14 | 6.9E-08 | 7.6E-08 | 8.3E-08 | 1.2E-07 | 8.9E-08 |
| Hexachloroethane | ug/L | 2.5 | <0.01 | <0.02 | <0.001 | <0.004 | <0.01 |
| Isophorone | ug/L | 730 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| N-Nitrosodimethylamine | ug/L | 7.3 | 0.001 | 0.001 | 0.0003 | 0.0005 | 0.001 |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 0.0005 | 0.001 | 0.00005 | 0.0001 | 0.0003 |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.01 | <0.02 | <0.002 | <0.01 | <0.01 |
| PAHs | ug/L | 0.0088 | 0.00041 | 0.00045 | 0.00049 | 0.00070 | 0.00052 |
| PCBs | ug/L | 0.000019 | 5.20E-06 | 5.72E-06 | 6.29E-06 | 8.98E-06 | 6.70E-06 |
| TCDD Equivalents | ug/L | 3.9E-09 | 1.18E-09 | 1.30E-09 | 1.42E-09 | 2.03E-09 | 1.52E-09 |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Tetrachloroethylene | ug/L | 2.0 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| Toxaphene | ug/L | 2.1E-04 | 5.43E-05 | 5.97E-05 | 6.57E-05 | 9.38E-05 | 6.99E-05 |
| Trichloroethylene | ug/L | 27 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <0.01 | <0.02 | <0.002 | <0.01 | <0.01 |
| Vinyl chloride | ug/L | 36 | <0.003 | <0.004 | <0.001 | <0.002 | <0.002 |

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[b] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

**Table 4 – Predicted concentrations of all COP constituents, expressed as percent of Ocean Plan Objective**

| Constituent | Units | Ocean Plan Objective | Estimated Percentage of Ocean Plan Objective at Edge of ZID by Discharge Scenario[c] | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| *Objectives for protection of marine aquatic life* | | | | | | | |
| Arsenic | ug/L | 8 | 41% | 41% | 38% | 38% | 40% |
| Cadmium | ug/L | 1 | 1% | 1% | 1% | 2% | 1% |
| Chromium (Hexavalent) | ug/L | 2 | 1% | 1% | 2% | 3% | 2% |
| Copper | ug/L | 3 | 73% | 73% | 75% | 78% | 75% |
| Lead | ug/L | 2 | 0.3% | 0.3% | 0.4% | 0.5% | 0.4% |
| Mercury | ug/L | 0.04 | 14% | 14% | 15% | 16% | 15% |
| Nickel | ug/L | 5 | 2% | 2% | 2% | 3% | 3% |
| Selenium | ug/L | 15 | 0.3% | 0.4% | 0.5% | 0.7% | 0.5% |
| Silver | ug/L | 0.7 | <24% | <24% | <23% | <23% | <24% |
| Zinc | ug/L | 20 | 42% | 42% | 42% | 43% | 42% |
| Cyanide (MBAS data) | ug/L | 1 | 61% | 66% | 26% | 44% | 50% |
| Cyanide | ug/L | 1 | 6% | 6% | 7% | 10% | 8% |
| Total Chlorine Residual | ug/L | 2 | - | - | - | - | - |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 46% | 51% | 56% | 80% | 60% |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 16% | 17% | 19% | 27% | 20% |
| Acute Toxicity[a] | TUa | 0.3 | | | | | |
| Chronic Toxicity[a] | TUc | 1 | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 2% | 2% | 2% | 3% | 2% |
| Chlorinated Phenolics | ug/L | 1 | <13% | <14% | <4% | <7% | <10% |
| Endosulfan | ug/L | 0.009 | 4% | 4% | 5% | 7% | 5% |
| Endrin | ug/L | 0.002 | 0.03% | 0.03% | 0.04% | 0.05% | 0.04% |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 11% | 13% | 14% | 20% | 15% |
| Radioactivity (Gross Beta)[a] | pci/L | – | | | | | |
| Radioactivity (Gross Alpha)[a] | pci/L | – | | | | | |
| *Objectives for protection of human health - noncarcinogens* | | | | | | | |
| Acrolein | ug/L | 220 | 0.03% | 0.03% | 0.04% | 0.05% | 0.04% |
| Antimony | ug/L | 1200 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.61% | <0.67% | <0.06% | <0.17% | <0.39% |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Chlorobenzene | ug/L | 570 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Chromium (III) | ug/L | 190000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Di-n-butyl phthalate | ug/L | 3500 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dichlorobenzenes | ug/L | 5100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Diethyl phthalate | ug/L | 33000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dimethyl phthalate | ug/L | 820000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.06% | <0.06% | <0.01% | <0.02% | <0.04% |
| 2,4-Dinitrophenol | ug/L | 4.0 | <2.10% | <2.30% | <0.28% | <0.68% | <1.38% |
| Ethylbenzene | ug/L | 4100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Fluoranthene | ug/L | 15 | <0.02% | <0.02% | <0.01% | <0.01% | <0.01% |
| Hexachlorocyclopentadiene | ug/L | 58 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Nitrobenzene | ug/L | 4.9 | <0.30% | <0.33% | <0.04% | <0.10% | <0.20% |
| Thallium | ug/L | 2 | 0.27% | 0.29% | 0.32% | 0.46% | 0.34% |
| Toluene | ug/L | 85000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Tributyltin | ug/L | 0.0014 | <23% | <25% | <3% | <8% | <15% |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| *Objectives for protection of human health - carcinogens* | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | 20% | 21% | 24% | 34% | 25% |
| Aldrin[b] | ug/L | 0.000022 | – | – | – | – | – |
| Benzene | ug/L | 5.9 | <0.06% | <0.06% | <0.02% | <0.03% | <0.04% |
| Benzidine[b] | ug/L | 0.000069 | – | – | – | – | – |
| Beryllium | ug/L | 0.033 | 14% | 15% | 3% | 5% | 9% |

| Constituent | Units | Ocean Plan Objective | Estimated Percentage of Ocean Plan Objective at Edge of ZID by Discharge Scenario[c] | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <60% | <66% | <6% | <16% | <38% |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 17% | 19% | 21% | 29% | 22% |
| Carbon tetrachloride | ug/L | 0.90 | 0.4% | 0.5% | 0.5% | 0.7% | 0.6% |
| Chlordane | ug/L | 0.000023 | 24% | 27% | 30% | 42% | 32% |
| Chlorodibromomethane | ug/L | 8.6 | 0.2% | 0.2% | 0.3% | 0.4% | 0.3% |
| Chloroform | ug/L | 130 | 0.2% | 0.3% | 0.3% | 0.4% | 0.3% |
| DDT | ug/L | 0.00017 | 9% | 10% | 37% | 62% | 27% |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.1% | 0.1% | 0.1% | 0.1% | 0.1% |
| 3,3-Dichlorobenzidine[b] | ug/L | 0.0081 | – | – | – | – | – |
| 1,2-Dichloroethane | ug/L | 28 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.4% | 0.4% | 0.1% | 0.2% | 0.3% |
| Dichlorobromomethane | ug/L | 6.2 | 0.3% | 0.4% | 0.4% | 0.6% | 0.4% |
| Dichloromethane (methylenechloride) | ug/L | 450 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,3-dichloropropene | ug/L | 8.9 | 0.05% | 0.05% | 0.06% | 0.08% | 0.06% |
| Dieldrin | ug/L | 0.00004 | 10% | 11% | 15% | 34% | 15% |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <0.5% | <0.5% | <0.02% | <0.1% | <0.3% |
| 1,2-Diphenylhydrazine (azobenzene) | ug/L | 0.16 | <17% | <18% | <2% | <5% | <11% |
| Halomethanes | ug/L | 130 | 0.01% | 0.01% | 0.01% | 0.01% | 0.01% |
| Heptachlor[b] | ug/L | 0.00005 | – | – | <38% | <70% | – |
| Heptachlor Epoxide | ug/L | 0.00002 | 2% | 2% | 3% | 4% | 3% |
| Hexachlorobenzene | ug/L | 0.00021 | 0.3% | 0.3% | 0.3% | 0.5% | 0.4% |
| Hexachlorobutadiene | ug/L | 14 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Hexachloroethane | ug/L | 2.5 | <0.6% | <0.6% | <0.1% | <0.2% | <0.4% |
| Isophorone | ug/L | 730 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| N-Nitrosodimethylamine | ug/L | 7.3 | 0.01% | 0.01% | <0.01% | 0.01% | 0.01% |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 0.13% | 0.14% | 0.01% | 0.04% | 0.08% |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.6% | <0.7% | <0.1% | <0.2% | <0.4% |
| PAHs | ug/L | 0.0088 | 5% | 5% | 6% | 8% | 6% |
| PCBs | ug/L | 0.000019 | 27% | 30% | 33% | 47% | 35% |
| TCDD Equivalents | ug/L | 3.9E-09 | 30% | 33% | 37% | 52% | 39% |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.1% | <0.2% | <0.04% | <0.1% | <0.1% |
| Tetrachloroethylene | ug/L | 2.0 | <0.2% | <0.2% | <0.05% | <0.1% | <0.1% |
| Toxaphene | ug/L | 2.1E-04 | 26% | 28% | 31% | 45% | 33% |
| Trichloroethylene | ug/L | 27 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.04% | <0.04% | <0.01% | <0.02% | <0.03% |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <5% | <6% | <1% | <2% | <3% |
| Vinyl chloride | ug/L | 36 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives (see Section 3.4).

[b] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[c] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%).

## 3.4 Toxicity

The NPDES permit includes daily maximum effluent limitations for acute and chronic toxicity that are based on the current allowable $D_m$ of 145. The acute toxicity effluent limitation is 4.7 TUa (acute toxicity units) and the chronic toxicity effluent limitation is 150 TUc (chronic toxicity units). The permit requires that toxicity testing be conducted twice per year, with one sample collected during the wet season when the discharge is primarily secondary effluent and once during the dry season when the discharge is primarily trucked brine waste. The MRWPCA ocean discharge has consistently complied with these toxicity limits (CCRWQCB, 2014).

Toxicity testing of RO concentrate generated by the pilot testing was conducted in support of the Proposed Project (Trussell Technologies, 2015). On April 9, 2014, a sample of RO concentrate was sent to Pacific EcoRisk for acute and chronic toxicity analysis. Based on these results (RO concentrate values presented in Table 1), the Proposed Project concentrate requires a minimum $D_m$ of 16:1 and 99:1 for acute and chronic toxicity, respectively, to meet the Ocean Plan objectives. These $D_m$ values were compared to predicted $D_m$ values for the discharge of concentrate only from the Proposed Project's full-scale AWT Facility and the discharge of concentrate combined with secondary effluent from the RTP. The minimum dilution modeled for the various Proposed Project discharge scenarios was 137:1, which is when the secondary effluent discharge is at the maximum possible flow under the current port configuration (FlowScience, 2014). Given that the lowest expected $D_m$ value for the various Proposed Project ocean discharge scenarios is greater than the required dilution factor for compliance with the Ocean Plan toxicity objectives, this sample illustrates that the discharge scenarios would comply with Ocean Plan objectives.

# 4 Conclusions

The purpose of the analysis documented in this technical memorandum was to assess the ability of the Proposed Project to comply with the Ocean Plan objectives. Trussell Tech used a conservative approach to estimate the water qualities of the RTP secondary effluent, RO concentrate, and hauled brine waste for the Proposed Project. These water quality data were then combined for various discharge scenarios, and a concentration at the edge of the ZID was calculated for each constituent and scenario. Compliance assessments could not be made for selected constituents, as noted, due to analytical limitations, but this is a typical occurrence for these Ocean Plan constituents. Based on the data, assumptions, modeling, and analytical methodology presented in this technical memorandum, the Proposed Project would comply with the Ocean Plan objectives.

# 5 References

Central Coast Regional Water Quality Control Board (CCRWQCB), 2014. Waste Discharge Requirements for the Monterey Regional Water Pollution Control Agency Regional Treatment Plant.

FlowScience, 2014. "MRWPCA GWR Discharge Dilution Analysis FSI 144082." Technical Memorandum to Robert Holden, MRWPCA. 8 Nov.

NRC, 1993. "Managing Wastewater in Coastal Urban Areas". National Academy Press, Washington, D.C.

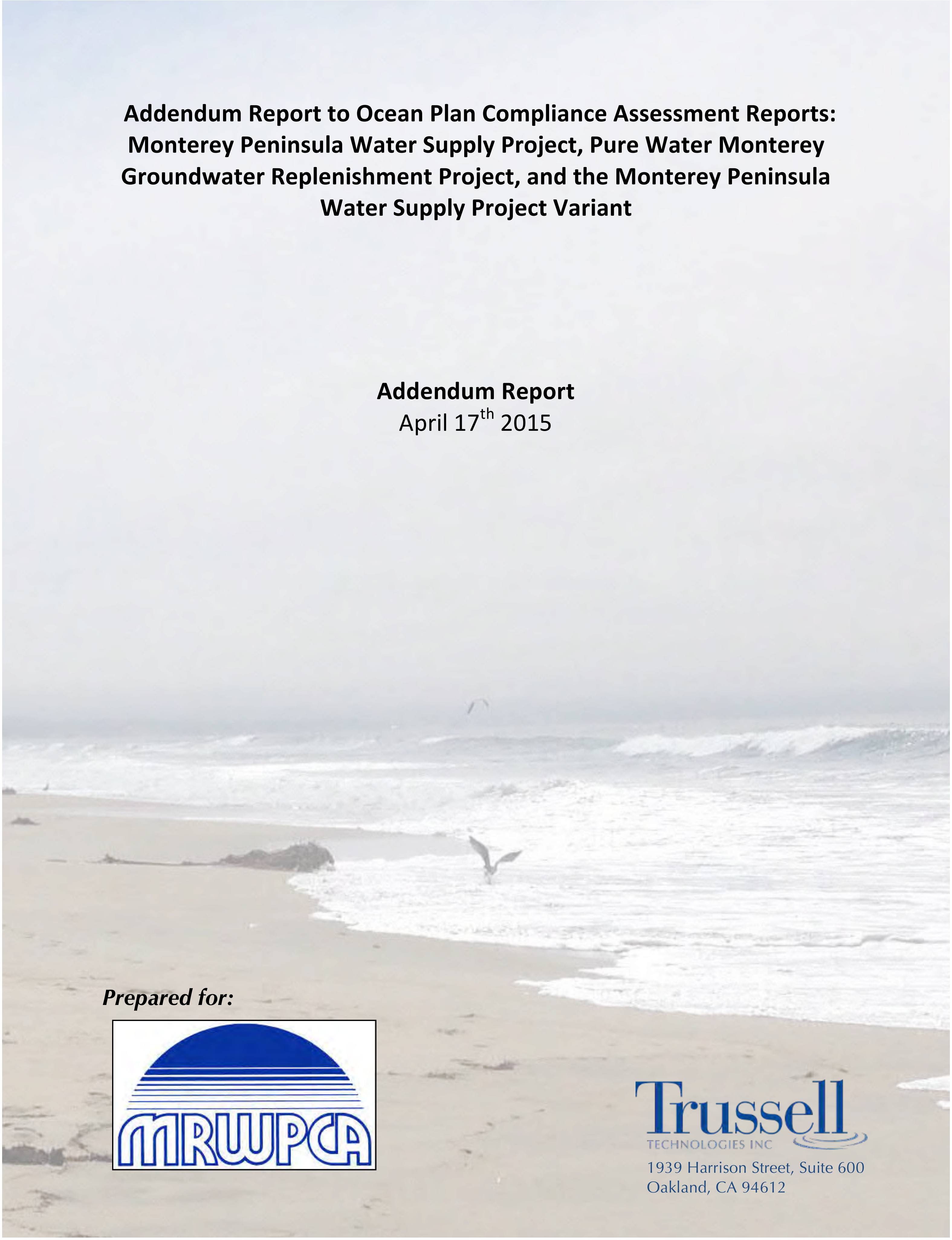
State Water Resources Control Board, California Environmental Protection Agency (SWRCB), 2012. *California Ocean Plan: Water Quality Control Plan, Ocean Waters of California*.

Trussell Technologies, Inc. (2014). *Pure Water Monterey Groundwater Recharge Project: Advanced Water Treatment Facility Piloting. Draft Report, Prepared for the MRWPCA and the MPWMD. Dec.*

Trussell Technologies, Inc. (2015). "AWT Facility Pilot-Scale RO Concentrate Toxicity Testing." *Communication, Prepared for Bob Holden, MRWPCA. Feb.*

# Appendix C

Trussell Technologies, Inc (Trussell Tech), 2015b. "Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant." *Technical Memorandum prepared for MRWPCA and MPWMD*. March.



# Addendum Report to Ocean Plan Compliance Assessment Reports: Monterey Peninsula Water Supply Project, Pure Water Monterey Groundwater Replenishment Project, and the Monterey Peninsula Water Supply Project Variant

**Addendum Report**

April 17th 2015

***Prepared for:***

MRWPCA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# Addendum Report to Ocean Plan Compliance Assessment Reports: Monterey Peninsula Water Supply Project, Pure Water Monterey Groundwater Replenishment Project, and the Monterey Peninsula Water Supply Project Variant

## Addendum Report

**April 17th 2015**

Prepared By:

**Trussell Technologies, Inc.**
Gordon Williams, Ph.D., P.E.

# Table of Contents

# 1 Introduction

Trussell Technologies, Inc. (Trussell Tech) previously prepared two Technical Memoranda to assess compliance of the following three proposed projects with the California Ocean Plan (SWRCB, 2012):

1. **Monterey Peninsula Water Supply Project ("MPWSP")**, which would include a seawater desalination plant capable of producing 9.6 million gallons per day (mgd) of drinking water (Ocean Plan compliance assessment described in Trussell Tech, 2015b).
2. **Pure Water Monterey Groundwater Replenishment Project ("GWR Project"),** which would include an Advanced Water Treatment facility ("AWT Facility") capable of producing an average flow of 3.3 mgd of highly purified recycled water for injection into the Seaside Groundwater Basin (Ocean Plan compliance assessment described in Trussell Tech, 2015a). The AWT Facility source water would be secondary treated wastewater ("secondary effluent") from the Monterey Regional Water Pollution Control Agency's (MRWPCA's) Regional Treatment Plant (RTP).
3. **Monterey Peninsula Water Supply Project Variant or "Variant Project"**, which would be a combination of a smaller seawater desalination plant capable of producing 6.4 mgd of drinking water along with the GWR Project (Ocean Plan compliance assessment described in Trussell Tech, 2015b).

Both the proposed desalination facility and the proposed AWT Facility would employ reverse osmosis (RO) membranes to purify the waters, and as a result, both projects would produce RO concentrate waste streams that would be disposed through the existing MRWPCA ocean outfall: the RO concentrate from the desalination facility ("Desal Brine"), and the RO concentrate from the AWT Facility ("GWR Concentrate"). Additional details regarding the project backgrounds, assessment methodologies, results, and conclusions for discharge of these waste streams are described in the previous Technical Memoranda (Trussell Tech, 2015a and 2015b).

The Ocean Plan objectives are to be met after initial dilution of the discharge in the ocean. The initial dilution occurs in an area known as the zone of initial dilution (ZID). The extent of dilution in the ZID is quantified and referred to as the minimum probable initial dilution ($D_m$). The water quality objectives established in the Ocean Plan are adjusted by the $D_m$ to derive the National Pollutant Discharge Elimination System (NPDES) permit limits for a treated wastewater discharge prior to ocean dilution.

Part of the methodology for estimating the concentration of a constituent for the Ocean Plan is estimating the $D_m$ based on ocean modeling. FlowScience, Inc. ("FlowScience") conducted modeling of mixing in the ocean for various discharge scenarios related to the proposed projects to determine $D_m$ values for the key discharge scenarios. Recently, additional modeling by FlowScience (FlowScience, 2015) was performed to (1) update the number of currently open discharge ports in the MRWPCA ocean outfall from 120 to 130 open ports, (2) update the GWR RO concentrate flow from 0.73 to 0.94 mgd and account for the hauled brine[1] for the MPWSP

[1] The hauled brine is waste that is trucked to the RTP and blended with secondary effluent prior to being discharged. The maximum anticipated flow of this stream is 0.1 mgd (blend of brine and secondary effluent).

and Variant Project discharge scenarios, and (3) model additional key discharge scenarios that were missing from the initial ocean modeling for the MPWSP and Variant Project.

The purpose of this Addendum Report is to provide an understanding of the impact of the updated ocean discharge modeling on the previous Ocean Plan compliance assessments for the various proposed projects.

# 2 Modeling Update Results

FlowScience performed additional ocean discharge modeling for key discharge scenarios (see Appendix A) and Trussell Tech used these modeling results to perform an updated analysis of Ocean Plan compliance for the various proposed projects. Results from these analyses are presented in the following subsections: the MPWSP in Section 2.1; the Variant Project in Section 2.2; and the GWR Project in Section 2.3. Note that the results for the GWR Project in Section 2.3 are also applicable to the Variant Project. Not all previously modeled scenarios were repeated; the scenarios selected for updating were chosen to demonstrate the impact of the updated model input parameters (*i.e.*, number of open ports, inclusion of the hauled waste flow, and GWR Concentrate flow update). In addition, some new scenarios were added to ensure that the worst-case discharge conditions were considered for all of the proposed projects.

## 2.1 Updated Results for the MPWSP

The following discharge scenarios related to the MPWSP were modeled using 130 open ports for the MRWPCA ocean outfall:

1. **Desal Brine with no secondary effluent (*updated scenario*):** The maximum influence of the Desal Brine on the overall discharge (*i.e.*, no secondary effluent discharged) would be when there is no secondary effluent discharged. This scenario would be representative of conditions when demand for recycled water is highest (*e.g.*, during summer months), and all of the RTP secondary effluent is recycled through the Salinas Valley Reclamation Project (SVRP) for agricultural irrigation. The hauled waste is also included in this discharge scenario.
2. **Desal Brine with moderate secondary effluent flow (*new scenario*):** Desal Brine discharged with a relatively moderate secondary effluent flow that results in a plume with slightly negative buoyancy. This scenario represents times when demand for recycled water is low or the secondary effluent flow is low, and there is excess secondary effluent that is discharged to the ocean.

The updated $D_m$ values for these two discharge scenarios are provided in Table 1. The net impact of using 130 open ports and including the hauled waste was a slight increase (approximately 6%) in the amount of dilution associated with ocean mixing. This confirms that previously modeled MPWSP discharge scenarios with Desal Brine included in Trussell 2015b were conservative (*i.e.* the previous analysis slightly over-estimated the ZID concentration for the Ocean Plan constituents).

**Table 1 – Updated minimum probable dilution ($D_m$) values for select MPWSP discharge scenarios**

| No. | Discharge Scenario (Ocean Condition) | Discharge flows (mgd) | | | Previously Reported $D_m$ (120 ports)[a] | Updated $D_m$ (130 ports) |
|---|---|---|---|---|---|---|
| | | Secondary effluent | Hauled Waste | Desal Brine | | |
| 1 | Desal Brine with no secondary effluent flow (Davidson) | 0 | 0.1 | 13.98 | 16 | 17 |
| 2 | Desal Brine with moderate secondary effluent flow (Davidson) | 9 | 0.1 | 13.98 | n/a [b] | 22 |

[a] The previously reported $D_m$ was used in the analysis presented in Trussell 2015b, and was determined with the assumption that 120 ports on the outfall were open and did not consider the hauled waste flow.
[b] Not applicable, as Discharge Scenario 2, consisting of Desal Brine and a moderate secondary effluent flow, was not previously modeled.

The $D_m$ values reported in Table 1 were used to assess the Ocean Plan compliance for MPWSP Scenarios 1 and 2 using the same methodology and water quality assumptions previously described (Trussell, 2015b). The estimated concentrations at the edge of the ZID for constituents that are expected to exceed the Ocean Plan objective are provided in Table 2. A new exceedance was identified in MPWSP Scenario 2, where the ammonia concentration at the edge of the ZID was predicted to exceed the 6-month median Ocean Plan objective. A list of estimated concentrations for these two scenarios for all Ocean Plan constituents is provided in Appendix B (Table A1).

**Table 2 - Predicted concentration at the edge of the ZID expressed for constituents of interest in the MPWSP as both a concentration and percentage of Ocean Plan Objective [a]**

| Constituent | Units | Ocean Plan Objective | MPWSP Ocean Discharge Scenario | | | |
|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | Estimated Percentage of Ocean Plan objective at Edge of ZID | |
| | | | 1 | 2 | 1 | 2 |
| Ammonia (as N) – 6-mo median | ug/L | 600 | 19 | 626 | 3% | 104% |
| PCBs | ug/L | 1.9E-05 | 1.2E-04 | 6.7E-05 | 609% | 351% |

[a] Red shading indicates constituent is expected to exceed the ocean plan objective for that discharge scenario.

## 2.2 Updated Results for the Variant Project

The following discharge scenarios related to the Variant Project were modeled using 130 open ports for the MRWPCA ocean outfall:

1. **Desal Brine without secondary effluent or GWR Concentrate (*updated scenario*):** Desal Brine discharged without secondary effluent or GWR Concentrate. This scenario would be representative of conditions when the smaller (6.4 mgd) desalination facility is in operation, but the AWT Facility is not operating (*e.g.*, offline for maintenance), and all of the secondary effluent is recycled through the SVRP (*e.g.*, during high irrigation water demand summer months). The hauled waste is also included in this discharge scenario.
2. **Desal Brine with moderate secondary effluent flow and no GWR concentrate (*new scenario*):** Desal Brine discharged with a relatively moderate secondary effluent flow, but no GWR Concentrate, which results in a plume with slightly negative buoyancy. This

scenario represents times when demand for recycled water is low or the secondary effluent flow is low, and there is excess secondary effluent that is discharged to the ocean. The hauled waste is also included in this discharge scenario.

3. **Desal Brine with GWR Concentrate and no secondary effluent (*updated scenario*):** Desal Brine discharged with GWR Concentrate and no secondary effluent. This scenario would be representative of the condition where both the desalination facility and the AWT Facility are in operation, and there is the highest demand for recycled water through the SVRP (*e.g.*, during summer months). The hauled waste is also included in this discharge scenario.
4. **Desal Brine with GWR Concentrate and a moderate secondary effluent flow (*new scenario*):** Desal Brine discharged with GWR Concentrate and a relatively moderate secondary effluent flow that results in a plume with slightly negative buoyancy. This scenario represents times when both the desalination facility and the AWT Facility are operating, but demand for recycled water is low and there is excess secondary effluent discharged to the ocean. The hauled waste is also included in this discharge scenario.

- **Variant conditions with no Desal Brine contribution**: All scenarios described for the GWR Project are also applicable to the Variant Project. See Section 2.3 for these additional scenarios.

The updated $D_m$ values for these two discharge scenarios are provided in Table 3. Similar to the MPWSP modeling, the net impact of using 130 open ports, including the hauled waste, and using a GWR concentrate flow of 0.94 mgd (instead of 0.73 mgd) was a slight increase (approximately 6%) in the amount of dilution associated with the ocean mixing for the Variant Project discharge scenarios. This confirms that previously modeled Variant discharge scenarios with Desal Brine included in Trussell 2015b were conservative (*i.e.* the previous analysis slightly over-estimated the ZID concentration for the Ocean Plan constituents).

**Table 3 – Updated minimum probable dilution ($D_m$) values for select MPWSP discharge scenarios**

| No. | Discharge Scenario (Ocean Condition) | Discharge flows (mgd) | | | | Previously Reported $D_m$ (120 ports)[a] | Updated $D_m$ (130 ports) |
|---|---|---|---|---|---|---|---|
| | | Secondary effluent | Hauled Waste | GWR Concentrate | Desal Brine | | |
| 1 | Desal Brine with no secondary effluent and no GWR Conc. (Upwelling) | 0 | 0.1 | 0 | 8.99 | 15 | 16 |
| 2 | Desal Brine with moderate secondary effluent flow and no GWR Conc. (Davidson) | 5.8 | 0.1 | 0 | 8.99 | n/a [b] | 22 |
| 3 | Desal Brine and GWR Conc. with no secondary effluent flow (Upwelling) | 0 | 0.1 | 0.94 | 8.99 | 17 | 18 |
| 4 | Desal Brine and GWR Conc. with moderate secondary effluent flow (Upwelling) | 5.3 | 0.1 | 0.94 | 8.99 | n/a [b] | 24 |

[a] The previously reported $D_m$ was used in the analysis presented in Trussell 2015b, and was performed with 120 open ports on the outfall, did not consider the hauled waste flow, and assumed a GWR Concentrate flow of 0.73 instead of 0.94 mgd.
[b] Not applicable, as Discharge Scenarios 2 and 4, with moderate secondary effluent flows, were not previously modeled.

The $D_m$ values reported in Table 3 were used to assess the Ocean Plan compliance for Variant Project Scenarios 1 through 4 using the same methodology and water quality assumptions previously described (Trussell, 2015b). The estimated concentrations at the edge of the ZID for constituents that are expected to exceed the Ocean Plan objective are provided in Table 4. For the updated scenarios (Variant Project Scenarios 1 and 3), the changes to the underlying modeling parameters increased the amount of dilution in the ocean mixing, thus the resulting ZID concentrations decreased slightly. For the new scenarios (Variant Project Scenarios 2 and 4), ammonia was identified as an exceedance in Variant Scenario 2 when there is no GWR Concentrate in the combined discharge. This had not been shown in the previous analysis. A list of estimated concentrations for these four scenarios for all Ocean Plan constituents is provided in Appendix B (Table A2).

**Table 4 - Predicted concentration at the edge of the ZID expressed for constituents of interest in the MPWSP as both a concentration and percentage of Ocean Plan Objective [a]**

| Constituent | Units | Ocean Plan Objective | Variant Project Ocean Discharge Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | | | Estimated Percentage of Ocean Plan objective at Edge of ZID | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| *Objectives for protection of marine aquatic life* | | | | | | | | | | |
| Copper | ug/L | 3 | 2.1 | 2.4 | 2.7 | 2.7 | 70% | 81% | 91% | 90% |
| Ammonia (as N) – 6-mo median | ug/L | 600 | 29 | 629 | 968 | 985 | 4.8% | 105% | 161% | 164% |
| *Objectives for protection of human health - carcinogens* | | | | | | | | | | |
| Chlordane | ug/L | 2.3E-05 | 1.2E-05 | 1.8E-05 | 2.9E-05 | 2.4E-05 | 52% | 77% | 125% | 106% |
| DDT | ug/L | 1.7E-04 | 4.6E-05 | 3.9E-05 | 2.1E-04 | 1.2E-04 | 27% | 23% | 122% | 70% |
| PCBs | ug/L | 1.9E-05 | 1.2E-04 | 6.7E-05 | 1.2E-04 | 6.7E-05 | 643% | 351% | 614% | 355% |
| TCDD Equivalents | ug/L | 3.9E-09 | 1.0E-10 | 2.7E-09 | 4.1E-09 | 4.2E-09 | 2.6% | 68% | 104% | 107% |
| Toxaphene | ug/L | 2.1E-04 | 8.0E-05 | 1.6E-04 | 2.5E-04 | 2.2E-04 | 38% | 74% | 119% | 106% |

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the Ocean Plan objective for that discharge scenario.

## 2.3 Updated Results for the GWR Project

The proposed Variant Project is inclusive of the proposed GWR Project, such that the analysis in this section is also part of the Variant Project. The following discharge scenarios related to the GWR Project were modeled using 130 open ports for the MRWPCA ocean outfall:

1. **Maximum Flow under Current Port Configuration (*updated scenario*):** the maximum flow that can be discharged with the current port configuration (130 of the 172 ports open). The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario. This scenario was chosen because it represents the maximum secondary effluent flow under existing diffuser conditions.
2. **Minimum Secondary effluent Flow - Oceanic/Upwelling (*updated scenario*):** the maximum influence of the GWR Concentrate on the ocean discharge under Oceanic and Upwelling ocean conditions (*i.e.*, no secondary effluent discharged). The Oceanic ocean condition was used as it represents less dilution for this flow scenario compared to the Upwelling condition.

3. **Minimum Secondary effluent Flow – Davidson (*updated scenario*):** the maximum influence of the GWR Concentrate on the ocean discharge under Davidson ocean condition (*i.e.*, the minimum secondary effluent flow). Observed historic secondary effluent flows generally exceed 0.4 mgd during Davidson oceanic conditions. Additional source waters would be brought into the RTP if necessary to maintain the 0.4 mgd minimum.
4. **Low Secondary effluent Flow (*updated scenario*):** conditions with a relatively low secondary effluent flow of 3 mgd when the GWR Concentrate has a greater influence on the water quality than in Scenarios 1, but where the $D_m$ is reduced due to the higher overall discharge flow (*i.e.*, compared to Scenarios 2 and 3). The Davidson ocean condition was used as it represents the worst-case dilution for this flow scenario.
5. **Moderate Secondary effluent Flow (*new scenario*):** conditions with a relatively moderate secondary effluent flow of 8 mgd when the GWR Concentrate has a greater influence on the water quality than in Scenario 1, but where the ocean dilution is reduced due to the higher overall discharge flow (*i.e.*, compared to Scenarios 2 through 4). The Davidson ocean condition was used as it represents the worst-case dilution for this flow scenario.

The updated $D_m$ values for these five discharge scenarios are provided in Table 5. Similar to the modeling for the MPWSP and Variant Project, the impact of using 130 open ports was a slight increase (approximately 4%) in the amount of dilution associated with the ocean mixing for the GWR Project discharge scenarios. This confirms that previously modeled GWR Project discharge scenarios included in Trussell 2015a were conservative (*i.e.* the previous analysis slightly over-estimated the ZID concentration for the Ocean Plan constituents).

**Table 5 – Updated minimum probable dilution ($D_m$) values for select MPWSP discharge scenarios**

| No. | Discharge Scenario (Ocean Condition) | Discharge flows (mgd) | | | Previously Reported $D_m$ (120 ports)[a] | Updated $D_m$ (130 ports) |
|---|---|---|---|---|---|---|
| | | Secondary effluent | Hauled Waste | GWR Concentrate | | |
| 1 | Maximum flow with GWR Concentrate with current port configuration (Oceanic) | 23.7 | 0.1 | 0.94 | 137 | 142 |
| 2 | GWR Concentrate with no secondary effluent (Oceanic) | 0 | 0.1 | 0.94 | 523 | 540 |
| 3 | GWR Concentrate with minimum secondary effluent flow (Davidson) | 0.4 | 0.1 | 0.94 | 285 | 295 |
| 4 | GWR Concentrate with low secondary effluent flow (Davidson) | 3 | 0.1 | 0.94 | 201 | 208 |
| 5 | GWR Concentrate with moderate secondary effluent flow (Davidson) | 8 | 0.1 | 0.94 | n/a [b] | 228 |

[a] The previously reported $D_m$ was used in the analysis presented in Trussell 2015a, and was performed with 120 open ports on the outfall.
[b] Not applicable, as Discharge Scenarios 5, with 8 mgd of secondary effluent flow, was not previously modeled.

The $D_m$ values reported in Table 5 were used to assess Ocean Plan compliance for GWR Project Scenarios 1 through 5 using the same methodology and water quality assumptions previously described (Trussell, 2015a). For the updated scenarios (GWR Project Scenarios 1 through 4), the changes to the underlying modeling parameters increased the amount of dilution from ocean mixing. Thus, as previously shown, none of the GWR Project scenarios resulted in an estimated exceedance of the Ocean Plan objectives. For the new scenario (GWR Project Scenario 5), it was estimated that none of the Ocean Plan objectives would be exceeded. Tables with the estimated Ocean Plan constituent concentrations at the edge of the ZID for the GWR Project discharge Scenarios 1 through 5 are provided in Appendix B as concentrations (Table A3) and as a percentage of the Ocean Plan objective (Table A4).

# 3 Conclusions

Additional modeling of the ocean discharges of various scenarios for the MPWSP, Variant Project, and GWR project were performed, including updating previous modeling to reflect changes in the baseline assumptions and key discharge scenarios that were absent from the previous analyses. Two primary conclusions can be drawn from these efforts: (1) all conclusions from the previously modeled discharge conditions remain the same, and (2) ammonia was identified as a potential exceedance for both the MPWSP and the Variant Project when the Desal Brine is discharged with a moderate flow of secondary effluent.

For the updated scenarios, three changes were made with respect to modeling of the ocean discharge: (1) there are currently 130 open discharge ports, which is more than the 120 ports used in the previous analysis; (2) for the MPWSP and Variant Project scenarios, the hauled waste flow was added; and (3) for the Variant Project scenarios, a GWR Concentrate flow 0.94 mgd was used instead of 0.73 mgd. In all cases, the impact of making these changes to the ocean mixing was minor and resulted in slightly greater dilution of the ocean discharges and thus slightly lower concentrations of constituents at the edge of the ZID. These changes were minimal and do not alter the previous conclusions.

Results from the newly modeled scenarios have implications with respect to Ocean Plan compliance. Previously, two types of exceedance were identified: (1) exceedance of PCBs for discharges with a high fraction of Desal Brine flow, and (2) exceedance of several parameters (ammonia, chlordane, DDT, PCBs, TCDD equivalents, and toxaphene) when discharging Desal Brine and GWR Concentrate with little or no secondary effluent. In this most recent analysis, a third type of exceedance was identified—when the discharge contains both the Desal Brine and a moderate secondary effluent flow there may be an exceedance of the Ocean Plan 6-month median objective for ammonia. This type of exceedance was shown for both the MPWSP (Scenario 2) and the Variant Projects (Scenarios 2 and 4) and is a result of the combination of having high ammonia in the treated wastewater with the high salinity (i.e., higher density) of the Desal Brine.

As previously shown, ammonia is not an issue when discharging secondary effluent and GWR Concentrate without Desal Brine, or when the dense Desal Brine[2] is discharged with sufficient secondary effluent, such that the combined discharge results in a rising plume with relatively

[2] Compared to the ambient seawater (33,000 to 34,000 mg/L of TDS), the Desal Brine is denser (~57,500 mg/L of TDS) and when discharged on its own would sink, whereas the secondary effluent (~1,000 mg/L of TDS) and GWR Concentrate (~5,000 mg/L) are relatively light and would rise when discharged. In the combined discharge, the secondary effluent and GWR Concentrate would dilute the salinity of the desalination brine and thus reduce the density. With sufficient dilution, the combined discharge would be less dense than the ambient ocean water, resulting in a rising plume with more dilution in the ZID.

high ocean mixing in the ZID. This potential Ocean Plan exceedance emerges when there is *not* sufficient secondary effluent to dilute the Desal Brine, and thus the combined discharge is denser than the ambient seawater. This negatively buoyant discharge sinks, resulting in relatively low mixing in the ZID. Similarly, as previously shown, ammonia is not an issue when the Desal Brine is discharged with a low secondary effluent flow, where even though there is relatively low ocean mixing in the ZID, the ammonia concentration in the discharge is less because the secondary effluent is a smaller fraction of the overall combined discharge. The worst-case scenario occurs near the point where the Desal Brine is discharged with the highest flow of secondary effluent that still results in a sinking plume. This secondary effluent flow ends up being a moderate flow: approximately 9 mgd when combined with the Desal Brine from the MPWSP or 5.3 mgd of Desal Brine in the case of the Variant Project.

It should be noted that ammonia was already identified as a potential exceedance (along with several other constituents) when the Desal Brine is discharged with the GWR Concentrate with little or no secondary effluent; however, as illustrated by the Variant Scenario 4, these exceedances also apply when there is a moderate flow of secondary effluent (approximately 5.3 mgd).

# 4 References

FlowScience, 2015. "Results of dilution analysis FSI 144082". *Transmittal from Gang Zhao*. April 17, 2015 (see Appendix A)

State Water Resources Control Board, California Environmental Protection Agency (SWRCB), 2012. *California Ocean Plan: Water Quality Control Plan, Ocean Waters of California*.

Trussell Technologies, Inc (Trussell Tech), 2015a. "Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project." *Technical Memorandum prepared for MRWPCA and MPWMD*. Feb.

Trussell Technologies, Inc (Trussell Tech), 2015b. "Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant." *Technical Memorandum prepared for MRWPCA*. March.

# Appendix A – Updated Ocean Discharge Modeling Results

FlowScience, 2015. "Results of dilution analysis FSI 144082". *Transmittal from Gang Zhao*. April 17, 2015

**Flow Science Incorporated**
48 S. Chester Avenue, Suite 200, Pasadena, CA 91106
**(626) 304-1134 FAX (626) 304-9427**

Transmittal Letter

| | | | |
|---|---|---|---|
| To: | Gordon Williams Ph.D., PE.<br>Trussell Technologies Inc. | Subject: | Results of dilution analysis<br>FSI 144082 |
| From: | Gang Zhao Ph.D., PE.<br>Flow Science Inc. | Date: | April 17, 2015 |

Dear Dr. Williams,

Please find attached the Excel® spreadsheet containing results of the latest round of dilution analyses for effluent discharged through the Monterey Regional Water Pollution Control Agency's ocean outfall. The method used in the Visual Plumes (VP) model is capable of handling slightly negatively buoyant conditions and produces reasonable results. In addition, the VP model results are conservative for the slightly negatively buoyant scenarios in that the VP predicted dilution ratios are lower than those obtained from the semi-empirical method. Therefore, the semi-empirical method was not used for all slightly negatively buoyant scenarios.

Please feel free to contact me if you have any questions.

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**MPWSP, Variant Project, and GWR Project Discharge Scenarios Update**

From: Flow Science Inc. (FSI 144082)

| Scenario Description | | Flow (mgd) | | | | | Combined TDS (mg/L) | Combined Temp (°C) | Ocean Condition | | | Number of Open Discharge Ports | VP | | | Semi-EMP | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | RTP Secondary Effluent | Hauled Waste | GWR Concentrate | Desal Brine | Total Discharge Flow (MGD) | | | Davidson | Upwelling | Oceanic | | Plume diam. (inch) | Min. Dilution | Horiz. Distance from port (ft) | Plume diam. (inch) | Min. Dilution | Horiz. Distance from port (ft) |
| ***MPWSP Scenarios (Large desal)*** | | | | | | | | | | | | | | | | | | |
| **M.1** | Desal Brine with no WW flow | 0 | 0.1 | | 13.98 | **14.08** | 58,101 | 11.7 | | X | | 130 | | | | 37 | 17 | 12 |
| **M.2** | Desal Brine with Moderate WW flow | 9 | 0.1 | | 13.98 | **23.08** | 35,254 | 14.9 | X | | | 130 | 84 | 22 | 17 | | | |
| **M.3** | Desal Brine with Moderate WW flow | 9.5 | 0.1 | | 13.98 | **23.58** | 34,523 | 15.0 | X | | | 130 | 90 | 23 | 18 | 84 | 34 | 9 |
| **M.4** | Desal Brine with Moderate WW flow | 10 | 0.1 | | 13.98 | **24.08** | 33,823 | 15.1 | X | | | 130 | 100 | 25 | 20 | | | |
| **M.5** | Desal Brine with Moderate WW flow | 12 | 0.1 | | 13.98 | **26.08** | 31,290 | 15.5 | X | | | 130 | 192 | 54 | 41 | | | |
| ***MPWSP Variant Scenarios (Small desal + AWT Facility RO Conc.)*** | | | | | | | | | | | | | | | | | | |
| **Var.1** | Desal Brine with no WW and no GWR flow | 0 | 0.1 | 0 | 8.99 | **9.09** | 58,029 | 10.0 | | X | | 130 | | | | 32 | 16 | 10 |
| **Var.2** | Desal Brine with Moderate WW flow | 5.8 | 0.1 | 0 | 8.99 | **14.89** | 35,353 | 14.9 | X | | | 130 | 79 | 22 | 16 | | | |
| **Var.3** | Desal Brine with Moderate WW flow | 6.2 | 0.1 | 0 | 8.99 | **15.29** | 34,457 | 15.1 | X | | | 130 | 89 | 25 | 18 | 82 | 37 | 9 |
| **Var.4** | Desal Brine with Moderate WW flow | 6.7 | 0.1 | 0 | 8.99 | **15.79** | 33,401 | 15.2 | X | | | 130 | 172 | 51 | 36 | | | |
| **Var.5** | Desal Brine and GWR Conc. with no WW flow | 0 | 0.1 | 0.94 | 8.99 | **10.03** | 53,135 | 10.9 | | X | | 130 | | | | 35 | 18 | 11 |
| **Var.6** | Desal Brine and GWR Conc. with moderate WW flow | 5.3 | 0.1 | 0.94 | 8.99 | **15.33** | 35,145 | 14.1 | | X | | 130 | 86 | 24 | 18 | | | |
| **Var.7** | Desal Brine and GWR Conc. with moderate WW flow | 5.6 | 0.1 | 0.94 | 8.99 | **15.63** | 34,491 | 14.2 | | X | | 130 | 99 | 28 | 20 | | | |
| **Var.8** | Desal Brine and GWR Conc. with moderate WW flow | 9 | 0.1 | 0.94 | 8.99 | **19.03** | 28,133 | 16.0 | X | | | 130 | 161 | 56 | 33 | | | |
| ***Variant (when no Brine and GWR Only)*** | | | | | | | | | | | | | | | | | | |
| **GWR.1** | Minimum wastewater flow (Oceanic/Upwelling) | 0 | 0.1 | 0.94 | | **1.04** | 9,088 | 20.0 | | | X | 130 | 124 | 540 | 6 | | | |
| **GWR.2** | Minimum wastewater flow (Davidson) | 0.4 | 0.1 | 0.94 | | **1.44** | 6,869 | 20.0 | X | | | 130 | 128 | 295 | 6 | | | |
| **GWR.3** | Minimum wastewater flow (Oceanic) | 0.4 | 0.1 | 0.94 | | **1.44** | 6,869 | 20.0 | | | X | 130 | 126 | 454 | 6 | | | |
| **GWR.4** | Low wastewater flow | 3 | 0.1 | 0.94 | | **4.04** | 3,156 | 20.0 | X | | | 130 | 136 | 208 | 10 | | | |
| **GWR.5** | Moderate Wastewater flow | 8 | 0.1 | 0.94 | | **9.04** | 2,019 | 20.0 | X | | | 130 | 208 | 228 | 17 | | | |
| **GWR.6** | Max flow under current port configuration | 23.7 | 0.1 | 0.94 | | **24.74** | 1,436 | 20.0 | | | X | 130 | 200 | 142 | 26 | | | |

# Appendix B – Estimated Concentrations of All Ocean Plan Constituents

**Table A1 – MPWSP complete list of Ocean Plan constituents at the edge of the ZID as estimated concentration and as a percentage of the Ocean Plan objective [a]**

| Constituent | Units | Ocean Plan Objective | MPWSP Ocean Discharge Scenario | | | |
|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | Estimated Percentage of Ocean Plan objective at Edge of ZID | |
| | | | 1 | 2 | 1 | 2 |
| *Objectives for protection of marine aquatic life* | | | | | | |
| Arsenic | ug/L | 8 | 4.9 | 4.6 | 62% | 58% |
| Cadmium | ug/L | 1 | 0.44 | 0.23 | 44% | 23% |
| Chromium (Hexavalent) | ug/L | 2 | 0.051 | 0.058 | 2.6% | 2.9% |
| Copper | ug/L | 3 | 2.1 | 2.2 | 69% | 72% |
| Lead | ug/L | 2 | 0.35 | 0.18 | 18% | 8.8% |
| Mercury | ug/L | 0.04 | 0.021 | 0.013 | 53% | 33% |
| Nickel | ug/L | 5 | 0.48 | 0.32 | 10% | 6.3% |
| Selenium | ug/L | 15 | 3.1 | 1.5 | 20% | 10% |
| Silver | ug/L | 0.7 | 0.15 | 0.16 | 22% | 23% |
| Zinc | ug/L | 20 | 9.5 | 8.9 | 47% | 45% |
| Cyanide | ug/L | 1 | 0.49 | 0.36 | 49% | 36% |
| Total Chlorine Residual [d] | ug/L | 2 | -- | -- | – | – |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 19 | 626 | 3.2% | 104% |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 24 | 842 | 1.0% | 35% |
| Acute Toxicity [b] | TUa | 0.3 | | | | |
| Chronic Toxicity [b] | TUc | 1 | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 0.027 | 1.2 | 0.09% | 3.9% |
| Chlorinated Phenolics | ug/L | 1 | <0.0079 | <0.34 | <0.8% | <34% |
| Endosulfan | ug/L | 0.009 | 9.6E-06 | 2.6E-04 | 0.1% | 2.9% |
| Endrin | ug/L | 0.002 | 1.6E-06 | 2.1E-06 | 0.08% | 0.1% |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 5.1E-05 | 6.0E-04 | 1.3% | 15% |
| Radioactivity (Gross Beta) [b] | pci/L | – | | | | |
| Radioactivity (Gross Alpha) [b] | pci/L | – | | | | |
| *Objectives for protection of human health – non carcinogens* | | | | | | |
| Acrolein | ug/L | 220 | <0.0020 | <0.086 | <0.01% | <0.04% |
| Antimony | ug/L | 1200 | 0.91 | 0.45 | 0.08% | 0.04% |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <2.0E-04 | <0.0086 | <0.01% | <0.2% |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| Chlorobenzene | ug/L | 570 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| Chromium (III) | ug/L | 190000 | 5.9 | 2.9 | <0.01% | <0.01% |
| Di-n-butyl phthalate | ug/L | 3500 | <0.0020 | <0.086 | <0.01% | <0.01% |
| Dichlorobenzenes | ug/L | 5100 | 6.3E-04 | 0.027 | <0.01% | <0.01% |
| Diethyl phthalate | ug/L | 33000 | <0.0020 | <0.086 | <0.01% | <0.01% |
| Dimethyl phthalate | ug/L | 820000 | <7.9E-04 | <0.034 | <0.01% | <0.01% |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| 2,4-Dinitrophenol | ug/L | 4.0 | <2.0E-04 | <0.0086 | <0.01% | <0.2% |
| Ethylbenzene | ug/L | 4100 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| Fluoranthene | ug/L | 15 | 1.0E-04 | 4.9E-05 | <0.01% | 0.00% |
| Hexachlorocyclopentadiene | ug/L | 58 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| Nitrobenzene | ug/L | 4.9 | <2.0E-04 | <0.0086 | <0.01% | <0.2% |
| Thallium | ug/L | 2 | <0.094 | <0.053 | <4.7% | <2.7% |
| Toluene | ug/L | 85000 | <0.050 | <0.032 | <0.01% | <0.0% |
| Tributyltin | ug/L | 0.0014 | <2.0E-05 | <8.6E-04 | <1.4% | <61% |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.050 | <0.032 | <0.01% | <0.01% |
| *Objectives for protection of human health - carcinogens* | | | | | | |
| Acrylonitrile | ug/L | 0.10 | <7.9E-04 | <0.034 | <0.8% | <34% |

| Constituent | Units | Ocean Plan Objective | MPWSP Ocean Discharge Scenario | | | |
|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | Estimated Percentage of Ocean Plan objective at Edge of ZID | |
| | | | 1 | 2 | 1 | 2 |
| Aldrin [c] | ug/L | 0.000022 | <2.0E-05 | <8.6E-04 | – | – |
| Benzene | ug/L | 5.9 | <0.050 | <0.032 | <0.8% | <0.5% |
| Benzidine [c] | ug/L | 0.000069 | <2.0E-04 | <0.0086 | – | – |
| Beryllium | ug/L | 0.033 | 2.1E-06 | 0.0085 | <0.01% | 26% |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <2.0E-04 | <0.0086 | <0.4% | <19% |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 0.086 | 1.4 | 2.5% | 39% |
| Carbon tetrachloride | ug/L | 0.90 | <0.028 | <0.022 | <3.1% | <2.4% |
| Chlordane | ug/L | 0.000023 | 1.1E-05 | 1.8E-05 | 48% | 77% |
| Chlorodibromomethane | ug/L | 8.6 | <2.0E-04 | <0.0086 | <0.01% | <0.10% |
| Chloroform | ug/L | 130 | 7.9E-04 | 0.034 | <0.01% | 0.03% |
| DDT | ug/L | 0.00017 | 3.1E-05 | 3.3E-05 | 18% | 20% |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.050 | 0.051 | 0.3% | 0.3% |
| 3,3-Dichlorobenzidine | ug/L | 0.0081 | <9.9E-06 | <4.3E-04 | <0.1% | <5.3% |
| 1,2-Dichloroethane | ug/L | 28 | <0.050 | <0.032 | <0.2% | <0.1% |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.050 | 0.032 | 5.5% | 3.6% |
| Dichlorobromomethane | ug/L | 6.2 | <2.0E-04 | <0.0086 | <0.01% | <0.1% |
| Dichloromethane | ug/L | 450 | 0.050 | 0.033 | 0.01% | <0.01% |
| 1,3-dichloropropene | ug/L | 8.9 | <0.050 | <0.032 | <0.6% | <0.4% |
| Dieldrin | ug/L | 0.00004 | 5.0E-06 | 1.1E-05 | 13% | 27% |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <7.9E-04 | <0.034 | <0.03% | <1.3% |
| 1,2-Diphenylhydrazine (azobenzene) | ug/L | 0.16 | <2.0E-04 | <0.0086 | <0.1% | <5.4% |
| Halomethanes | ug/L | 130 | 2.9E-04 | 0.0093 | <0.01% | <0.01% |
| Heptachlor | ug/L | 0.00005 | 4.8E-07 | 2.3E-07 | 1.0% | 0.5% |
| Heptachlor Epoxide | ug/L | 0.00002 | 2.3E-08 | 1.0E-06 | 0.1% | 5.1% |
| Hexachlorobenzene | ug/L | 0.00021 | 3.1E-08 | 1.3E-06 | 0.01% | 0.6% |
| Hexachlorobutadiene | ug/L | 14 | 3.6E-09 | 1.5E-07 | <0.01% | <0.01% |
| Hexachloroethane | ug/L | 2.5 | <2.0E-04 | <0.0086 | <0.01% | <0.3% |
| Isophorone | ug/L | 730 | <2.0E-04 | <0.0086 | <0.01% | <0.01% |
| N-Nitrosodimethylamine | ug/L | 7.3 | 1.7E-04 | 3.7E-04 | <0.01% | <0.01% |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 2.0E-04 | 0.0014 | 0.05% | 0.4% |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <2.0E-04 | <0.0086 | <0.01% | <0.3% |
| PAHs | ug/L | 0.0088 | 6.8E-04 | 0.0012 | 7.7% | 14% |
| PCBs | ug/L | 0.000019 | 1.2E-04 | 6.7E-05 | 609% | 351% |
| TCDD Equivalents | ug/L | 3.9E-09 | 6.0E-11 | 2.6E-09 | 1.5% | 67% |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.050 | <0.032 | <2.2% | <1.4% |
| Tetrachloroethylene | ug/L | 2.0 | <0.050 | <0.032 | <2.5% | <1.6% |
| Toxaphene | ug/L | 2.1E-04 | 7.5E-05 | 1.6E-04 | 35% | 74% |
| Trichloroethylene | ug/L | 27 | <0.050 | <0.032 | <0.2% | <0.1% |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.050 | <0.032 | <0.5% | <0.3% |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <2.0E-04 | <0.0086 | <0.07% | <3.0% |
| Vinyl chloride | ug/L | 36 | <0.028 | <0.022 | <0.08% | <0.06% |

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%). Also, shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of the constituent. These constituents were measured for the secondary effluent and those concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.

**Table A2 – Variant Project list of predicted concentrations of Ocean Plan constituents at the edge of the ZID as a concentration and as a percentage of the Ocean Plan objective [a]**

| Constituent | Units | Ocean Plan Objective | Variant Project Ocean Discharge Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | | | Estimated Percentage of Ocean Plan objective at Edge of ZID | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| *Objectives for protection of marine aquatic life* | | | | | | | | | | |
| Arsenic | ug/L | 8 | 5.1 | 4.6 | 4.7 | 4.4 | 63% | 58% | 59% | 55% |
| Cadmium | ug/L | 1 | 0.46 | 0.23 | 0.41 | 0.22 | 46% | 23% | 41% | 22% |
| Chromium (Hexavalent) | ug/L | 2 | 0.084 | 0.083 | 0.14 | 0.11 | 4.2% | 4.2% | 6.9% | 5.3% |
| Copper | ug/L | 3 | 2.1 | 2.4 | 2.7 | 2.7 | 70% | 81% | 91% | 90% |
| Lead | ug/L | 2 | 0.37 | 0.18 | 0.32 | 0.17 | 19% | 9.1% | 16% | 8.6% |
| Mercury | ug/L | 0.04 | 0.022 | 0.014 | 0.021 | 0.014 | 56% | 35% | 54% | 36% |
| Nickel | ug/L | 5 | 0.51 | 0.45 | 0.75 | 0.56 | 10% | 9.0% | 15% | 11% |
| Selenium | ug/L | 15 | 3.3 | 1.6 | 2.8 | 1.5 | 22% | 10.5% | 19% | 10% |
| Silver | ug/L | 0.7 | 0.16 | 0.18 | 0.16 | 0.18 | 22% | 26% | 22% | 25% |
| Zinc | ug/L | 20 | 9.6 | 9.4 | 10.5 | 9.8 | 48% | 47% | 53% | 49% |
| Cyanide | ug/L | 1 | 0.53 | 0.36 | 0.62 | 0.41 | 53% | 36% | 62% | 41% |
| Total Chlorine Residual [d] | ug/L | 2 | -- | -- | -- | -- | -- | -- | – | – |
| Ammonia (as N); 6-mo median | ug/L | 600 | 29 | 629 | 968 | 985 | 4.8% | 105% | 161% | 164% |
| Ammonia (as N); Daily Max | ug/L | 2,400 | 37 | 846 | 1302 | 1325 | 1.5% | 35% | 54% | 55% |
| Acute Toxicity [b] | TUa | 0.3 | | | | | | | | |
| Chronic Toxicity [b] | TUc | 1 | | | | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 0.045 | 1.2 | 1.8 | 1.9 | 0.1% | 4.0% | 6.1% | 6.2% |
| Chlorinated Phenolics | ug/L | 1 | <0.013 | <0.34 | <0.11 | <0.33 | <1.3% | <34% | <11% | <33% |
| Endosulfan | ug/L | 0.009 | 3.5E-05 | 8.3E-04 | 0.0013 | 0.0013 | 0.4% | 9.2% | 14% | 14% |
| Endrin | ug/L | 0.002 | 1.7E-06 | 2.1E-06 | 3.4E-06 | 2.8E-06 | 0.08% | 0.10% | 0.2% | 0.1% |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 7.8E-05 | 0.0010 | 0.0016 | 0.0016 | 2.0% | 26% | 40% | 41% |
| Radioactivity (Gross Beta) [b] | pci/L | – | 5.1 | 4.6 | 4.7 | 4.4 | 63% | 58% | 59% | 55% |
| Radioactivity (Gross Alpha) [b] | pci/L | – | 0.46 | 0.23 | 0.41 | 0.22 | 46% | 23% | 41% | 22% |
| *Objectives for protection of human health – non carcinogens* | | | | | | | | | | |
| Acrolein | ug/L | 220 | 0.0058 | 0.16 | 0.24 | 0.24 | <0.01% | 0.07% | 0.1% | 0.1% |
| Antimony | ug/L | 1200 | 0.96 | 0.45 | 0.80 | 0.41 | 0.08% | 0.04% | 0.07% | 0.03% |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.0027 | <0.072 | <0.0071 | <0.062 | <0.06% | <1.64% | <0.2% | <1.40% |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.0027 | <0.072 | <0.0071 | <0.062 | <0.01% | <0.01% | <0.01% | <0.01% |
| Chlorobenzene | ug/L | 570 | <3.2E-04 | <0.0086 | <0.0027 | <0.0083 | <0.01% | <0.01% | <0.01% | <0.01% |
| Chromium (III) | ug/L | 190000 | 6.3 | 3.0 | 5.3 | 2.7 | <0.01% | <0.01% | <0.01% | <0.01% |
| Di-n-butyl phthalate | ug/L | 3500 | <0.0045 | <0.12 | <0.0086 | <0.10 | <0.01% | <0.01% | <0.01% | <0.01% |
| Dichlorobenzenes | ug/L | 5100 | 0.0010 | 0.028 | 0.042 | 0.043 | <0.01% | <0.01% | <0.01% | <0.01% |
| Diethyl phthalate | ug/L | 33000 | <0.0032 | <0.086 | <0.0076 | <0.073 | <0.01% | <0.01% | <0.01% | <0.01% |
| Dimethyl phthalate | ug/L | 820000 | <0.0013 | <0.034 | <0.0035 | <0.029 | <0.01% | <0.01% | <0.01% | <0.01% |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.013 | <0.34 | <0.035 | <0.29 | <0.01% | <0.2% | <0.02% | <0.1% |
| 2,4-Dinitrophenol | ug/L | 4.0 | <0.0084 | <0.22 | <0.031 | <0.20 | <0.2% | <5.6% | <0.8% | <4.9% |
| Ethylbenzene | ug/L | 4100 | <3.2E-04 | <0.0086 | <0.0027 | <0.0083 | <0.01% | <0.01% | <0.01% | <0.01% |
| Fluoranthene | ug/L | 15 | 1.1E-04 | 4.9E-05 | 5.8E-04 | 2.9E-04 | <0.01% | <0.01% | <0.01% | 0.05% |
| Hexachlorocyclopentadiene | ug/L | 58 | <3.2E-04 | <0.0086 | <5.1E-04 | <0.0072 | <0.01% | <0.01% | <0.01% | <0.01% |
| Nitrobenzene | ug/L | 4.9 | <0.0015 | <0.040 | <0.0061 | <0.035 | <0.03% | <0.8% | <0.1% | <0.7% |
| Thallium | ug/L | 2 | 0.10 | 0.057 | 0.10 | 0.059 | 5.0% | 2.8% | 4.9% | 2.9% |
| Toluene | ug/L | 85000 | <0.053 | <0.032 | <0.045 | <0.029 | <0.01% | <0.01% | <0.01% | <0.01% |
| Tributyltin | ug/L | 0.0014 | <3.2E-05 | <8.6E-04 | <1.2E-04 | <7.5E-04 | <2.3% | <62% | <8.9% | <54% |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.053 | <0.032 | <0.045 | <0.029 | <0.01% | <0.01% | <0.01% | <0.01% |
| *Objectives for protection of human health - carcinogens* | | | | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | 0.0016 | 0.044 | 0.067 | 0.069 | 1.6% | 44% | 67% | 69% |
| Aldrin [c] | ug/L | 0.000022 | <4.5E-06 | <1.2E-04 | <5.3E-05 | <1.2E-04 | <21% | – | – | – |
| Benzene | ug/L | 5.9 | <0.053 | <0.032 | <0.045 | <0.029 | <0.9% | <0.5% | <0.8% | <0.5% |
| Benzidine [c] | ug/L | 0.000069 | <0.013 | <0.34 | <0.011 | <0.28 | – | – | – | – |

| Constituent | Units | Ocean Plan Objective | Variant Project Ocean Discharge Scenario | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Estimated Concentration at Edge of ZID | | | | Estimated Percentage of Ocean Plan objective at Edge of ZID | | | |
| | | | 1 | 2 | 3 | 4 | 1 | 2 | 3 | 4 |
| Beryllium | ug/L | 0.033 | 3.4E-06 | 1.5E-06 | 0.0025 | 0.0012 | 0.01% | <0.0% | 7.5% | 3.7% |
| Bis(2-chloroethyl)ether [c] | ug/L | 0.045 | <0.0027 | <0.072 | <0.0071 | <0.062 | <6.0% | – | <16% | – |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 0.11 | 1.4 | 2.1 | 2.1 | 3.1% | 39% | 60% | 61% |
| Carbon tetrachloride | ug/L | 0.90 | 0.029 | 0.022 | 0.037 | 0.025 | 3.3% | 2.4% | 4.1% | 2.8% |
| Chlordane | ug/L | 0.000023 | 1.2E-05 | 1.8E-05 | 2.9E-05 | 2.4E-05 | 52% | 77% | 125% | 106% |
| Chlorodibromomethane | ug/L | 8.6 | 0.0016 | 0.042 | 0.065 | 0.066 | 0.02% | 0.5% | 0.8% | 0.8% |
| Chloroform | ug/L | 130 | 0.025 | 0.67 | 1.0 | 1.0 | 0.02% | 0.5% | 0.8% | 0.8% |
| DDT | ug/L | 0.00017 | 4.6E-05 | 3.9E-05 | 2.1E-04 | 1.2E-04 | 27% | 23% | 122% | 70% |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.053 | 0.051 | 0.085 | 0.064 | 0.3% | 0.3% | 0.5% | 0.4% |
| 3,3-Dichlorobenzidine [c] | ug/L | 0.0081 | <0.012 | <0.33 | <0.020 | <0.27 | – | – | – | – |
| 1,2-Dichloroethane | ug/L | 28 | <0.053 | <0.032 | <0.045 | <0.029 | <0.2% | <0.1% | <0.2% | <0.1% |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.053 | 0.032 | 0.045 | 0.029 | 5.9% | 3.6% | 5.0% | 3.3% |
| Dichlorobromomethane | ug/L | 6.2 | 0.0017 | 0.045 | 0.069 | 0.071 | 0.03% | 0.7% | 1.1% | 1.1% |
| Dichloromethane | ug/L | 450 | 0.053 | 0.035 | 0.060 | 0.038 | 0.01% | <0.0% | 0.01% | <0.01% |
| 1,3-dichloropropene | ug/L | 8.9 | 0.053 | 0.033 | 0.057 | 0.036 | 0.6% | 0.4% | 0.6% | 0.4% |
| Dieldrin | ug/L | 0.00004 | 8.7E-06 | 1.2E-05 | 2.2E-05 | 1.8E-05 | 22% | 31% | 54% | 44% |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <0.0013 | <0.034 | <0.0015 | <0.028 | <0.05% | <1.3% | <0.06% | <1.1% |
| 1,2-Diphenylhydrazine | ug/L | 0.16 | <0.0027 | <0.072 | <0.0071 | <0.062 | <1.7% | <45% | <4.5% | <39% |
| Halomethanes | ug/L | 130 | 9.2E-04 | 0.025 | 0.038 | 0.038 | <0.01% | 0.02% | 0.03% | 0.03% |
| Heptachlor | ug/L | 0.00005 | 5.0E-07 | 2.3E-07 | 4.1E-07 | 2.0E-07 | 1.0% | 0.5% | 0.8% | 0.4% |
| Heptachlor Epoxide | ug/L | 0.00002 | 3.8E-08 | 1.0E-06 | 1.6E-06 | 1.6E-06 | 0.2% | 5.1% | 7.8% | 8.0% |
| Hexachlorobenzene | ug/L | 0.00021 | 5.0E-08 | 1.3E-06 | 2.1E-06 | 2.1E-06 | 0.02% | 0.6% | 1.0% | 1.0% |
| Hexachlorobutadiene | ug/L | 14 | 5.8E-09 | 1.6E-07 | 2.4E-07 | 2.4E-07 | <0.01% | <0.01% | <0.01% | <0.01% |
| Hexachloroethane | ug/L | 2.5 | <0.0015 | <0.040 | <0.0037 | <0.034 | <0.06% | <1.6% | <0.1% | <1.3% |
| Isophorone | ug/L | 730 | <3.2E-04 | <0.0086 | <0.0027 | <0.0083 | <0.01% | <0.01% | <0.01% | <0.01% |
| N-Nitrosodimethylamine | ug/L | 7.3 | 2.4E-04 | 0.0017 | 9.3E-04 | 0.0018 | <0.01% | 0.02% | 0.01% | 0.02% |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 2.2E-04 | 0.0014 | 2.8E-04 | 0.0012 | 0.06% | 0.4% | 0.07% | 0.3% |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.0015 | <0.040 | <0.0061 | <0.035 | <0.06% | <1.6% | <0.2% | <1.4% |
| PAHs | ug/L | 0.0088 | 7.3E-04 | 0.0012 | 0.0020 | 0.0017 | 8.3% | 14% | 22% | 19% |
| PCBs | ug/L | 0.000019 | 1.2E-04 | 6.7E-05 | 1.2E-04 | 6.7E-05 | 643% | 351% | 614% | 355% |
| TCDD Equivalents | ug/L | 3.9E-09 | 1.0E-10 | 2.7E-09 | 4.1E-09 | 4.2E-09 | 2.6% | 68% | 104% | 107% |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.053 | <0.032 | <0.045 | <0.029 | <2.3% | <1.4% | <2.0% | <1.3% |
| Tetrachloroethylene | ug/L | 2.0 | <0.053 | <0.032 | <0.045 | <0.029 | <2.6% | <1.6% | <2.3% | <1.5% |
| Toxaphene | ug/L | 2.1E-04 | 8.0E-05 | 1.6E-04 | 2.5E-04 | 2.2E-04 | 38% | 74% | 119% | 106% |
| Trichloroethylene | ug/L | 27 | <0.053 | <0.032 | <0.045 | <0.029 | <0.2% | <0.1% | <0.2% | <0.1% |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.053 | <0.032 | <0.045 | <0.029 | <0.6% | <0.3% | <0.5% | <0.3% |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <0.0015 | <0.040 | <0.0061 | <0.035 | <0.5% | <14% | <2.1% | <12% |
| Vinyl chloride | ug/L | 36 | <0.029 | <0.022 | <0.026 | <0.020 | <0.08% | <0.06% | <0.07% | <0.06% |

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%). Also, Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.

**Table A3 – GWR Project complete list of predicted concentrations of Ocean Plan constituents at the edge of the ZID for updated scenarios**

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| *Objectives for protection of marine aquatic life* | | | | | | | |
| Arsenic | ug/L | 8 | 3.3 | 3.0 | 3.1 | 3.2 | 3.2 |
| Cadmium | ug/L | 1 | 0.010 | 0.011 | 0.016 | 0.012 | 0.0077 |
| Chromium (Hexavalent) | ug/L | 2 | 0.025 | 0.046 | 0.064 | 0.040 | 0.023 |
| Copper | ug/L | 3 | 2.2 | 2.2 | 2.3 | 2.2 | 2.2 |
| Lead | ug/L | 2 | 0.0066 | 0.0073 | 0.010 | 0.0078 | 0.0051 |
| Mercury | ug/L | 0.04 | 0.0057 | 0.0059 | 0.0062 | 0.0059 | 0.0056 |
| Nickel | ug/L | 5 | 0.11 | 0.12 | 0.17 | 0.12 | 0.083 |
| Selenium | ug/L | 15 | 0.055 | 0.071 | 0.10 | 0.070 | 0.045 |
| Silver | ug/L | 0.7 | <0.17 | <0.16 | <0.16 | <0.17 | <0.17 |
| Zinc | ug/L | 20 | 8.3 | 8.4 | 8.6 | 8.4 | 8.3 |
| Cyanide | ug/L | 1 | 0.060 | 0.072 | 0.10 | 0.073 | 0.047 |
| Total Chlorine Residual [c] | ug/L | 2 | – | – | – | – | – |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 295 | 326 | 465 | 346 | 230 |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 398 | 439 | 626 | 466 | 309 |
| Acute Toxicity [a] | TUa | 0.3 | | | | | |
| Chronic Toxicity [a] | TUc | 1 | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 0.56 | 0.62 | 0.88 | 0.66 | 0.44 |
| Chlorinated Phenolics | ug/L | 1 | <0.14 | <0.037 | <0.068 | <0.10 | <0.087 |
| Endosulfan | ug/L | 0.009 | 3.9E-04 | 4.3E-04 | 6.1E-04 | 4.6E-04 | 3.0E-04 |
| Endrin | ug/L | 0.002 | 6.4E-07 | 7.1E-07 | 1.0E-06 | 7.5E-07 | 5.0E-07 |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 4.8E-04 | 5.4E-04 | 7.6E-04 | 5.7E-04 | 3.8E-04 |
| Radioactivity (Gross Beta) [a] | pci/L | – | | | | | |
| Radioactivity (Gross Alpha) [a] | pci/L | – | | | | | |
| *Objectives for protection of human health – non-carcinogens* | | | | | | | |
| Acrolein | ug/L | 220 | 0.073 | 0.081 | 0.12 | 0.086 | 0.057 |
| Antimony | ug/L | 1200 | 0.0064 | 0.0071 | 0.010 | 0.0075 | 0.0050 |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.028 | <0.0024 | <0.0071 | <0.017 | <0.017 |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.028 | <0.0024 | <0.0071 | <0.017 | <0.017 |
| Chlorobenzene | ug/L | 570 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Chromium (III) | ug/L | 190000 | 0.061 | 0.079 | 0.11 | 0.079 | 0.050 |
| Di-n-butyl phthalate | ug/L | 3500 | <0.047 | <0.0029 | <0.010 | <0.027 | <0.028 |
| Dichlorobenzenes | ug/L | 5100 | 0.013 | 0.014 | 0.020 | 0.015 | 0.010 |
| Diethyl phthalate | ug/L | 33000 | <0.034 | <0.0026 | <0.0081 | <0.019 | <0.020 |
| Dimethyl phthalate | ug/L | 820000 | <0.014 | <0.0012 | <0.0034 | <0.0079 | <0.0081 |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.14 | <0.012 | <0.034 | <0.079 | <0.081 |
| 2,4-Dinitrophenol | ug/L | 4.0 | <0.089 | <0.011 | <0.026 | <0.053 | <0.053 |
| Ethylbenzene | ug/L | 4100 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Fluoranthene | ug/L | 15 | <0.0034 | <2.6E-04 | <8.1E-04 | <0.002 | <0.002 |
| Hexachlorocyclopentadiene | ug/L | 58 | <0.0034 | <1.7E-04 | <7.0E-04 | <0.0019 | <0.0020 |
| Nitrobenzene | ug/L | 4.9 | <0.016 | <0.0021 | <0.0049 | <0.010 | <0.0095 |
| Thallium | ug/L | 2 | 0.0056 | 0.0062 | 0.0089 | 0.0066 | 0.0044 |
| Toluene | ug/L | 85000 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Tributyltin | ug/L | 0.0014 | <3.4E-04 | <4.2E-05 | <1.0E-04 | <2.1E-04 | <2.0E-04 |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| *Objectives for protection of human health - carcinogens* | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | 0.021 | 0.023 | 0.033 | 0.024 | 0.016 |
| Aldrin [b] | ug/L | 0.000022 | <5.0E-05 | <1.8E-05 | <3.0E-05 | <3.7E-05 | <3.2E-05 |
| Benzene | ug/L | 5.9 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Benzidine [b] | ug/L | 0.000069 | <0.13 | <0.0036 | <0.023 | <0.073 | <0.078 |
| Beryllium | ug/L | 0.033 | 0.0047 | 8.4E-04 | 0.0018 | 0.0030 | 0.0029 |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <0.028 | <0.0024 | <0.0071 | <0.017 | <0.017 |

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 0.63 | 0.70 | 1.0 | 0.74 | 0.49 |
| Carbon tetrachloride | ug/L | 0.90 | 0.0041 | 0.0045 | 0.0064 | 0.0048 | 0.0032 |
| Chlordane | ug/L | 0.000023 | 6.0E-06 | 6.6E-06 | 9.4E-06 | 7.0E-06 | 4.6E-06 |
| Chlorodibromomethane | ug/L | 8.6 | 0.020 | 0.022 | 0.031 | 0.023 | 0.015 |
| Chloroform | ug/L | 130 | 0.31 | 0.35 | 0.50 | 0.37 | 0.24 |
| DDT | ug/L | 0.00017 | 1.7E-05 | 6.2E-05 | 8.2E-05 | 4.5E-05 | 2.1E-05 |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.013 | 0.014 | 0.020 | 0.015 | 0.010 |
| 3,3-Dichlorobenzidine [b] | ug/L | 0.0081 | <0.13 | <0.0067 | <0.027 | <0.072 | <0.075 |
| 1,2-Dichloroethane | ug/L | 28 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.0035 | 9.2E-04 | 0.0017 | 0.0024 | 0.0022 |
| Dichlorobromomethane | ug/L | 6.2 | 0.021 | 0.023 | 0.033 | 0.025 | 0.017 |
| Dichloromethane | ug/L | 450 | 0.0052 | 0.0058 | 0.0082 | 0.0061 | 0.0041 |
| 1,3-dichloropropene | ug/L | 8.9 | 0.0046 | 0.0050 | 0.0072 | 0.0053 | 0.0035 |
| Dieldrin | ug/L | 0.00004 | 4.3E-06 | 5.9E-06 | 8.2E-06 | 5.7E-06 | 3.5E-06 |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <0.013 | <5.2E-04 | <0.0026 | <0.0074 | <0.0079 |
| 1,2-Diphenylhydrazine | ug/L | 0.16 | <0.028 | <0.0024 | <0.0071 | <0.017 | <0.017 |
| Halomethanes | ug/L | 130 | 0.012 | 0.013 | 0.018 | 0.014 | 0.0090 |
| Heptachlor [b] | ug/L | 0.00005 | <7.0E-05 | <1.8E-05 | <3.4E-05 | <4.8E-05 | <4.4E-05 |
| Heptachlor Epoxide | ug/L | 0.00002 | 4.8E-07 | 5.3E-07 | 7.5E-07 | 5.6E-07 | 3.7E-07 |
| Hexachlorobenzene | ug/L | 0.00021 | 6.3E-07 | 7.0E-07 | 1.0E-06 | 7.4E-07 | 4.9E-07 |
| Hexachlorobutadiene | ug/L | 14 | 7.3E-08 | 8.1E-08 | 1.2E-07 | 8.6E-08 | 5.7E-08 |
| Hexachloroethane | ug/L | 2.5 | <0.016 | <0.0012 | <0.0038 | <0.0090 | <0.0092 |
| Isophorone | ug/L | 730 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| N-Nitrosodimethylamine | ug/L | 7.3 | 6.9E-04 | 2.7E-04 | 4.4E-04 | 5.2E-04 | 4.5E-04 |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 5.2E-04 | 4.5E-05 | 1.3E-04 | 3.0E-04 | 3.1E-04 |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.016 | <0.0021 | <0.0049 | <0.010 | <0.0095 |
| PAHs | ug/L | 0.0088 | 4.3E-04 | 4.7E-04 | 6.8E-04 | 5.0E-04 | 3.3E-04 |
| PCBs | ug/L | 0.000019 | 5.5E-06 | 6.1E-06 | 8.7E-06 | 6.5E-06 | 4.3E-06 |
| TCDD Equivalents | ug/L | 3.9E-09 | 1.2E-09 | 1.4E-09 | 2.0E-09 | 1.5E-09 | 9.7E-10 |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Tetrachloroethylene | ug/L | 2.0 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| Toxaphene | ug/L | 2.1E-04 | 5.8E-05 | 6.4E-05 | 9.1E-05 | 6.7E-05 | 4.5E-05 |
| Trichloroethylene | ug/L | 27 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <0.016 | <0.0021 | <0.0049 | <0.010 | <0.0095 |
| Vinyl chloride | ug/L | 36 | <0.0035 | <9.2E-04 | <0.0017 | <0.0024 | <0.0022 |

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of these constituents. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[b] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[c] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.

**Table A4 – GWR Project complete list of predicted concentrations of Ocean Plan constituents at the edge of the ZID as a percentage of the Ocean Plan objective for updated scenarios [a]**

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| *Objectives for protection of marine aquatic life* | | | | | | | |
| Arsenic | ug/L | 8 | 41% | 38% | 38% | 40% | 40% |
| Cadmium | ug/L | 1 | 1.0% | 1.1% | 1.6% | 1.2% | 0.8% |
| Chromium (Hexavalent) | ug/L | 2 | 1.3% | 2.3% | 3.2% | 2.0% | 1.1% |
| Copper | ug/L | 3 | 73% | 74% | 78% | 75% | 72% |
| Lead | ug/L | 2 | 0.3% | 0.4% | 0.5% | 0.4% | 0.3% |
| Mercury | ug/L | 0.04 | 14% | 15% | 16% | 15% | 14% |
| Nickel | ug/L | 5 | 2.1% | 2.4% | 3.3% | 2.5% | 1.7% |
| Selenium | ug/L | 15 | 0.4% | 0.5% | 1% | 0.5% | 0.3% |
| Silver | ug/L | 0.7 | <24% | <23% | <23% | <24% | <24% |
| Zinc | ug/L | 20 | 42% | 42% | 43% | 42% | 41% |
| Cyanide | ug/L | 1 | 6.0% | 7.2% | 10% | 7.3% | 4.7% |
| Total Chlorine Residual [d] | ug/L | 2 | – | – | – | – | – |
| Ammonia (as N) - 6-mo median | ug/L | 600 | 49% | 54% | 78% | 58% | 38% |
| Ammonia (as N) - Daily Max | ug/L | 2,400 | 17% | 18% | 26% | 19% | 13% |
| Acute Toxicity [b] | TUa | 0.3 | | | | | |
| Chronic Toxicity [b] | TUc | 1 | | | | | |
| Phenolic Compounds (non-chlorinated) | ug/L | 30 | 1.9% | 2.1% | 2.9% | 2.2% | 1.5% |
| Chlorinated Phenolics | ug/L | 1 | <14% | <3.7% | <6.8% | <9.6% | <8.7% |
| Endosulfan | ug/L | 0.009 | 4.3% | 4.8% | 6.8% | 5.1% | 3.4% |
| Endrin | ug/L | 0.002 | 0.03% | 0.04% | 0.05% | 0.04% | 0.02% |
| HCH (Hexachlorocyclohexane) | ug/L | 0.004 | 12% | 13% | 19% | 14% | 9% |
| Radioactivity (Gross Beta) [b] | pci/L | – | | | | | |
| Radioactivity (Gross Alpha) [b] | pci/L | – | | | | | |
| *Objectives for protection of human health – non-carcinogens* | | | | | | | |
| Acrolein | ug/L | 220 | 0.03% | 0.04% | 0.05% | 0.04% | 0.03% |
| Antimony | ug/L | 1200 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Bis (2-chloroethoxy) methane | ug/L | 4.4 | <0.6% | <0.05% | <0.2% | <0.4% | <0.4% |
| Bis (2-chloroisopropyl) ether | ug/L | 1200 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Chlorobenzene | ug/L | 570 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Chromium (III) | ug/L | 190000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Di-n-butyl phthalate | ug/L | 3500 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dichlorobenzenes | ug/L | 5100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Diethyl phthalate | ug/L | 33000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Dimethyl phthalate | ug/L | 820000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 4,6-dinitro-2-methylphenol | ug/L | 220 | <0.06% | <0.01% | <0.02% | <0.04% | <0.04% |
| 2,4-Dinitrophenol | ug/L | 4.0 | <2.2% | <0.3% | <0.7% | <1.3% | <1.3% |
| Ethylbenzene | ug/L | 4100 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Fluoranthene | ug/L | 15 | <0.02% | <0.01% | <0.01% | <0.01% | <0.01% |
| Hexachlorocyclopentadiene | ug/L | 58 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Nitrobenzene | ug/L | 4.9 | <0.3% | <0.04% | <0.1% | <0.2% | <0.2% |
| Thallium | ug/L | 2 | 0.3% | 0.3% | 0.4% | 0.3% | 0.2% |
| Toluene | ug/L | 85000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Tributyltin | ug/L | 0.0014 | <24% | <3.0% | <7.3% | <15% | <15% |
| 1,1,1-Trichloroethane | ug/L | 540000 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| *Objectives for protection of human health - carcinogens* | | | | | | | |
| Acrylonitrile | ug/L | 0.10 | 21% | 23% | 33% | 24% | 16% |
| Aldrin [c] | ug/L | 0.000022 | – | – | – | – | – |
| Benzene | ug/L | 5.9 | <0.06% | <0.02% | <0.03% | <0.04% | <0.04% |
| Benzidine [c] | ug/L | 0.000069 | – | – | – | – | – |
| Beryllium | ug/L | 0.033 | 0.4% | 2.5% | 3.3% | 1.7% | 0.7% |
| Bis(2-chloroethyl)ether | ug/L | 0.045 | <63% | <5.4% | <16% | <37% | <38% |
| Bis(2-ethyl-hexyl)phthalate | ug/L | 3.5 | 18% | 20% | 28% | 21% | 14% |

| Constituent | Units | Ocean Plan Objective | Estimated Concentration at Edge of ZID by Discharge Scenario | | | | |
|---|---|---|---|---|---|---|---|
| | | | 1 | 2 | 3 | 4 | 5 |
| Carbon tetrachloride | ug/L | 0.90 | 0.5% | 0.5% | 0.7% | 0.5% | 0.4% |
| Chlordane | ug/L | 0.000023 | 26% | 29% | 41% | 30% | 20% |
| Chlorodibromomethane | ug/L | 8.6 | 0.2% | 0.3% | 0.4% | 0.3% | 0.2% |
| Chloroform | ug/L | 130 | 0.2% | 0.3% | 0.4% | 0.3% | 0.2% |
| DDT | ug/L | 0.00017 | 10% | 36% | 49% | 26% | 12% |
| 1,4-Dichlorobenzene | ug/L | 18 | 0.07% | 0.08% | 0.1% | 0.08% | 0.06% |
| 3,3-Dichlorobenzidine [c] | ug/L | 0.0081 | – | – | – | – | – |
| 1,2-Dichloroethane | ug/L | 28 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,1-Dichloroethylene | ug/L | 0.9 | 0.4% | 0.1% | 0.2% | 0.3% | 0.2% |
| Dichlorobromomethane | ug/L | 6.2 | 0.3% | 0.4% | 0.5% | 0.4% | 0.3% |
| Dichloromethane | ug/L | 450 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,3-dichloropropene | ug/L | 8.9 | 0.05% | 0.06% | 0.08% | 0.06% | 0.04% |
| Dieldrin | ug/L | 0.00004 | 11% | 15% | 21% | 14% | 8.9% |
| 2,4-Dinitrotoluene | ug/L | 2.6 | <0.5% | <0.02% | <0.10% | <0.3% | <0.3% |
| 1,2-Diphenylhydrazine | ug/L | 0.16 | <18% | <1.5% | <4.5% | <10% | <11% |
| Halomethanes | ug/L | 130 | <0.01% | <0.01% | 0.01% | 0.01% | <0.01% |
| Heptachlor [c] | ug/L | 0.00005 | – | <37% | <68% | – | – |
| Heptachlor Epoxide | ug/L | 0.00002 | 2.4% | 2.6% | 3.8% | 2.8% | 1.9% |
| Hexachlorobenzene | ug/L | 0.00021 | 0.3% | 0.3% | 0.5% | 0.4% | 0.2% |
| Hexachlorobutadiene | ug/L | 14 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| Hexachloroethane | ug/L | 2.5 | <0.6% | <0.05% | <0.2% | <0.4% | <0.4% |
| Isophorone | ug/L | 730 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| N-Nitrosodimethylamine | ug/L | 7.3 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| N-Nitrosodi-N-Propylamine | ug/L | 0.38 | 0.1% | 0.01% | 0.03% | 0.08% | 0.08% |
| N-Nitrosodiphenylamine | ug/L | 2.5 | <0.6% | <0.08% | <0.2% | <0.4% | <0.4% |
| PAHs | ug/L | 0.0088 | 4.9% | 5.4% | 7.7% | 5.7% | 3.8% |
| PCBs | ug/L | 0.000019 | 29% | 32% | 46% | 34% | 23% |
| TCDD Equivalents | ug/L | 3.9E-09 | 32% | 35% | 50% | 38% | 25% |
| 1,1,2,2-Tetrachloroethane | ug/L | 2.3 | <0.2% | <0.04% | <0.07% | <0.1% | <0.09% |
| Tetrachloroethylene | ug/L | 2.0 | <0.2% | <0.05% | <0.08% | <0.1% | <0.1% |
| Toxaphene | ug/L | 2.1E-04 | 27% | 30% | 43% | 32% | 21% |
| Trichloroethylene | ug/L | 27 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |
| 1,1,2-Trichloroethane | ug/L | 9.4 | <0.04% | <0.01% | <0.02% | <0.03% | <0.02% |
| 2,4,6-Trichlorophenol | ug/L | 0.29 | <5.4% | <0.7% | <1.7% | <3.3% | <3.3% |
| Vinyl chloride | ug/L | 36 | <0.01% | <0.01% | <0.01% | <0.01% | <0.01% |

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%).

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of these constituents. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.

**About AECOM**

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
West Coast Region
777 Sonoma Avenue, Room 325
Santa Rosa, California 95404-4731

October 23, 2017 **Refer to NMFS No:** WCR-2017-7437

Paul Michel, Superintendent
Monterey Bay National Marine Sanctuary
99 Pacific Street Building 455a
Monterey, California 93940

Re: Endangered Species Act Section 7(a)(2) Concurrence Letter and Magnuson-Stevens Fishery Conservation and Management Act Essential Fish Habitat Response for the Monterey Peninsula Water Supply Project [NOAA/MBNMS-2015-022]

Dear Mr. Michel:

On June 30, 2017, NOAA's National Marine Fisheries Service (NMFS) received Monterey Bay National Marine Sanctuary's (MBNMS) June 30, 2017, letter requesting NMFS' written concurrence that the California American Water Company's (Cal-Am) Monterey Peninsula Water Supply Project (MPWSP) is not likely to adversely affect (NLAA) species listed as threatened or endangered or critical habitats designated under the Endangered Species Act (ESA). The MBNMS is serving as the federal action agency for the proposed federal action, which includes the authorization and issuance of a permit to Cal-Am for the construction and operation of the Project components within the Monterey Bay National Marine Sanctuary.

NMFS also reviewed the proposed action for potential effects on essential fish habitat (EFH) designated under the Magnuson-Stevens Fishery Conservation and Management Act (MSA), including conservation measures and any determination you made regarding the potential effects of the action. This review was pursuant to section 305(b) of the MSA, implementing regulations at 50 CFR 600.920, and agency guidance for use of the ESA consultation process to complete EFH consultation.

This letter underwent pre-dissemination review using standards for utility, integrity, and objectivity in compliance with applicable guidelines issued under the Data Quality Act (section 515 of the Treasury and General Government Appropriations Act for Fiscal Year 2001, Public Law 106-554). The concurrence letter will be available through NMFS' Public Consultation Tracking System available at: https://pcts.nmfs.noaa.gov/pcts-web/homepage.pcts.[1] A complete record of this consultation is on file at NMFS' West Coast Region North Central Coast Office located at 777 Sonoma Avenue, Room 325, Santa Rosa, California 95404.

[1] Once on the PCTS homepage, use the following PCTS tracking number within the Quick Search column: WCR-2017-7437.

**Proposed Action**

Cal-Am proposes to build a desalinization plant as part of the MPWSP (Project). The Project would include construction of a subsurface seawater intake system, a new reverse osmosis (RO) desalination plant, a brine discharge system, product water conveyance pipelines, a pump station, storage facilities, and improvements to the existing Seaside Groundwater Basin's aquifer storage and recovery (ASR) system. The purpose of the Project is to replace existing water supply sources for Cal-Am's Monterey District, with a focus on reducing diversions from the Carmel River and extractions from the Seaside Groundwater Basin. On July 19, 2016, the State Water Resources Control Board (SWRCB) adopted Order WR 2016-0016, which amended Order WR 2009-0060 and required unauthorized diversions from the Carmel River to end by December 31, 2021.

The Project involves construction of pipelines and facilities in unincorporated areas of Monterey County, including the town of Castroville, and the cities of Marina and Seaside. These facilities include (Figure 1):

- Seawater intake system which will consist of seven subsurface slant wells (an existing test slant well plus six new wells) at the existing CEMEX Plant site. The wells would extend offshore into the submerged lands of MBNMS and a Source Water Pipeline would convey the combined source water from the slant wells to the new desalination plant;
- A new 6.4 million-gallon-per-day (mgd) desalination plant and associated auxiliary facilities;
- Desalinated water conveyance facilities, including pipelines, a pump station, and treated water storage tanks;
- A brine storage and disposal system, which will include an uncovered 3 million-gallon brine storage basin with two impermeable liners, a brine discharge pipeline to a proposed Brine Mixing Facility at the Monterey Regional Water Pollution Control Agency (MRWPCA) waste water treatment plant, and a combined discharge to the existing MRWPCA ocean outfall that discharges into MBNMS; and
- An expanded ASR system, including two additional injection/extraction wells (ASR-5 and ASR-6 wells) and three parallel ASR pipelines (ASR Recirculation Pipeline, ASR Conveyance Pipeline, and ASR Pump-to-Waste Pipeline). These pipelines will convey water to and from the new ASR injection/extraction wells, and backwash effluent, from the wells to an existing settling basin.

The following focuses primarily on the descriptions of project features that interact with NMFS-trust species or their designated critical habitats. For a more complete description of all project facilities, see *Monterey Peninsula Water Supply Project Biological Assessment for National Marine Fisheries Service Consultation* (AECOM 2017).

*Seawater Intake System*

The seawater intake system would include seven subsurface slant wells (five active at any given time and two on standby) that would draw seawater from groundwater aquifers that extend beneath the ocean floor for use as source water at the new desalination plant. The slant wells would be drilled on the landward side of the dunes, south of the existing CEMEX Plant access road, and extend down below the surf zone of the adjacent MBNMS. Installation of the permanent subsurface slant wells would include the use of 22- to 36-inch diameter steel casings.

The six new permanent slant wells would be approximately 900 to 1,000 feet long and drilled at approximately 14 degrees below horizontal, extending offshore 161 to 356 feet seaward of the year 2020 mean high water[2] (MHW) line, to a depth of 190 to 210 feet beneath the seafloor. All construction activities and ground disturbance would occur above mean sea level, landward of the 2020 MHW line.

The seven slant wells would be located at five new wellhead sites plus the one existing test slant well site, all of which would be located on the inland side of the dunes. Each slant well would be equipped with a 2,500 gallons per minute (gpm), 300 horsepower (hp) submersible well pump. The electrical controls for operation of the slant wells would be housed in a single-story, 17-foot-long, by 10-foot-wide, 10-foot-high fiberglass enclosure located at each of the six well sites. Each site would also have a pump-to-waste basin for the percolation of turbid water produced during slant well startup and shutdown. The pump-to-waste basin would be constructed of rip-rap material, and would be approximately 1 to 2 feet deep, 12 feet long, and 8 feet wide. The new permanent slant wells and associated infrastructure at Sites 2 through 6 would be constructed on a 5,250 to 6,025-square-foot graded pad located above the maximum high tide elevation on the inland side of the dunes. A 750-foot-long, 42-inch-diameter buried pipe would collect the seawater pumped from Sites 2 through 6 and convey it to the proposed buried Source Water Pipeline located at the existing CEMEX Plant access road.

*Brine Storage and Disposal Facilities*

The brine storage and disposal system would have an uncovered 3-million-gallon brine storage basin with two impermeable liners; two 6 mgd, 40 hp brine discharge pumps; and a brine aeration system to maintain dissolved oxygen (DO) concentrations in the brine at 5 milligrams per liter (mg/L). The RO process would generate approximately 9 mgd of brine, including decanted backwash water. Brine from the RO system would be conveyed through the 3,900-foot long, 36-inch diameter Brine Discharge Pipeline to a proposed Brine Mixing Facility at the MRWPCA waste water treatment plant and then conveyed to the existing MRWPCA ocean outfall that discharges into the waters on the bottom of the MBNMS. When temporary storage is needed, brine would be directed to the brine storage basin where it can be stored for up to 5 hours, then pumped to the Brine Discharge Pipeline.

The existing MRWPCA ocean outfall pipeline is 2.1 miles long and ends with a 1,100-foot long, underwater diffuser that rests on rock ballast (Figure 1). The diffuser ports are approximately 6 inches above the rock ballast and nominally 54 inches above the seafloor, although this height varies due to unevenness in the sea floor topography. For the dilution calculations, the ports are assumed to be 4 feet above the seafloor at approximately 90 to 110 feet below mean sea level. The diffuser has a maximum capacity of 82 mgd and is equipped with 172 ports each 2 inches in diameter and spaced 8 feet apart on alternating sides of the pipe. For the proposed project, the

[2] The 2020 MHW at the Monterey Tide Gauge NOAA #9413450 equals 5.02 feet North American Vertical Datum 1988 (NAVD 88), considering a high sea level rise scenario of 3.2 inches by 2020 (5.46 feet by 2100).

volume of discharge will be substantially less than the maximum capacity for the diffuser (currently less than 20 mgd, which requires only 129 of the diffuser ports to be open).

*Desalinated Water Conveyance*

Desalinated, post-treatment product water would flow to two covered, aboveground treated-water storage tanks (clearwells). Each tank would provide 1.75 million gallons of storage, for a total storage volume of 3.5 million gallons. Desalinated product water from the desalination plant would flow south through a series of proposed pipelines into the Cal-Am system. These pipelines would include surface equipment. Salinas Valley return flow pumps would pump desalinated product water to water distribution systems as needed.

*Castroville Pipeline*

The Project will include the construction of a new 4.5-mile-long, 12-inch diameter Castroville Pipeline that will convey desalinated Salinas Valley return water[3] from the desalination plant to the Castroville Seawater Intrusion Project (CSIP) distribution system and the Castroville Community Services District (CCSD) Well #3. The pipeline would cross over the Salinas River Lagoon (Salinas Lagoon) at Monte Road attached to the underside of the Monte Road Bridge (Figure 2).

To construct the pipeline crossing at the Salinas Lagoon, minor vegetation clearing would be required. The majority of excavation and ground disturbance would be within the dirt roadways on the north side of the Monte Road Bridge. Grubbing (removal) and excavation of vegetated areas would be required at two small areas on both the north and south end of the elevated pipeline (a total of 0.05 acres) to bring the underground pipeline from the dirt road to underneath the bridge. On both the north and south sides of the channel, trimming of riparian vegetation would also be required to position and affix the pipeline to the underside of the bridge. The total required area of riparian vegetation trimming would be 0.86 acres. To install the pipe over the Salinas Lagoon, a barge will be used. The barge would remain in the lagoon for at most, 1 month. During this time, the barge would be moved incrementally during construction and would not remain in one location for an extended period.

The pipeline would continue northeast from the Salinas River, along the Transportation Authority of Monterey County's (TAMC) right-of-way (ROW) and Monte Road, to Nashua Road. A new pipe connection to the CSIP distribution system would be built at the northern end of Monte Road, where it meets Nashua Road. The Castroville Pipeline would continue north along the TAMC ROW, where it will be piped beneath Tembladero Slough and then to Highway 183. From Highway 183, the pipeline would continue north between Del Monte Avenue and

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[3] The slant wells are anticipated to intercept primarily ocean water but may intercept some water that originated from inland sources. In 1990, state legislature enacted the Monterey County Water Resources Agency Act (Agency Act), which empowered the MCWRA to prevent extraction of groundwater from particular areas of the Salinas Valley Groundwater Basin (SVGB). Accordingly, MCWRA adopted Ordinance 3709, which prohibits groundwater extraction within the northern Salinas Valley (including the Marina Subarea of the SVGB) between the depths of 0 mean sea level (msl) and -250 msl. To comply with the Agency Act, the first 800 afy of desalinated product water produced by the Project would go to the CCSD in lieu of pumping an equal amount of groundwater in the Castroville area, and the rest would go to the CSIP, also in lieu of groundwater pumping. These are the Salinas Valley return waters.

Union Pacific Railroad, turn west across Del Monte Avenue and connect to CCSD Well #3 at the north corner of Del Monte Avenue and Merritt Street.


**Figure 1. The existing and proposed facilities for the Project. Source: AECOM (2017)**

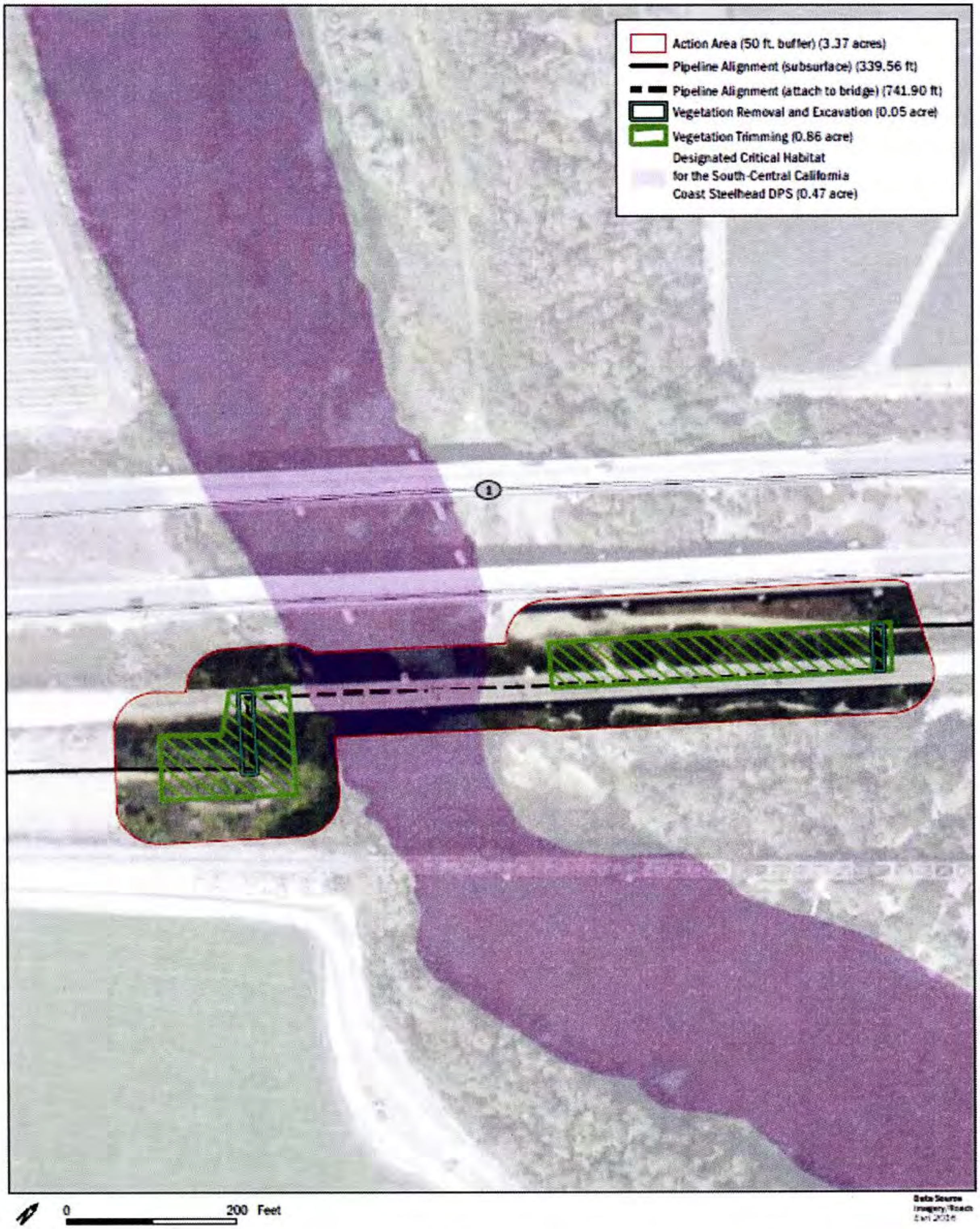


**Figure 2. The Salinas River crossing portion of the project action area. Source: AECOM (2017)**

*Project Construction*
Construction is expected to start July 2018 and continue through June 2020 (24 months total).

Site clearing and preparation: Work areas would be cleared and prepared for construction in stages, as construction progresses. The contractor would recontour and restore the temporary construction work areas to their original profile upon completion of construction, and would hydroseed or pave the areas, as appropriate.

Staging Areas: Construction equipment and materials would be stored within the construction work areas to the extent feasible. Construction staging for the subsurface slant wells at the CEMEX Plant site, the desalination plant, and the ASR-5 and ASR-6 wells would be contained within the project area boundaries associated with that feature. For construction of all other facilities and pipelines, eight staging areas in the vicinity of the project area will be used that are primarily paved parking lots located in highly disturbed areas, except the sandy lot proposed as the staging area near Seaside Middle School. Because all of the proposed staging areas are paved or sand, Cal-Am's contractors would not need to remove vegetation to prepare the staging sites. Heavy machinery would not be operated at the staging areas unless it is used to move lighter-duty machinery in and out of the staging area, or to load and unload material onto transportation vehicles for delivery to the construction sites. Only temporary motion-censored nighttime lighting would be installed at staging areas.

Subsurface Slant Wells: Well installation would be done in two phases: (1) well drilling and (2) well development. All construction activities for the slant wells would occur inland of the year 2020 MHW line and in previously disturbed areas, landward of the dunes. Surface construction activities would occur outside of MBNMS. Slant well construction would take approximately 10 to 12 months to complete, and could take place anytime throughout the overall 24-month construction duration. Construction activities associated with installation of the six new subsurface slant wells, including staging, materials storage, and stockpiling, would temporarily disturb approximately 6 acres of land (approximately 1 acre of disturbance per slant well) within the project area boundary. Construction activities would occur 24 hours per day, 7 days per week, with multiple slant wells being built simultaneously. Construction related trucks and vehicles would access the slant well site via Del Monte Boulevard, Lapis Road, and the existing access roads in the CEMEX mining area.

The proposed slant wells would be built using a dual rotary drilling rig, pipe trailers, portable drilling fluid tanks, Baker tanks, haul and flatbed trucks, pumps, and air compressors. The slant wells would be drilled at approximately 14 degrees below horizontal. Drilling fluids, such as water, bentonite mud, or environmentally inert biodegradable additives, would be used to drill through the first 100 feet of the dry dune sands to prevent the sand from locking up the drill bit inside the conductor casing. The fluid would be recirculated using a mud tank located next to the drill rig. Once the drill bit reaches groundwater, the construction contractor would pump out all of the sand-bentonite mud slurry and put it in a storage container for off-site disposal. The elevation of the groundwater surface would be determined from the existing monitoring wells.

The remaining 900 feet of borehole below the top of the groundwater table would be drilled using water already present in the sand and some potable water. No bentonite mud or other additives would be used to drill this segment of the slant well. The water and sediment mixture generated during drilling of the lower portion of slant well would be placed in settling tanks, as necessary, to allow sediment to settle out. The volume of water produced during this drilling phase would be small, allowing the construction contractor to dispose of the clarified effluent by percolating it into the ground at the CEMEX mining area. Drilling spoils generated while drilling the lower portion of the slant well would not contain bentonite mud or other additives; they would be spread within the construction disturbance area and would not require offsite disposal.

To develop the slant wells, a submersible pump would be lowered several hundred feet into each well and would be pumped for two to six weeks during slant well completion and initial well testing periods. The groundwater pumped from the wells during well development would be discharged to the ocean through the test slant well discharge pipe and the existing MRWPCA ocean outfall. The wellheads would include 12-inch diameter mechanical discharge piping which would be located in a below ground vault (12 feet by 6 feet). The discharge piping would then connect to the buried source water pipeline.

Brine Discharge: Continuously recording automated water quality monitoring devices will be installed at least one year prior to implementing operational discharges to the receiving waters of Monterey Bay. The devices will monitor salinity and dissolved oxygen to ensure that the operational discharges from the Project are in compliance with the 2.0 parts per thousand (ppt) receiving water salinity limitation as required by the California Ocean Plan (SWRCB 2016). A Monitoring and Reporting Plan, consistent with the standard monitoring procedures in Appendix III of the Ocean Plan, will be implemented as described in Section 6.6.1, Water Quality Monitoring of AECOM (2017).

Pipeline Installation: Approximately 21 miles of pipelines would be installed within paved roadways, or adjacent to roads and the Monterey Peninsula Recreational Trail. Most pipeline segments would be installed using conventional open-trench technology; however, where it is not feasible or desirable to perform open-cut trenching, trenchless methods would be used.

Typical construction equipment for pipeline installation would include flatbed trucks, backhoes, excavators, pipe cutting and welding equipment, haul trucks for spoils transport, trucks for materials delivery, compaction equipment, Baker tanks, pickup trucks, arc-welding machines, generators, air compressors, cranes, drill rigs, and skip loaders. Pipeline segments would typically be delivered and installed in 6- to 40-foot-long sections. Soil removed from trenches and pits would be stockpiled and reused, to the extent feasible, or hauled away for offsite disposal. Topsoil would be stockpiled separately and replaced last. Under typical circumstances, the width of the disturbance corridor for pipeline construction would vary from 50 to 100 feet, depending on the size of the pipe being installed. Multiple pipelines would be built simultaneously. Although most pipeline construction would occur over a 15-month period, pipeline construction could occur any time throughout the entire 24-month construction period. The construction duration for most individual pipelines would be much shorter than 15 months. Pipeline installation would be sequenced to minimize land use disturbance and traffic disruption to the extent possible.

Where it is not feasible or desirable to perform open-cut trenching, workers would use trenchless methods such as jack-and-bore, drill-and-burst, horizontal directional drilling, or micro-tunneling. Pipeline segments in heavily congested underground utility areas or in sensitive habitat areas would likely be installed using horizontal directional drilling or micro-tunneling. Jack-and-bore methods would likely be used beneath railroad crossings. Horizontal directional drilling would likely be used for pipeline segments that cross beneath Highway 1 (Transmission Main) and beneath drainages (Castroville Pipeline at Tembladero Slough).

Disinfection of Existing and Newly Installed Pipelines: Before connecting existing and new pipelines, Cal-Am would drain and disinfect the existing pipeline segments. Similarly, upon completing construction activities, facility operators would disinfect the newly installed pipelines and pipeline connections before bringing the pipelines into service. Effluent produced during the pipeline disinfection process would be discharged to the local stormwater drainage system in accordance with the Central Coast Regional Water Quality Control Board (RWQCB) General Waste Discharge Requirements for Discharges with Low Threat to Water Quality (Order No. R3-2011-0223, NPDES Permit No. CAG993001).

*Project Operation*

The desalination plant would operate at an overall recovery rate of 42 percent. Approximately 15.5 mgd of raw seawater would be needed to produce 6.4 mgd of desalinated product water. The RO process would generate approximately 9.0 mgd of brine. The salinity of the brine is expected to range between 57.0 and 58.0 ppt. The brine stream would be discharged to Monterey Bay via the existing MRWPCA ocean outfall and diffuser.

Brine would be mixed with treated wastewater from the MRWPCA Regional Wastewater Treatment Plant during some times of the year before being discharged through the ocean outfall. During the agricultural irrigation season, April through October, the treated wastewater is diverted to the Salinas Valley Reclamation Project's tertiary treatment facility for additional advanced treatment and then used to irrigate crops as part of the CSIP (in lieu of groundwater pumping). During irrigation season, the project's brine stream would be discharged to Monterey Bay without dilution if the MRWPCA treated wastewater flows are equal to or less than the CSIP demand for irrigation water. During the non-irrigation season (November through March), when the CSIP is not operating, the brine stream would be mixed with treated wastewater from the MRWPCA Regional Wastewater Treatment Plant before being discharged to the ocean.

Year-round, the brine would be blended with 0.94 mgd of RO concentrate from the Pure Water Monterey Groundwater Replenishment (GWR) Project. Together, the brine from the Proposed Action, GWR Project concentrate, and treated wastewater effluent are referred to as the "combined discharge." The MRWPCA's diffuser would disperse the combined discharge along its multiport length, increasing the initial dilution and thereby minimizing salinity differences between the discharges and the surrounding seawater.

*Avoidance and Minimization Measures*

Cal-Am has proposed several avoidance and minimization measures to reduce impacts to federally managed species and their habitats. These include and are described in greater detail in Chapter 6 of AECOM (2017):

- Retain a lead biologist to oversee implementation of avoidance and minimization measures;
- General best management practices (BMPs);
- Environmental awareness training;
- Hazardous material spill prevention;
- Minimization of sedimentation and turbidity;
- Protocols to prevent exceeding water quality objectives from combined discharge;
- Mitigation and monitoring plan.

To ensure that the combined discharges are in compliance with the 2.0 ppt receiving water salinity limitation at the brine mixing zone (BMZ) compliance point required by the California Ocean Plan (SWRCB 2016), the discharger will implement a Monitoring and Reporting Plan. The Monitoring and Reporting Plan will, at a minimum, include protocols for monitoring of effluent and receiving water salinity characteristics, as well as protocols for determining statistically significant changes[4] in benthic community composition within the maximum extent of the zone of initial dilution (ZID) in comparison to baseline conditions (established a minimum of 1 year prior to operations). Such protocols will include, but are not limited to, monitoring for benthic community health, aquatic life toxicity, and hypoxia, in the ZID. The Plan will be consistent with the standard monitoring procedures detailed in Appendix III of the California Ocean Plan (SWRCB 2016). These monitoring protocols specify a monitoring plan framework, scope, and design for determining compliance with the California Ocean Plan's defined receiving water limitations relating to salinity. Prior to implementation, the Monitoring and Reporting Plan will be approved by the RWQCB and MBNMS. Following implementation, the Monitoring and Reporting Plan will be reviewed by the RWQCB, and revised if necessary, as part of the NPDES permit renewal process.

All temporarily impacted habitat (*i.e.,* Salinas Lagoon crossing) will be restored to previous conditions, or better, at the end of construction. To the extent feasible, topsoil will be salvaged during grading, stockpiled separately from subsoil, and protected from erosion.

*Interrelated Actions*

Cal-Am is under order from the SWRCB to reduce its water diversions from the Carmel River to 3,376 afy by the year 2021. Another project anticipated to provide a replacement water source to satisfy the SWRCB's order, is the GWR Project. As noted above, the effluent produced by the GWR project will be mixed with, and dilute, the brine effluent produced by the proposed action. The combined waters will discharge through the existing outfall pipeline and diffuser on the bottom of Monterey Bay. Because the GWR Project will share facilities with the proposed action (discharge pipeline) and because the product waters from both projects will be used in part or in whole to satisfy the requirements of the SWRCB's order to Cal-Am, the GWR Project is considered an interrelated project. On December 5, 2016, NMFS concurred with the U.S. Environmental Protection Agency (EPA) that the GWR Project may affect but was not likely to

[4] Changes that are directly associated with changes in salinity resulting from operational discharges (with consideration given to natural and seasonal variations and long-term regional trends).

adversely affect S-CCC steelhead or its designated critical habitat in the Salinas River, Reclamation Ditch, Tembladero Slough or the Old Salinas River channel.

**Action Area**

The action area encompasses the total area associated with project components. This includes the MBNMS, beach dune habitat at the existing CEMEX sand mining plant, the lower Salinas River and Lagoon, and upland habitats (coastal scrub, ruderal, and agricultural lands) in unincorporated areas of Monterey County (the town of Castroville in the north, the City of Marina, and the City of Seaside to the south). For the Project, there are four distinct areas within its greater footprint that coincide with the potential for direct or indirect impacts to species or habitats managed by NMFS. These include the Combined Discharge area located at the bottom of the MBNMS, the banks of the Salinas Lagoon where the Castroville Pipeline would cross through the riparian zone and over the river attached to the Monte Road Bridge, a small section of Tembladero Slough where the Castroville Pipeline will be routed beneath the slough using trenchless methods, and the lower Salinas River and Lagoon where groundwater intercepted by the slant wells may cause a decrease in flow to the river. These areas are briefly described below. For more information see AECOM (2017).

*Combined Discharge - MBNMS*

The action area associated with the combined discharge is approximately 1.5 miles offshore of the City of Marina, and about 2.5 miles southwest of the mouth of the Salinas River. The underwater diffuser is 1,100 feet long and sits on ballast rock in about 100 feet of water. The combined discharge Action Area is 162.6 acres in size, includes the entire water column, and extends beyond the project footprint; it also includes the ZID, the BMZ, and the area over which salinity may be increased above ambient by 0.5 ppt or more (*i.e.,* far-field dilution zone). The orientation of the potential effects of the combined discharge area would vary depending on ocean climate and water chemistry conditions but would not be expected to exceed the area associated with the far field dilution zone. Based on modeling of the combined discharge, the ZID would extend up to 42 feet from the diffusers and the area far-field dilution zone may extend out as much as 1,148 feet from the diffusers. The BMZ, as defined by the California Ocean Plan (SWRCB 2016), extends out 328 feet from the diffuser.

*Castroville Pipeline – Salinas River and Tembladero Slough*

The action area associated with the Salinas River crossing is approximately 1,081 feet long and includes the project footprint required for construction, the limits of vegetation clearing trimming, and a 50-foot buffer up and downstream of the crossing. This area totals 3.37 acres (Figure 1 and Figure 2) of mixed riparian and ruderal vegetation, and existing unpaved roads. In addition, the Pipeline will be installed beneath Tembladero Slough south of the town of Castroville using trenchless methods. In this vicinity, Tembladero Slough is a trapezoidal channel consisting of fine sediments (*i.e.,* clay) with little to no native vegetation on either bank. The area is surrounded entirely by large expanses of agricultural fields and unpaved farm roads.

*Groundwater Diversions – Salinas River and Lagoon*

The slant wells may intercept a small amount of brackish groundwater from the Dune Sands Aquifer that otherwise may have flowed to the lower Salinas River and lagoon and therefore could impact the volume of surface water. Because of this, the lower Salinas River (and the lagoon) downstream of Blanco Road is part of the action area. This portion of the river is a gaining reach and is not subject to dryback like areas of the river farther upstream. Several small surface water ditches contribute runoff to the lagoon during the irrigation season and bypass flows from the operation of the Salinas Valley Water Project, which operates from April to October, provides additional freshwater inflow.

**Action Agency's Effects Determination**

The MBNMS has determined the Project may affect but is not likely to adversely affect the following species, including multiple Distinct Population Segments (DPS) and Evolutionary Significant Units (ESUs), and designated critical habitats:

**South-Central California Coast (S-CCC) steelhead DPS** (*Oncorhynchus mykiss*)
Threatened (71 FR 834; January 5, 2006)
Critical habitat (70 FR 52488; September 2, 2005);

**Central California Coast steelhead DPS** (*O. mykiss*)
Threatened (71 FR 834; January 5, 2006);

**California Coastal Chinook salmon ESU** (*O. tshawytscha*)
Threatened (June 28, 2005, 70 FR 37160);

**Sacramento River winter-run Chinook salmon ESU** (*O. tshawytscha*)
Endangered (70 FR 37160; June 28, 2005);

**Central Valley spring-run Chinook salmon ESU** (*O. tshawytscha*)
Threatened (70 FR 37160; June 28, 2005);

**Southern DPS of North American green sturgeon** (*Acipenser medirostris*)
Threatened (71 FR 17757; April 7, 2006)
Critical habitat (74 FR 52300; October 9, 2009);

**Leatherback sea turtle** (*Dermochelys coriacea*)
Critical habitat (77 FR 4170; January 26, 2012);

**Southern Resident DPS killer whale** (*Orcinus orca*)
Endangered (70 FR 69903; November 18, 2005).

With the exception of S-CCC steelhead, which exist in the Salinas River, potential impacts to the other species or critical habitats identified below are only anticipated to occur as a result of the combined discharge through the diffuser on the bottom of Monterey Bay. The offshore combined discharge area is designated critical habitat for the southern DPS of North American green sturgeon and leatherback sea turtle.

MBNMS' rationale for the above determinations is based on the following:

- The species listed above are anticipated to only temporarily move through areas associated with combined discharge. The combined discharge may cause minor changes to the benthic community in the vicinity of the discharge due to slightly elevated salinity up to 1,148 feet from the outfall structure. However, such changes are not expected to result in adverse effects to species due to the transient nature of the potential exposure. Also, avoidance and minimization measures will be implemented to ensure water quality requirements (SWRCB 2016) associated with the combine discharge are met and impacts to species are avoided or minimized (AECOM 2017).

- At the Salinas Lagoon pipeline crossing, the crossing itself will be above the high water line and there will be no impacts on the wetted channel outside of minor and temporary disturbances associated with the use of a barge during construction. Avoidance and minimization measures will be implemented to prevent injury or harassment of the S-CCC steelhead during construction of the Salinas River pipeline crossing.

- Designated critical habitat for the S-CCC steelhead DPS exists at the Salinas River pipeline crossing site. Construction of the pipeline will only result in temporary impacts to riparian vegetation (0.67 acres) outside of, but adjacent to, designated critical habitat. The use of a barge to attach the pipeline to the bottom of the Del Monte Road Bridge will result only in temporary disturbance to the waters within the river.

- The offshore combined discharge area supports designated critical habitat for only the southern DPS of North American green sturgeon and the leatherback sea turtle. The discharge associated with the proposed action may cause changes to the benthic community due to minor increases in salinity surrounding the outfall. However, the overall productivity of benthic organisms is not expected to be reduced as a result of combined discharge. Implementation of avoidance and minimization measures will ensure water quality requirements (SWRCB 2016) associated with the combine discharge are met.

The MBNMS also considered potential effects to EFH found in the action area and determined there would be no adverse effects for various life stages of fish species managed within the following Fishery Management Plans (FMP) under the MSA:

**Pacific Groundfish FMP**

*e.g.,* starry flounder, English and sand sole, spiny dogfish, rockfish and some shark species;

**Coastal Pelagic Species FMP**

*e.g.,* market squid, northern anchovy, Pacific sardine, Pacific and jack mackerel;

**Pacific Coast Salmon FMP**
*e.g.,* Chinook, coho and pink salmon ;

**West Coast Fisheries for Highly Migratory Species FMP**
*e.g.,* various species of shark and tuna, marlin, swordfish, and dorado.

MBNMS' rationale for these determinations is similar to the rationale stated above under the ESA determinations. They note the conservation measures identified in the various FMPs are reflected in their proposed avoidance and minimization measures (see Section 6.6 in AECOM 2017).

A portion of the project occurs within the Salinas Lagoon, which is an area designated as a Habitat Area Particular Concern (HAPC) for various federally-managed species within Pacific Groundfish and Pacific Coast Salmon FMPs. HAPCs are described in the regulations as subsets of EFH that are "rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area" (50 CFR 600.815). Designated HAPCs are not afforded any additional regulatory protection under the MSA; however, federal projects with potential adverse impacts to HAPC are more carefully scrutinized during the consultation process.

**Consultation History**

On April 20, 2016, staff from NMFS, USFWS, AECOM, CDFW, MBNMS, and other consultants held a project coordination meeting. On June 30, 2017, NMFS received an electronic request for consultation for the Project and a copy of the biological assessment (AECOM 2017). Additional information was requested on August 1, 2017. Staff from NMFS, MBNMS, and their consultant had a conference call on August 29, 2017, to discuss Project components related to groundwater sources for the slant wells. Additional information was provided by the consultant on August 30 and September 11, 2017, at which time NMFS determined the information was sufficient to initiate consultation.

## ENDANGERED SPECIES ACT

**Effects of the Action**

Under the ESA, "effects of the action" means the direct and indirect effects of an action on the listed species or critical habitat, together with the effects of other activities that are interrelated or interdependent with that action (50 CFR 402.02). To determine whether an informal consultation is sufficient under Section 7 of the ESA, the applicable standard is whether the action is not likely to adversely affect listed species or critical habitat; if all of the effects of the action are expected to be discountable, insignificant, or completely beneficial, the Service may conclude that the action is "not likely to adversely affect" and an informal consultation is sufficient. Beneficial effects are contemporaneous positive effects without any adverse effects to the species or critical habitat. Insignificant effects relate to the size of the impact and should never reach the scale where take occurs. Discountable effects are those extremely unlikely to occur.

The effects of the Project will include permanent but insignificant changes to water quality (primarily salinity) and velocities from the Project's combined discharge through the diffuser on the bottom of Monterey Bay, temporary but insignificant impacts to riparian vegetation and shading of the Salinas Lagoon related to the installation of the Castroville Pipeline beneath the Monte Road Bridge, and insignificant potential decrease in brackish groundwater that discharges into the lower Salinas River and Lagoon from the operation of the slant wells.

*Combined Discharge*
The proposed addition of concentrated brine effluent to the existing wastewater flow will result in an increase in total discharges through the diffuser which could affect velocity, or turbulence, and water quality in the immediate area.

<u>Turbulence</u>: The minor increase in turbulence immediately adjacent to the diffuser will not result in direct affects to the above listed species due to the large physical size and maneuverability of the individuals in the action area. Based on the life history of these species, the lifestages present in Monterey Bay will consist of advanced juvenile (smolt or subadult) or adult (including leatherback sea turtles and southern resident killer whales), which will be of sufficient size and strength to avoid direct, physical impacts caused by the localized, minor increases in turbulence along the diffuser. However, the impact of the turbulence, caused by small eddies, may affect smaller organisms, such as plankton, which are a foundation of the marine food web and therefore could result in indirect affects to NMFS-trust species. Based on information presented in Appendix B (Roberts 2016) of MBNMS (2017), potential mortality of plankton would be limited to those organisms less than 0.03 inches in diameter, which constitutes approximately 27 percent of the plankton sampled in the area. The precise fraction of this portion of the plankton community that could be harmed as a result of the increased turbulence is unknown, but based on literature, could range from 0 to 50 percent (Roberts 2016). Furthermore, the total volume of water where turbulent intensities are greater than background was estimated to be 0.006 to 0.4 percent of the volumes in the BMZ. Based on the small area of impact and the small fraction of the plankton community within that impacted area that may be harmed or killed as a result of the discharge, NMFS expects the potential impacts from the minor and localized levels of turbulence on NMFS-trust species and their designated critical habitat within the action area, will be insignificant.

<u>Water Quality</u>: The addition of the brine effluent to the existing wastewater will result in an increase in the salinity of the combined discharge into Monterey Bay. On August 9, 2016, NMFS issued its letter of concurrence under Section 7(a) of the ESA for a finding by the U.S. EPA that the *Narrative Receiving Water Limitations for Salinity to the Amendments to the Statewide Water Quality Control Plan for Ocean Waters of California Addressing Desalination Facility Intakes, Brine Discharges and to Incorporate Other Nonsubstantive Changes (SWRCB Resolution 2015-0033) under the Clean Water Act* was not likely to adversely affect various ESA-listed species and critical habitats (including all of those listed above). Under the requirements approved by the U.S. EPA and adopted by the SWRCB, discharges shall not cause the salinity of receiving waters to exceed a daily maximum of 2.0 ppt above ambient as measured 328 feet (or 100 meters) horizontally from the discharge (*i.e.*, the BMZ). Roberts (2016) modeled multiple operating scenarios of the proposed action to assess whether or not they

would meet the requirements of the California Ocean Plan. Under all operating scenarios applicable to the proposed action, the horizontal distance where receiving waters no longer exceeded 2.0 ppt above ambient was less than 42 feet from the point of discharge (*i.e.,* the diffuser), and much less than SWRCBs 328-foot requirement.

The existing discharge is considerably fresher than the ocean and therefore is positively buoyant. As noted above, the addition of the brine effluent from the proposed action will increase the density of the discharge, which could make the combined discharge denser (*i.e.,* saltier) than the ocean, or negatively buoyant under some operating conditions. The buoyancy of the future combined discharge will depend on the proportion of brine effluent produced by the proposed action, to the fresher effluent produced from existing wastewater treatment and the future Pure Water Monterey GWR project effluent. Positively buoyant discharges are able to rise through the water column and are therefore diluted much more rapidly by pelagic currents. Conversely, negatively buoyant discharges sink or spread horizontally from the source near the ocean bottom and are therefore diluted less easily. The rate of dilution and spread of the effluent ultimately depends on the velocity of the ambient current. Roberts (2016) used a conservative velocity of 5 centimeters per second (cm/s) for all analyses, which is less than the tidal currents recorded in Monterey Bay (10 to 25 cm/s) and those recorded at the existing diffuser (6 to 13 cm/s). The discharged salinity plume would diffuse with distance, and by 328 feet, salinity is estimated to be less than 0.98 ppt above ambient levels.[5]

During periods of negatively buoyant discharges, increases in the salinity on the bottom of the ocean could result in shifts in the composition of the benthic community in the vicinity of the diffuser. AECOM (2017) summarizes observations made from various studies on the effects of brine discharges on various species in the benthic community off California. Based on information from these studies, the proposed minimization measures, and the small affected area immediately surrounding the diffuser, the minor increase in salinity is expected to have an insignificant impact on the quality of the habitat necessary to meet the short-term and long-term needs of the identified ESA-listed species and designated critical habitats.

The change in buoyancy and dilution described above could affect the dispersal and dilution of other water quality constituents within the combined discharge. Other constituents of concern that may be present in the combined discharge include ammonia, chlordane, polychlorinated biphenyl (PCBs), tetrachlorodibenzo-p-dioxin (TCDD) equivalents, and toxaphene. However, based on the analysis described in MBNMS (2017) and Roberts (2016), concentrations of these constituents in the discharge are not expected to result in any measureable toxicity to marine life or result in adverse impacts to designated critical habitats within the action area (*i.e.,* ZID) and are therefore insignificant.

*Installation of Castroville Pipeline*

At the Salinas River site, which supports S-CCC steelhead and their designated critical habitat, the installation of the Castroville Pipeline will result in the removal or trimming of a small

[5] According to MBNMS (2017) the salinity within the action area varies between 33.5 and 34.0 ppt depending on marine season (Davidson, upwelling, and oceanic).

amount (0.05 acres) of mixed riparian and upland vegetation and some minor ground disturbance. In addition, the temporary use of a barge to attach the Pipeline to the underside of the Monte Road Bridge will cause insignificant and temporary increases in shade over the surface of the Salinas Lagoon because the bridge already provides shade and this area is such a relatively miniscule portion of the much larger unshaded lagoon.

Riparian vegetation helps maintain stream habitat conditions necessary for steelhead and other fisheries that utilize the Salinas River Lagoon utilized by S-CCC steelhead. Riparian zones and wetland/aquatic vegetation serve important functions in stream ecosystems such as providing shade (Poole and Berman 2001), sediment storage and sorting (Cooper *et al.* 1987, Mitsch and Gosselink 2000), nutrient inputs (Murphy and Meehan 1991), water quality improvements (Mitsch and Gosselink 2000), channel and stream bank stability (Platts 1991), source of woody debris that creates fish habitat diversity (Bryant 1983, Lisle 1986, Shirvell 1990), and both cover and shelter for fish (Bustard and Narver 1975, Wesche *et al.* 1987, Murphy and Meehan 1991). Riparian vegetation disturbance and removal can degrade these ecosystem functions and impair stream habitat. For the proposed project, the removal or trimming of riparian and upland vegetation will be very minimal (0.05 acres), limited to the amount necessary to facilitate access for the pipe installation. Of this amount, only a small proportion is adjacent to the lagoon and a majority is located in upland or ruderal areas and is of no value to S-CCC steelhead habitat. Vegetation along the lagoon does not contribute much shade or influence water temperatures within the wide and vastly unshaded Salinas River lagoon (see Figure 2). Based on the small amount of mixed riparian and upland vegetation proposed for removal or trimming, the proposed replanting with native species expected to regrow quickly (*e.g.,* willow), impacts to a small amount of vegetation along the Salinas River lagoon is expected to have an insignificant effect on the function and ability of that habitat to meet the short-term and long-term needs of steelhead in the Salinas River.

Construction of the pipeline over the Salinas Lagoon will disturb the banks of the Salinas River Lagoon and may introduce sediment into the water column. In cases where suspended sediment loads remain high for an extended period of time, the primary productivity of an aquatic area may be reduced (Cloern 1987) and fish may suffer reduced feeding ability and be prone to fish gill injury (Benfield and Minello 1996; Nightingale and Simenstad 2001). The implementation of erosion control BMPs along the bank is expected to minimize sediment disturbance and prevent any disturbed sediment from entering the lagoon. Due to the small size of the affected areas, disturbance to the banks will be very minimal and will not result in significant short-term or long-term increases in suspended sediment. Therefore, it is unlikely that any meaningful effects from suspended sediment will result from this project, and any increases in suspended sediment will be temporary and likely to have an insignificant impact on steelhead and their habitat.

The temporary use of a barge could result in a disturbance to the substrate of the lagoon during anchoring which is likely to result in insignificant (or immeasurable) increases in turbidity in the lagoon which is naturally turbid due to common high wind velocities in the area. The temporary and minor increases in shade over the lagoon from the barge are also considered insignificant and unlikely to cause any measureable changes in productivity within the lagoon as permanent shade already occurs beneath the existing bridge.

Installation of the pipeline beneath Tembladero Slough using trenchless methods is unlikely to result in any impacts to S-CCC steelhead or their designated critical habitat. The basis for this determination is due to the lack of steelhead in the Gabilan Creek-Tembladero Slough watershed (Casagrande 2010), particularly during the dry season, and the extremely low likelihood the trenchless methods would result in a frac-out or any other impacts to the habitat at the site. Therefore, NMFS considers the potential for impacts to S-CCC steelhead or their habitat in Tembladero Slough from the installation of the pipeline to be discountable.

*Groundwater loss to the Lower Salinas River and Lagoon*

The Salinas River within the area of influence of the slant well pumping is a gaining stream. The slant well pumping could draw in groundwater that would otherwise discharge to the lower river or lagoon. However, the proposed project would not directly pull surface water from the Salinas River, but instead would intercept groundwater from the Dune Sands Aquifer that would otherwise have flowed to the lower river and lagoon, which are utilized by S-CCC steelhead. The Dune Sand Aquifer has experienced seawater intrusion. This magnitude of brackish groundwater diversion away from the Salinas River would be a minor, if not unmeasurable, reduction and therefore is not expected to impact surface flows or water quality of the Salinas River lagoon and adjacent habitats. Furthermore, the existing flow prescription for the Salinas Valley Water Project and the required hydrologic criteria for GWR Project will ensure sufficient bypass flows and water elevations are met in the lower Salinas River and the lagoon. Therefore, NMFS expects the minor potential loss of brackish groundwater from the Dune Sands Aquifer would have an insignificant impact to S-CCC steelhead or the quality of their designated critical habitat in the Salinas River lagoon.

**Conclusion**

Based on this analysis, NMFS concurs with the MBNMS that the proposed action is not likely to adversely affect the subject listed species and designated critical habitats.

**Reinitiation of Consultation**

Reinitiation of consultation is required and shall be requested by MBNMS or by NMFS, where discretionary Federal involvement or control over the action has been retained or is authorized by law and (1) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not previously considered; (2) the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat that was not considered in this concurrence letter; or if (3) a new species is listed or critical habitat designated that may be affected by the identified action (50 CFR 402.16). This concludes the ESA portion of this consultation.

## MAGNUSON-STEVENS FISHERY CONSERVATION AND MANAGEMENT ACT

Under the MSA, this consultation is intended to promote the protection, conservation and enhancement of EFH as necessary to support sustainable fisheries and the managed species' contribution to a healthy ecosystem. For the purposes of the MSA, EFH means "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity", and includes the associated physical, chemical, and biological properties that are used by fish (50 CFR 600.10), and "adverse effect" means any impact which reduces either the quality or quantity of EFH (50 CFR 600.910(a)). Adverse effects may include direct, indirect, site-specific or habitat-wide impacts, including individual, cumulative, or synergistic consequences of actions.

NMFS has determined the proposed action would adversely affect EFH by establishing mixing zones with salinity levels up to 2.0 ppt greater than ambient levels within 328 feet (100 meters) from the discharge area. Within these zones, salinity levels and minor increases in turbulence from the discharge facilities may be high enough to impair the physical, chemical, and biological properties of the habitat to the detriment of fisheries managed under the MSA, including those fisheries federally managed under the Pacific Groundfish, Coastal Pelagic Species, Pacific Coast Salmon, and the West Coast Fisheries for Highly Migratory Species FMPs.

However, the MBNMS proposes to implement various minimization measures to avoid or minimize impacts to federally managed fisheries. For example, SWRCB (2016) requires dischargers to commingle the desalination brine with wastewater if possible to reduce its salinity prior to discharging to receiving waters, or to utilize multiport diffusers if dilution with wastewater is not possible. For the proposed action, the brine effluent will be diluted with other waters from the wastewater treatment plant, and all discharges will be released into Monterey Bay through a multi-port diffuser. In addition, a monitoring program is proposed to ensure discharges are kept within SWRCB criteria. Therefore, NMFS has no practical conservation recommendations to provide to further avoid or mitigate for these impacts.

The MBNMS must reinitiate EFH consultation with NMFS if the proposed action is substantially revised in a way that may adversely affect EFH, or if new information becomes available that affects the basis for NMFS' EFH conservation recommendations (50 CFR 600. 920(l)). This concludes the MSA portion of this consultation.

Please contact Mr. Joel Casagrande in Santa Rosa, California at (707) 575-6016, or via email at joel.casagrande@noaa.gov, if you have any questions regarding this consultation.

Sincerely,

A. Morris

for Barry A. Thom
Regional Administrator

cc: USFWS, Ventura
Corps, San Francisco
CDFW, Fresno
CCRWQCB, San Luis Obispo
Copy to File ARN 151422WCR2017SR00193

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL OCEAN SERVICE
Monterey Bay National Marine Sanctuary
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July 25, 2017

Sent Via Electronic Email Only

Mr. Steve Henry, Field Supervisor
United States Fish and Wildlife Service
Ventura Field Office
2493 Portola Road, Suite B
Ventura, California 93003

SUBJECT: Request for formal consultation under the Endangered Species Act (ESA) Section 7

PROJECT: California American Water Company's Monterey Peninsula Water Supply Project (MPWSP); NOAA/MBNMS-2015-022

Dear Mr. Henry:

The California American Water Company (CalAm) proposes to build a desalinization plant, called the Monterey Peninsula Water Supply Project (MPWSP), which would drill slant wells into the submerged lands of Monterey Bay National Marine Sanctuary (MBNMS) and discharge concentrated brine through an existing outfall into MBNMS. Their action must be authorized or permitted by several federal agencies, including authorizations by the U.S. Army Corp of Engineers pursuant to Section 10 of the Rivers and Harbors Act of 1899 and Section 404 of the Clean Water Act. The U.S. Army may issue a land use permit (Army Regulation (AR) 405-80, 200-1). NOAA, through MBNMS, proposes to issue authorizations and a permit pursuant to the National Marine Sanctuaries Act and has been designated as the lead federal agency for the purposes of the Endangered Species Act. This letter serves to request formal consultation under Section 7 of the Endangered Species Act (ESA) for the Proposed Project/Action.

A Biological Assessment (BA) was prepared by AECOM on behalf of CalAm and submitted to MBNMS on July 1, 2017 titled *Monterey Peninsula Water Supply Project Biological Assessment for United States Fish and Wildlife Service*. It analyzes potential effects of CalAm's MPWSP (Proposed Action) on listed species and designated critical habitat that are regulated by the U.S. Fish and Wildlife Service (USFWS) under the federal ESA. The BA was prepared to meet the ESA requirements identified in 50 Code of Federal Regulations (CFR) §402.12(f). The Proposed Action would be to issue permits for the CalAm project that include a subsurface seawater intake system, a 6.4 million-gallon-per-day (mgd) seawater reverse osmosis (RO) desalination plant, a brine discharge system, product water conveyance pipelines, one pump station, storage facilities and improvements to the existing Seaside Groundwater Basin's aquifer storage and recovery system. The purpose of MPWSP is to replace existing water supplies for CalAm's Monterey District service area, with a focus on reducing water diversions from the Carmel River.

Summary of Findings

Based on review of the BA, MBNMS has determined that the Proposed Action would have temporary direct adverse impacts on federally listed plants and animals during construction, and the Proposed Action would have permanent impacts in the form of eliminating habitat for some species. These impacts would be minimized through implementation of Avoidance and Minimization Measures. Impact determinations for each federally listed species under USFWS jurisdiction are included in Table 1.

Table 1. Impact Determinations for Federally Listed Species Under USFWS Jurisdiction

| Common Name | Scientific Name | Species Determination | DCH Determination |
|---|---|---|---|
| **Monterey spineflower**<br>**Monterey gilia**<br>**Yadon's piperia**<br>**Menzies' wallflower** | *Chorizanthe pungens var. pungens*<br>*Gilia tenuiflora ssp. Arenaria*<br>*Piperia yadonii*<br>*Erysimum menziesii* | LAA | NE |
| **Smith's blue butterfly** | *Euphilotes enoptes smithi* | LAA | NE |
| **tidewater goby** | *Eucyclogobius newberryi* | NLAA | NLAA |
| **California tiger salamander** | *Ambystoma californiense* | LAA | NE |
| **California red-legged frog** | *Rana draytonii* | LAA | LAA |
| **western snowy plover** | *Charadrius alexandrinus nivosus* | LAA | NE |
| **least Bell's vireo** | *Vireo bellii pusillus* | NE | NE |
| **southern sea otter** | *Enhydra lutris nereis* | NE | NE |

Notes
DCH – Designated Critical Habitat
LAA – May affect, and is likely to adversely affect
NE – No Effect
NLAA – May affect, but is not likely to adversely affect

Project Description

CalAm proposed to build a desalination plant with the capacity to produce up to 9.6 mgd of desalinated product water (proposed project in MPWSP DEIR/EIS Jan 2017). However, the Pure Water Monterey Groundwater Replenishment project (GWR) was approved by the Monterey Regional Water Pollution Control Agency (MRWPCA) in October 2015, and the California Public Utilities Commission (CPUC) in September 2016, which authorized CalAm to purchase 3,500 afy of the GWR supply for extraction from the Seaside Groundwater Basin. The GWR Project was considered in the MPWSP DEIR/EIS as a project in the cumulative scenario for several of the alternatives, including Alternative 5a, which was determined to be the Environmentally Preferred project by MBNMS. Alternative 5a represents a reduced-capacity project compared to the original proposed desalination facility and is the project that was analyzed for the Biological Assessment. An Endangered Species Act Section 7 Concurrence Letter for the GWR project was issued by your office on December 20, 2016 (08EVEN00-2016-F-0523) and is therefore not included in this consultation.

The project area extends approximately 18 miles from the town of Castroville in the north to the City of Carmel in the south. A more complete project description can be found in the *Monterey Peninsula Water Supply Project Biological Assessment for United States Fish and Wildlife Service* beginning on page 2-1.

<u>Action Area</u>
The project footprint is comprised of the pipeline alignments; the boundaries of all permanent infrastructure (Intake Slant Wells, the Proposed Desalination Plant, Aquifer Storage and Recovery (ASR) wells, source water and desalinated water pipelines and the Carmel Valley Pump Station); and all work areas, access routes and staging areas necessary for construction. The Action Area, as defined in 50 CFR §402.2, includes all areas directly or indirectly affected by the federal action, as well as interrelated and interdependent actions. The Action Area includes the project footprint plus a 50-foot (15 meter) buffer around the project footprint totaling approximately 151 acres (See Table 2-2 in BA). The size of this buffer is based on the extent of expected construction activities and is relatively small due to the avoidance and minimization measures identified for the project, which include measures to prevent erosion and hazardous materials spills, limit mobilization of dust, and limit noise disturbance from construction equipment (See Figure 2-1 in BA).

<u>Construction Schedule</u>
Construction is expected to start July 2018 and continue through June 2020 (24 months total).

The slant well installation would be done in two phases: (1) well drilling and (2) well development. All construction activities for the subsurface slant wells would occur inland of the year 2020 MHW line and in previously disturbed areas, landward of the dunes. Slant well construction would take approximately 10 to 12 months to complete, and could take place anytime throughout the overall 24 month construction duration for the Proposed Action.

Construction activities at the Desalination Plant site are expected to occur over 24 months.

ASR injection and extraction well construction activity would be necessary 24 hours per day for approximately 4 weeks, per well, from the initial well drilling until final depth is reached and the borehole is stabilized. Construction of both wells is expected to take 12 months.

Pipeline installation would occur at a rate of approximately 150 to 250 feet per day over the 24 month construction period. Topsoil would be stockpiled separately and replaced last. Under typical circumstances, the width of the disturbance corridor for pipeline construction would vary from 50 to 100 feet (15 to 30 meters), depending on the size of the pipe being installed. Multiple pipelines would be built simultaneously. Although most pipeline construction would occur over a 15-month period, pipeline construction could occur any time throughout the entire 24-month construction period. The construction durations for most individual pipelines would be much shorter than 15 months. Pipeline installation would be sequenced to minimize land use disturbance and traffic disruption to the extent possible.

At the Carmel Valley Pump Station construction is estimated to begin in June 2018 and conclude by September 2018. Construction would occur 8 hours per day, 5 days a week over a 4 month construction period.

Consultation Summary

AECOM (formerly URS) met with the assigned Ventura USFWS program manager, Jake Martin, at his Santa Cruz office located at 1100 Fiesta Way in Watsonville, CA, on at least three occasions over the past three years. During each of these discussions, biological resource survey plans and/or prior survey results were discussed and direction was sought from the regulatory agencies, including USFWS, MBNMS and the California Department of Fish and Wildlife (CDFW), on future survey methods based on project design elements developed to date. In addition, MBNMS staff, acting as lead federal agency, as well as other stakeholders have been engaged with the USFWS regarding the Proposed Action over the last five years. The following meetings have occurred in preparation for consultation with USFWS:

- Meeting with USFWS 2/12/14: USFWS and AECOM discussed approach to consultation under the federal Endangered Species Act (ESA).
- Meeting with USFWS 11/12/15: USFWS, CDFW, MBNMS, CalAm, AECOM, Environmental Science Associates, and Point Blue discussed federal consultation requirements, coordination of whole Proposed Action for consultation, timing of the biological assessment versus the Draft Environmental Impact Report/Environmental Impact Statement (DEIR/EIS).
- Meeting with USFWS 4/20/16: USFWS, AECOM, CDFW, MBNMS, and other consultants.

Project Effects

The definition of direct effects is "the direct or immediate effects of the project on the species or its habitat" (USFWS and NMFS 1998). Indirect effects are defined as those "that are caused by the Proposed Action and are later in time, but still are reasonably certain to occur" (50 CFR §402.2).

The following direct effects could occur as a result of the construction activities and are explained in more detail in Table 2 and below:

- Direct disturbance to habitat, including crushing or removing vegetation;
- Crushing or injuring of species by construction equipment;
- Permanent loss of suitable upland habitat where the new desalination plant is constructed;
- Noise or light disturbance, which could deter nesting birds and nocturnal animals.

Indirect effects, including decreases in water quality from construction related erosion and sedimentation as well as habitat degradation from increases in human visitation and trash could result from construction of the proposed project. However, with the implementation of avoidance and minimization measures listed below and in the BA, indirect effects of the proposed action are considered insignificant and discountable. Table 2 (Table 5-1 in BA) lists areas of temporary and permanent impacts to habitat for federally listed species.

Table 2. Areas of Temporary and Permanent Impact to habitat for Federally Listed Species

| Species | Temporary Impact Area acres (hectares) | Permanent Impact Area acres (hectares) |
|---|---|---|
| Monterey spineflower | 105.08 acres (42.52 hectares) total<br>10.63 acres (4.30 hectares) on federal land | 14.39 acres (5.82 hectares) total<br>0.04 acres (0.02 hectares) on federal land |
| Menzies' wallflower | 33.18 acres (13.43 hectares) | 0 |
| Monterey gilia | 88.06 acres (35.64 hectares) total<br>10.63 acres (4.30 hectares) on federal land | 11.20 acres (4.53 hectares) total<br>0.04 acres (0.02 hectares) on federal land |

Table 2. Areas of Temporary and Permanent Impact to habitat for Federally Listed Species

| Species | Temporary Impact Area acres (hectares) | Permanent Impact Area acres (hectares) |
|---|---|---|
| Yadon's piperia | 21.42 acres (8.67 hectares) total<br>1.99 acres (0.81 hectares) on federal land | 0 |
| Smith's blue butterfly | 107.34 acres (43.44 hectares) | 14.74 (5.97 hectares) |
| tidewater goby | 0.26 | 0 |
| California tiger salamander | 38.01 acres (15.38 hectares) | 14.73 acres (5.96 hectares) |
| California red-legged frog | 6.07 acres (2.46 hectares) | 0 |
| western snowy plover | 25.74 acres (10.42 hectares) | 0.01 acres (0.004 hectares) |
| least Bell's vireo | 0 | 0 |
| southern sea otter | Impacts discountable; areas not calculated | Impacts discountable; areas not calculated |

**Federally listed plants on federal lands**

Three federally listed plants have potential to occur on federal lands: Monterey spineflower (federally threatened), Monterey gilia (federally endangered), and Yadon's piperia (federally endangered). There is suitable habitat for Monterey spineflower, Monterey gilia, and Yadon's piperia within the Action Area on federal lands and the Proposed Action is likely to cause disturbance and mortality through vegetation clearing, grubbing, grading, and trenching along the pipeline alignment. The Proposed Action would also permanently eliminate habitat at the ASR well sites. The Avoidance and Minimziation Measures described in Section 3 will limit habitat disturbance and mortality to the greatest extent practicable. In addition, temporarily-disturbed habitat will be mitigated at a 1:1 ratio and permanently-disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for mortality during construction, the Proposed Action **may affect, and is likely to adversely affect** Monterey spineflower, Monterey gilia, and Yadon's piperia on federal lands. There is no Designated Critical Habitat (DCH) for federally listed plants on federal lands within the Action Area. Therefore, the Proposed Action would have **no effect** on federally listed plant DCH on federal lands.

**Federally listed plants on non-federal lands**

Four federally listed plants have potential to occur on federal lands: Monterey spineflower (federally threatened), Monterey gilia (federally endangered), Yadon's piperia (federally endangered) and Menzies' wallflower. The Proposed Action is likely to cause disturbance and mortality through vegetation clearing, grubbing, grading and trenching along the pipeline alignment, at the Proposed Desalination Plant Site, at the Intake Slant Well sites, and at the Carmel Valley Pump Station. Construction of the Proposed Desalination Plant and the Carmel Valley Pump Station would also permanently eliminate habitat for federally listed plants on non-federal lands. The Avoidance and Minimization Measures described below will limit habitat disturbance and mortality to the greatest extent practicable. In addition, temporarily-disturbed habitat will be mitigated at a 1:1 ratio and permanently-disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for mortality during construction, the Proposed Action **may affect, and is likely to adversely affect** federally listed plants on non-federal lands. Critical habitat for federally listed plants either has not been designated or does not overlap with the Action Area. Therefore, the Proposed Action would have **no effect** on DCH for federally listed plants.

**Smith's Blue Butterfly**

Suitable habitat for Smith's blue butterfly is present within the Action Area along the majority of the pipeline alignment south of the Salinas River, at the Intake Slant Well sites, at the Proposed Desalination Plant site and at the Carmel Valley Pump Station. The Proposed Action may cause injury or mortality during construction and would permanently eliminate some habitat for the species; however, the Avoidance and Minimization Measures described below and in the BA will limit habitat disturbance, injury, and mortality to the greatest extent practicable. In addition, temporarily disturbed habitat will be mitigated at a 1:1 ratio and permanently disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for injury or mortality during construction, the Proposed Action **may affect, and is likely to adversely affect** Smith's blue butterfly. Critical habitat has not been designated for Smith's blue butterfly; therefore, the Proposed Action would have **no effect** on Smith's blue butterfly DCH.

**Tidewater Goby**

There is high potential for tidewater goby to occur in the Salinas River in the Action Area and a low potential for the species to occur in Tembladero Slough in the Action Area. The Proposed Action may cause adverse impacts on habitat or injury or mortality during construction if equipment or materials fall into the water or in the event of a horizontal directional drilling (HDD) frac-out. However, with proper implementation of the Avoidance and Minimization Measures described below and in the BA, the likelihood of objects falling into the water during construction and the likelihood of an HDD frac-out would be discountable. Therefore, the Proposed Action **may affect, but is not likely to adversely affect** tidewater goby.

DCH for tidewater goby overlaps with the Action Area in the Salinas River. The Proposed Action may cause adverse impacts on DCH for tidewater goby if equipment or materials fall into the water and degrade water quality. However, with proper implementation of the Avoidance and Minimization Measures described below and in the BA, the likelihood of objects falling into the water during construction would be discountable. Therefore, the Proposed Action **may affect, but is not likely to adversely modify** tidewater goby DCH.

**California Tiger Salamander**

Suitable habitat for California tiger salamanders is present along portions of the ASR pipelines, the new Transmission Main, Desalinated Water Pipeline, Source Water Pipeline, Brine Discharge Pipeline, Pipeline to Castroville Seawater Intrusion Project (CSIP) Pond, and Castroville Pipeline, as well as at the proposed Desalination Plant site. There is high potential for California tiger salamander to occur in the Action Area due to the presence of suitable upland habitat including small mammal burrows. The Proposed Action may cause injury or mortality during construction and would eliminate habitat for the species at the proposed Desalination Plant site and the ASR well sites. The Avoidance and Minimization Measures described below and in the BA will limit habitat disturbance, injury, and mortality to the greatest extent practicable. In addition, temporarily disturbed habitat will be mitigated at a 1:1 ratio and permanently disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for injury or

mortality during construction, the Proposed Action **may affect, and is likely to adversely affect** California tiger salamander.
DCH for California tiger salamander is not present in the Action Area; therefore the Proposed Action would have **no effect** on California tiger salamander DCH.

**California Red-legged Frog**
The Action Area contains suitable breeding and dispersal habitat for California red-legged frog and there is moderate potential for the species to occur along segments of the pipeline alignment, particularly in the portion of the Action Area around Tembladero Slough (new Castroville Pipeline), the Salinas River (new Castroville Pipeline), and the Carmel River (Carmel Valley Pump Station). There is also potential for the species to occur near the proposed Desalination Plant site along the banks of the Salinas River and adjacent wetlands, and at the Neponset Road Pond. The Proposed Action may cause injury or mortality during construction. The Avoidance and Minimization Measures described below and in the BA will limit habitat disturbance, injury, and mortality to the greatest extent practicable. In addition, temporarily disturbed habitat will be mitigated at a 1:1 ratio and permanently disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for injury or mortality during construction at the Salinas River and Tembladero Slough, the Proposed Action **may affect, and is likely to adversely affect** California red-legged frog.

DCH for California red-legged frog is present in the Action Area at the Carmel Valley Pump Station. Construction of the Carmel Valley Pump Station would include clearing and grading construction and staging areas; excavating; installing pipelines and pipe connections; pouring concrete footings; constructing walls and roofs; and finish work such as paving, landscaping and fencing. Temporarily disturbed DCH will be mitigated at a 1:1 ratio and permanently disturbed DCH will be mitigated at a 3:1 ratio. Because the facility would permanently eliminate California red-legged frog DCH, the Proposed Action **may affect, and is likely to adversely modify** California red-legged frog DCH.

**Western Snowy Plover**
A breeding population of western snowy plover has been documented in the sand dunes at the CEMEX Lapis Plant annually since 2008, and modeling results also show suitable habitat for western snowy plover at the CEMEX Lapis Plant. There is high potential for western snowy plover to occur in the Action Area at the CEMEX Lapis Plant. The Proposed Action may cause disturbance, injury, or mortality during construction and would permanently eliminate habitat for the species at the source-water Intake Slant Well sites. The Avoidance and Minimization Measures described below and in the BA will limit habitat disturbance, injury, and mortality to the greatest extent practicable. In addition, temporarily disturbed habitat will be mitigated at a 1:1 ratio and permanently disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for injury or mortality during construction, the Proposed Action **may affect, and is likely to adversely affect** western snowy plover. DCH for western snowy plover is not present in the Action Area; therefore, the Proposed Action would have **no effect** on western snowy plover DCH.

**Least Bell's Vireo**
There is low potential for least Bell's vireo to occur in the Action Area and the modeling showed no suitable habitat in the Action Area. Due to the lack of suitable habitat and low potential for the species to occur in the Action Area, any potential adverse of effects of the Proposed Action would be discountable

and therefore the Proposed Action would have **no effect** on least Bell's vireo. DCH for least Bell's vireo is not present in the Action Area; therefore, the Proposed Action would have **no effect** on least Bell's vireo DCH.

**Southern Sea Otter**

The Proposed Action is not anticipated to directly affect the southern sea otter due to the absence of construction activities that would alter suitable, occupied habitat in the Action Area. There is potential for southern sea otter to be indirectly adversely affected by the Proposed Action if the brine discharge associated with the Proposed Action alters the benthic community. While there is some potential for southern sea otter to occur in the Action Area, individuals are unlikely to spend extended periods of time in the area due to the distance from shore and water depths. The Proposed Action may cause minor changes to the benthic community in the vicinity of the discharge due to elevated ammonia (up to 15 meters from the outfall structure) or salinity (up to 350 meters from the outfall structure). However, such changes are not expected to have adverse effects on sea otter due to the transient nature of the exposure. Therefore, the Proposed Action would have **no effect** southern sea otter.

Critical habitat has not been designated for the southern sea otter; therefore, the Proposed Action would have **no effect** on southern sea otter DCH.

Avoidance and Minimization Measures

CalAm will retain a lead biologist to oversee implementation of Avoidance and Minimization Measures to protect special-status species and sensitive natural communities prior to construction, during construction and periodic maintenance activities. In the event that construction-related activities have the potential to violate the prescribed special-status species and habitat protection measures, the project Lead Biologist, or other appointed qualified biological monitors will report to construction or operational site supervisors with authority to stop work to prevent any violations. Work will proceed only after the construction-related hazards to special-status species and habitats are removed and the species is no longer at risk.

1) Implement general best management practices (BMPs) (See *Monterey Peninsula Water Supply Project Biological Assessment* Section 3.1 for list of 22 BMPs.
2) Environmental Awareness Training will be provided to all construction workers prior to starting work.
3) General noise controls will be implemented, i.e. muffle internal combustion engines, use of hydraulic or electric tools instead of pneumatic, move noise sources away from sensitive special-status species.
4) A Storm Water Pollution Prevention Plan and Hazardous Materials Spill Prevention Plan will be developed and implemented.
5) Use of vibration reduction measures
6) Site –specific construction lighting measures
7) Contractors will implement a dust control plan on construction sites.
8) Frac-out contingency plan
9) Measures listed in Section 3.1.9 will be implemented to avoid, minimize, and compensate for construction impacts on sensitive communities.
10) A Habitat Mitigation and Monitoring Plan (HMMP) will be developed and submitted to appropriate resource agencies for approval prior to project construction. The HMMP will be

implemented at all areas where special-status species habitat or sensitive natural communities will be restored, created, or enhanced to mitigate for project impacts either prior to, concurrently with, or following project construction, as specified in the HMMP. The HMMP will outline measures to be implemented to, depending on the mitigation requirements, restore, improve, or reestablish special-status species habitat, sensitive natural communities and critical habitat on the site.

11) Measures listed in Section 3.2 of the BA will be implemented for species-specific avoidance for federally listed plants, Smith's Blue butterfly, tidewater goby, California tiger salamander and California red-legged frog, Western snowy plover and birds covered by the Migratory Bird Treaty Act.

In summary, the Proposed Action would have temporary direct adverse impacts on federally listed plants and animals during construction. The Proposed Action would have permanent impacts in the form of eliminating habitat for some species as a result of the placement of the project facilities. These impacts would be minimized through implementation of Avoidance and Minimization Measures. We respectfully request for formal consultation for the impacts described above related to the proposed action, pursuant to ESA Section 7. If you have any questions, please contact Bridget Hoover, of my staff, at 831-647-4217 or by email at bridget.hoover@noaa.gov.

Sincerely,

Dawn L. Hayes
Deputy Superintendent
Monterey Bay National Marine Sanctuary

Enclosure: MPWSP BA for USFWS Consultation

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Prepared by
AECOM
300 Lakeside Drive, Suite 400
Oakland, CA 94612
February 2018

# Monterey Peninsula Water Supply Project
# Biological Assessment
# for
# U.S. Fish and Wildlife Service Consultation

*Photo: A. Larsen 2016*

February 2018

**Prepared** for:
Monterey Bay National Marine Sanctuary
99 Pacific Street, Building 455A
Monterey, California 93940

February 2018

# Table of Contents

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# List of Tables



# List of Figures

# List of Acronyms

| | |
|---|---|
| afy | acre feet per year |
| ANSI | American National Standards Institute |
| ASR | aquifer storage and recovery |
| BIRP | Begonia Iron Removal Plant |
| CalAm | California American Water |
| CCC | California Castroville Community Services District |
| CCSD | Castroville Community Services District |
| CDFW | California Department of Fish and Wildlife |
| CEQA | California Environmental Quality Act |
| CESA | California Endangered Species Act |
| CNDDB | California Natural Diversity Database |
| CNPS | California Native Plant Society |
| CPUC | California Public Utilities Commission |
| CSIP | Castroville Seawater Intrusion Project |
| CWHR | California Wildlife Habitat Relationships |
| dBA | decibels |
| DCH | designated critical habitat |
| DPS | Distinct Population Segment |
| EIS/R | Environmental Impact Statement/Report |
| ESA | federal Endangered Species Act |
| ESHA | environmentally sensitive habitat areas |
| gpm | gallons per minute |
| GWR | Groundwater Replenishment Project |
| HDD | horizontal directional drilling |
| HMMP | Habitat Mitigation and Monitoring Plan |
| hp | horsepower |
| LAA | likely to adversely affect |
| Leq | equivalent sound level |
| MBMH | Monterey Bay Military Housing |
| MBNMS | Monterey Bay National Marine Sanctuary |
| MBTA | Migratory Bird Treaty Act |
| mgd | million gallons per day |
| MHW | mean high water |
| MRWPCA | Monterey Regional Water Pollution Control Agency |
| MPWSP | Monterey Peninsula Water Supply Project |
| NE | no effect |
| NEPA | National Environmental Policy Act |
| NLAA | not likely to adversely affect |
| NMFS | National Marine Fisheries Service |
| NSF | National Sanitation Foundation |
| PCE | Primary Constituent Element |
| ppt | parts per thousand |
| RO | reverse osmosis |
| ROW | right-of-way |

| | |
|---|---|
| **RWQCB** | **Regional Water Quality Control Board** |
| **SCADA** | **Supervisory Control and Data Acquisition** |
| **SWRCB** | **State Water Resources Control Board** |
| **TAMC** | **Transportation Agency for Monterey County** |
| **USACE** | **U.S. Army Corps of Engineers** |
| **USFWS** | **U.S. Fish and Wildlife Service** |

# Executive Summary

**As the lead federal agency, Monterey Bay National Marine Sanctuary (MBNMS) is responsible for compliance with the federal Endangered Species Act (ESA). This Biological Assessment (BA) analyzes the potential effects of the proposed federal actions, including MBNMS issuing authorizations and a permit to the California American Water (CalAm) Company's Monterey Peninsula Water Supply Project (MPWSP), on listed species and designated critical habitat that are regulated by the U.S. Fish and Wildlife Service (USFWS) under the ESA. The Proposed Action would consist of infrastructure expansion, including installation of a seawater Desalination Plant. CalAm is proposing the MPWSP as a means of developing water supplies for CalAm's Monterey District service area.**

**The draft Environmental Impact Report/Environmental Impact Statement (DEIR/EIS) for the Proposed Action was published on January 13, 2017. This BA analyzes the effects on listed species regulated by USFWS[1] that are associated with the Proposed Action (the environmentally preferred alternative, Alternative 5a)[2] and the various project components described in the DEIR/EIS, except where noted.**

**The proposed MPWSP comprises the following facilities:**

- **A seawater intake system, which would have seven subsurface slant wells (the existing test slant well plus 6 new wells) located at the CEMEX Lapis Plant site (sand mining facility). These wells would extend offshore into the submerged lands of MBNMS. A Source Water Pipeline would convey the combined source water from the slant wells to the Desalination Plant.**
- **A 6.4 million gallons per day Desalination Plant and associated administrative and auxiliary facilities.**
- **Desalinated water conveyance facilities, including pipelines, a pump station and treated water storage tanks.**
- **Brine storage and disposal system including an uncovered 3 million-gallon brine storage basin with two impermeable liners, brine discharge pipeline to a proposed Brine Mixing Facility at the MRWPCA waste water treatment plant, and a combined discharge to the existing MRWPCA ocean outfall that discharges into MBNMS.**
- **An expanded aquifer storage and recovery (ASR) system that would include 2 new wells (ASR-5 and ASR-6) and three parallel pipelines that would convey water to and from the new ASR injection/extraction wells and backwash effluent from the wells to an existing settling basin.**

**In order to assess the potential adverse impacts of the Proposed Action on federally listed species under USFWS jurisdiction, a background literature review was conducted and several years of wildlife and botanical surveys were performed. Potential impacts were evaluated for twelve federally listed plants, two of which are federally endangered and have potential to occur on federal lands in the Action Area, and twelve federally listed animals. In addition, designated critical habitat for two federally listed animals (tidewater goby and California red-legged frog) overlaps with the Action Area.**

---

[1] A separate National Marine Fisheries Service (NMFS) BA has been prepared to address species under NMFS jurisdiction and essential fish habitat.

[2] The Proposed Project or Action in the DEIR/EIS is a larger version of the project, with the same components and at the same location; the Proposed Action in this BA is the reduced-size project analyzed as Alternative 5a in the DEIR/EIS.

**The Proposed Action would have temporary direct adverse impacts on federally listed plants and animals during construction, and the Proposed Action would have permanent impacts in the form of eliminating habitat for some species. These impacts would be minimized through implementation of Avoidance and Minimization Measures. Impact determinations for each federally listed species under USFWS jurisdiction are included in Table ES-1.**

**Table ES-1. Impact Determinations for Federally Listed Species Under USFWS Jurisdiction**

| Common Name | Scientific Name | Species Determination | DCH Determination |
|---|---|---|---|
| Federally listed plants on federal lands | Multiple | LAA | NE |
| Federally listed plants on non-federal lands | Multiple | LAA | NE |
| Smith's blue butterfly | *Euphilotes enoptes smithi* | LAA | NE |
| tidewater goby | *Eucyclogobius newberryi* | NLAA | NLAA |
| California tiger salamander | *Ambystoma californiense* | LAA | NE |
| California red-legged frog | *Rana draytonii* | LAA | LAA |
| western snowy plover | *Charadrius alexandrinus nivosus* | LAA | NE |
| least Bell's vireo | *Vireo bellii pusillus* | NE | NE |
| southern sea otter | *Enhydra lutris nereis* | NE | NE |

Notes
DCH – Designated Critical Habitat
LAA – May affect, and is likely to adversely affect
NE – No Effect
NLAA – May affect, but is not likely to adversely affect

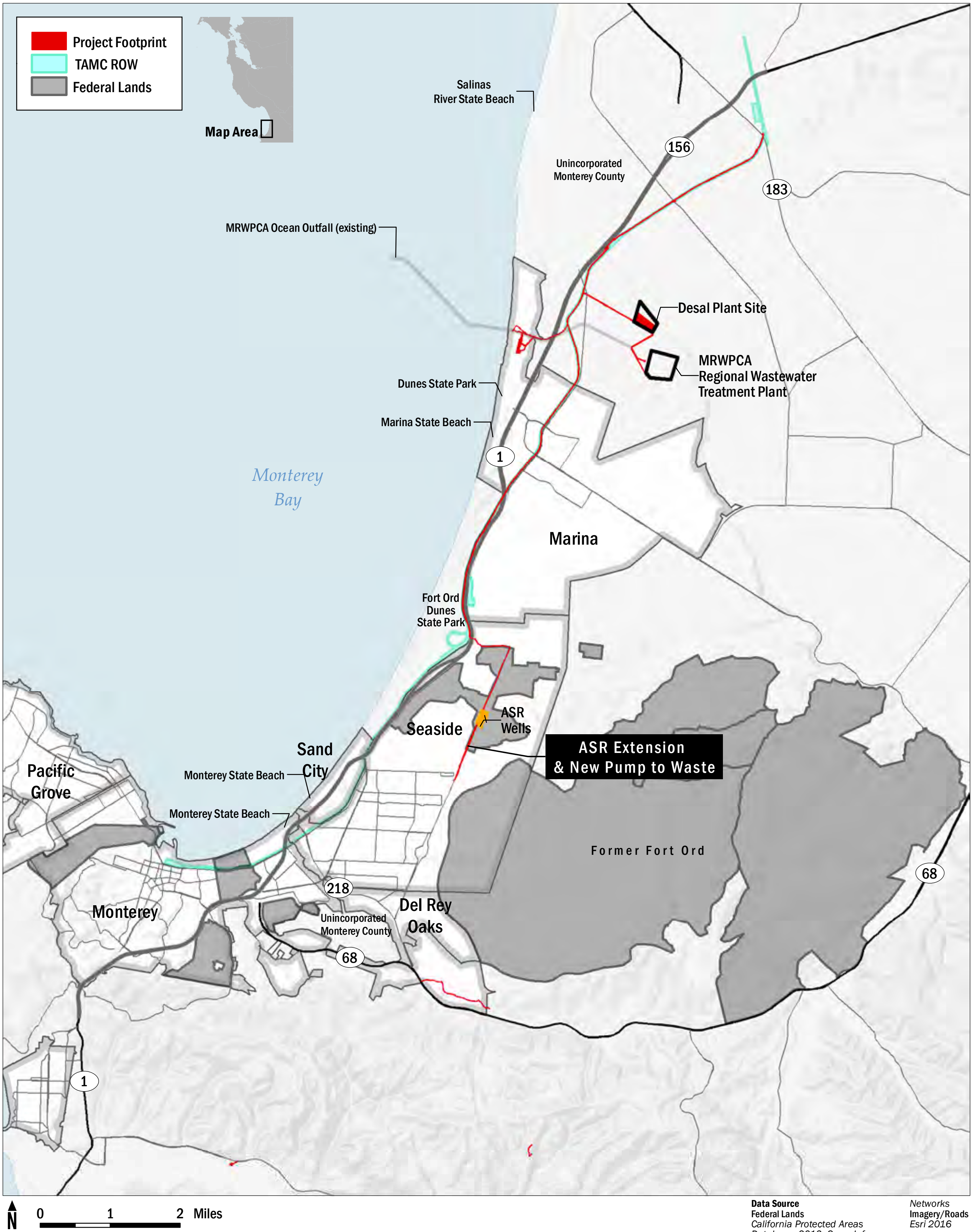
# 1 Introduction

As the lead federal agency, Monterey Bay National Marine Sanctuary (MBNMS) is responsible for compliance with the Endangered Species Act (ESA). This Biological Assessment (BA) analyzes the potential effects of the California American Water (CalAm) Company's Monterey Peninsula Water Supply Project (MPWSP; Proposed Action) on listed species and designated critical habitat (DCH) that are regulated by the U.S. Fish and Wildlife Service (USFWS) under the ESA. This BA has been prepared to meet the ESA requirements identified in 50 Code of Federal Regulations (CFR) §402.12(f). The purpose of the Proposed Action is to replace existing water supplies for CalAm's Monterey District, with a focus on reducing surface water diversions from the Carmel River and extractions from the Seaside Groundwater Basin.

CalAm and the MPWSP are constrained by legal decisions affecting the Carmel River and Seaside Groundwater Basin water resources. State Water Resources Control Board (SWRCB) Order 95-10, SWRCB Order 2009-0060, and the Monterey County Superior Court's adjudication of the Seaside Groundwater Basin in 2006 substantially reduced CalAm's rights to use these two primary sources of water supply. SWRCB Order 95-10 established that CalAm must reduce diversion of water from the Carmel River to its legal entitlement of 3,376 acre-feet per year (afy) and SWRCB Order 2009-0060 established that CalAm must reduce diversion from the Seaside Groundwater Basin from approximately 4,000 afy to 1,474 afy by December 31, 2016. On July 19, 2016, the SWRCB adopted Order WR 2016- 0016, amending Order WR 2009-0060, requiring that unauthorized diversions from the Carmel River end by December 31, 2021, regardless of whether the envisioned projects are timely built. CalAm must replace this reduction in source water with a consistent and reliable water supply in order to maintain existing service to its Monterey District customers. In response, CalAm has proposed the MPWSP to the California Public Utilities Commission (CPUC) as the preferred solution.

The public draft of the joint Environmental Impact Report (EIR)/Environmental Impact Statement (EIS) was prepared for the Proposed Action by MBNMS, the National Environmental Policy Act (NEPA) lead federal agency, in coordination with the CPUC, the lead agency for the California Environmental Quality Act (CEQA); and was published on January 13, 2017. This BA analyzes the effects on listed species regulated by USFWS associated with the Proposed Action and the various project components described in the January 2017 Draft EIR/EIS (identified as the environmentally preferred alternative, Alternative 5a), except where noted.

The MPWSP (Proposed Action) would consist of an infrastructure expansion project that includes construction of a seawater Desalination Plant, to serve its 40,000 customers and to meet the SWRCB orders in a timely manner. The project location is shown in Figure 1-1. The Proposed Action would produce and store desalinated water in order to convey it to CalAm customers across the greater Monterey Peninsula via the existing distribution system. Implementation of the Proposed Action would also increase use of existing storage capacity in the Seaside Groundwater Basin.




California American Water
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 1-1**
*Project Location*

The Proposed Action would include the construction of a seawater intake system, a 6.4-mgd Desalination Plant and attached or auxiliary facilities, desalinated water conveyance facilities (e.g., pipelines, pump stations, and tanks), and an expanded ASR system (injection and extraction wells, pipelines). The primary objectives of the Proposed Action are to:

1. Develop water supplies for CalAm Monterey District service area to replace existing Carmel River water, in accordance with SWRCB Orders 95-10 and 2016-0016;
2. Develop water supplies to enable CalAm to reduce pumping from the Seaside Groundwater Basin consistent with the adjudication of the groundwater basin, with natural yield and improvement of groundwater quality;
3. Provide water supplies to allow CalAm to meet its obligation to pay back the Seaside Groundwater Basin by approximately 700 afy over 25 years, as established by the Seaside Groundwater Basin Watermaster;
4. Develop a reliable water supply for the CalAm Monterey District service area, accounting for the peak month demand of existing customers;
5. Develop a reliable water supply that meets fire flow requirements for public safety;
6. Provide sufficient water supplies to serve existing vacant legal lots of record;
7. Accommodate tourism demand under recovered economic conditions;
8. Minimize energy requirements and greenhouse gas emissions per unit of water delivered; and
9. Minimize project cost and associated water rate increases (CPUC and MBNMS 2017).

The secondary objectives of the Proposed Action are to:

1. Locate key project facilities in areas that are protected against predicted future sea-level rise in a manner that maximizes efficiency for construction and operation, and minimizes environmental impacts;
2. Provide sufficient conveyance capacity to accommodate supplemental water supplies that may be developed at some point in the future to meet build-out demand in accordance with adopted General Plans; and
3. Improve the ability to convey water to the Monterey Peninsula cities by eliminating the hydraulic lowpoint in front of the Naval Postgraduate School, improving the existing interconnections at satellite water systems, and providing additional pressure to move water over the Segunda Grade.

Three federal actions by MBNMS are associated with the MPWSP; they include:

1. Authorization of a Coastal Development Permit, for CalAm to drill into the submerged lands of MBNMS to install a subsurface seawater intake system;
2. Authorization of a Central Coast Regional Water Quality Control Board issued National Pollutant Discharge Elimination System permit or other discharge authorization to allow for the discharge of brine into the Pacific Ocean and MBNMS via an existing ocean outfall pipe; and
3. Issuance of a special use permit to CalAm for the continued presence of a pipeline conveying seawater to and from a desalination facility.

## 1.1 Consultation History

**AECOM (formerly URS) has met with the assigned Ventura U. S. Fish and Wildlife Service (USFWS) program manager, Mr. Jacob "Jake" Martin, at his Santa Cruz Sub-office located at 1100 Fiesta Way in Watsonville, CA, on at least three occasions over the past three years. During each of these discussions, biological resource survey plans and/or prior survey results were discussed and direction was sought from the regulatory agencies, including USFWS, the National Marine Fisheries Service (NMFS), and the California Department of Fish and Wildlife (CDFW), on future survey methods based on project design elements developed to date. In addition, MBNMS staff as lead federal agency, as well as other stakeholders have been engaged with the USFWS regarding the Proposed Action over the last five years. The following meetings have occurred in preparation for consultation with USFWS:**

- **Meeting with USFWS 2/12/14: USFWS and AECOM discussed approach to consultation under the federal Endangered Species Act (ESA).**
- **Meeting with USFWS 11/12/15: USFWS, CDFW, MBNMS, CalAm, AECOM, Environmental Science Associates, and Point Blue discussed federal consultation requirements, coordination of whole Proposed Action for consultation, timing of the biological assessment versus the Draft Environmental Impact Report/Environmental Impact Statement (DEIR/EIS), and State needs.**
- **Meeting with USFWS 4/20/16: USFWS, AECOM, CDFW, MBNMS, and other consultants.**

# 2 Project Description

The Proposed Action involves construction of pipelines and facilities to be placed in unincorporated areas of Monterey County, the town of Castroville, and in the cities of Marina and Seaside. It consists of several distinct physical components which are described below (Figure 2-1). The Proposed Action was evaluated in the DEIR/EIS as Alternative 5a, which is a reduced-size project compared to the DEIR/EIS proposed project.

## 2.1 Project Components

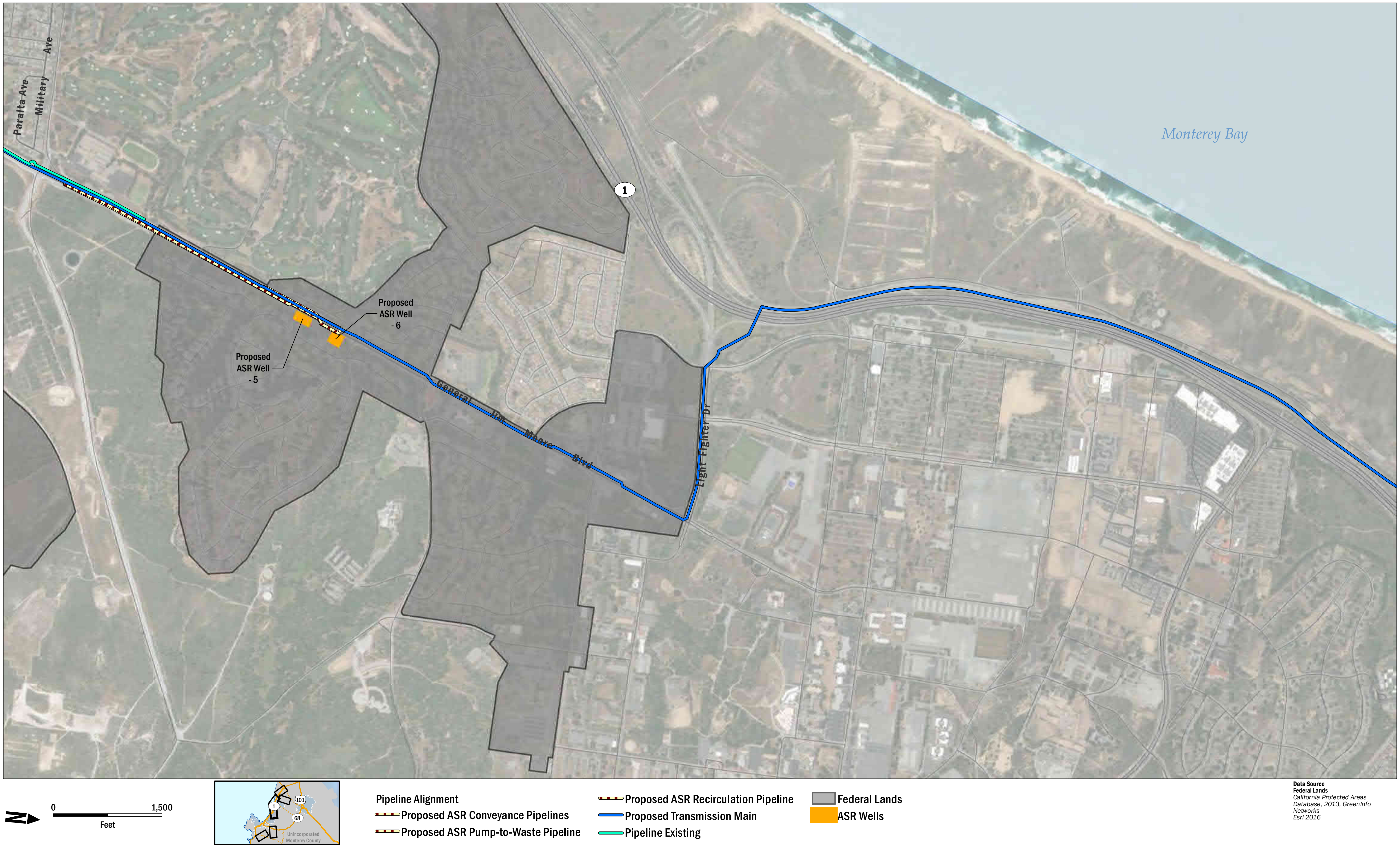
The MPWSP is comprised of the following facilities:

- A seawater intake system, which would have seven subsurface slant wells (the existing test slant well plus 6 new wells) located at the CEMEX Lapis Plant site. These wells would extend offshore into the submerged lands of MBNMS. A Source Water Pipeline would convey the combined source water from the slant wells to the Desalination Plant.
- A 6.4 million gallons per day (mgd) Desalination Plant and attached or auxiliary facilities, including source water receiving tanks; pretreatment, reverse osmosis (RO), and post-treatment systems; chemical feed and storage facilities; brine storage and conveyance facilities; and other associated non-process facilities.
- Desalinated water conveyance facilities, including pipelines, a pump station, and treated water storage tanks.
- Brine storage and disposal system including an uncovered 3 million-gallon brine storage basin with two impermeable liners, brine discharge pipeline to a proposed Brine Mixing Facility at the MRWPCA waste water treatment plant and a combined discharge to the existing MRWPCA ocean outfall that discharges into MBNMS.
- An expanded aquifer storage and recovery (ASR) system, including two additional injection/extraction wells (ASR-5 and ASR-6 wells) and three parallel pipelines: the ASR Conveyance Pipeline, ASR Pump-to-Waste Pipeline, and ASR Recirculation Pipeline. These pipelines would convey water to and from the new ASR injection/extraction wells, and backwash effluent from the wells to an existing settling basin.

### 2.1.1 Seawater Intake System

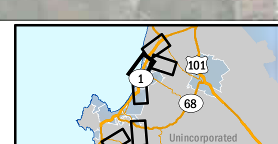
#### *2.1.1.1 Slant Wells*

The seawater intake system would include seven subsurface slant wells located at the CEMEX Lapis Plant site (five active wells at any given time and two on standby). These wells would draw seawater from beneath the ocean floor for use as source water for the MPWSP Desalination Plant. The subsurface slant wells would be located in the City of Marina, about 2 miles (3 kilometers) south of the Salinas River, in the retired mining area section of the CEMEX Lapis Plant site (Figure 2-2). The slant wells would be built on the landward side of the dunes, south of the existing CEMEX access road.




**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# FIGURE 2-1
*Project Footprint*
*Page 1 of 6*

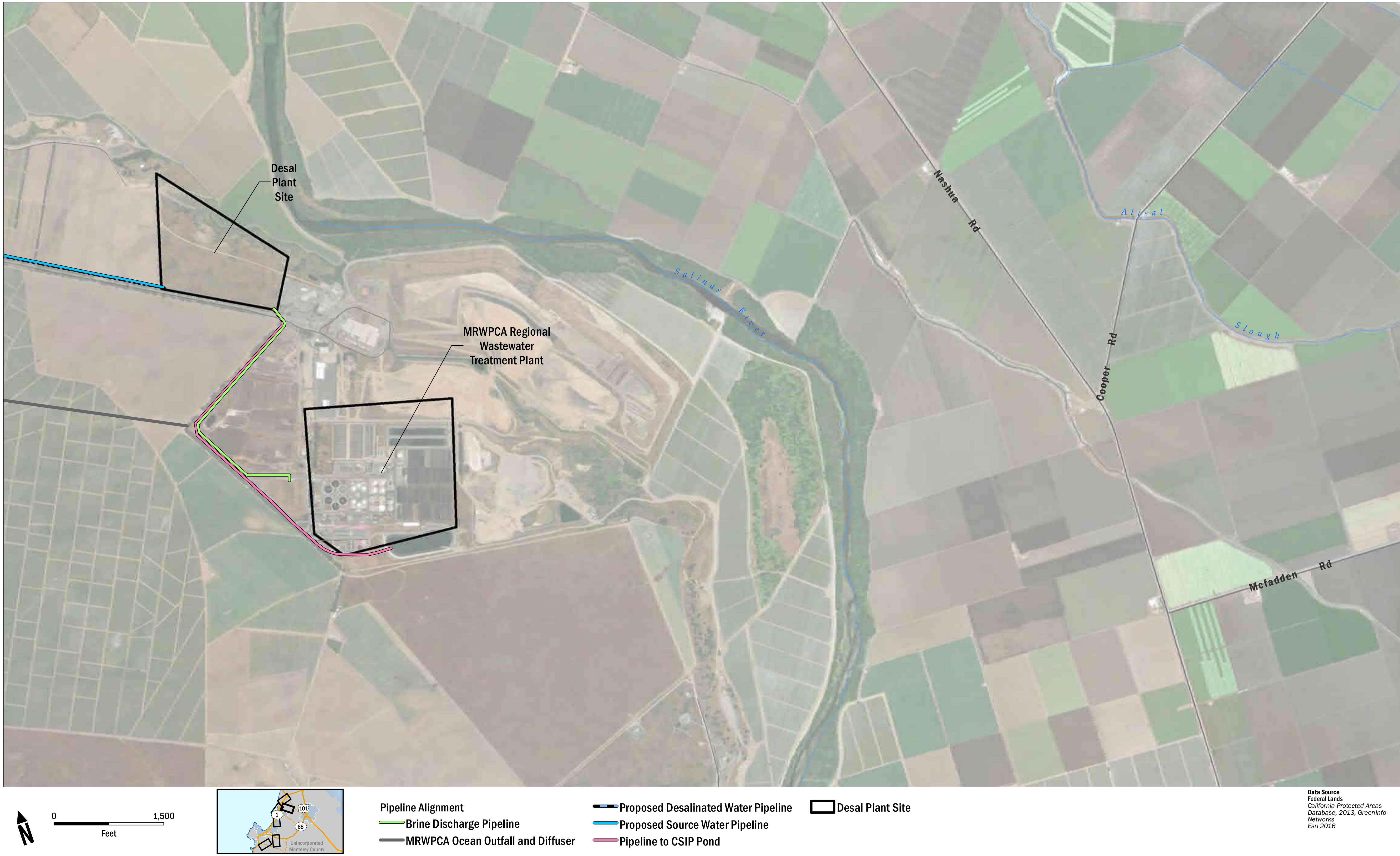

0 1,500
Feet

**Pipeline Alignment**
- MRWPCA Ocean Outfall and Diffuser
- Proposed Desalinated Water Pipeline
- Proposed Source Water Pipeline
- Proposed Transmission Main
- Existing Slant Well
- Proposed Slant Well

**Data Source**
**Federal Lands**
*California Protected Areas Database, 2013, GreenInfo Networks*
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA
WATER SUPPLY PROJECT, MPWSP

# FIGURE 2-1
*Project Footprint*




**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 2-1**
*Project Footprint*
*Page 3 of 6*


0 1,500
Feet

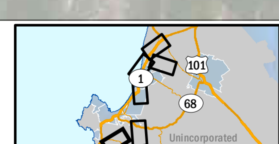
Pipeline Alignment
Proposed Castroville
Proposed Desalinated Water Pipeline
Proposed Source Water Pipeline

Data Source
Federal Lands
*California Protected Areas Database, 2013, GreenInfo Networks*
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 2-1**
*Project Footprint*
*Page 4 of 6*






Pipeline Alignment

Carmel Valley Pump Station Inlet Pipeline

Carmel Valley Pump Station Outlet Pipeline

**Data Source**
**Federal Lands**
*California Protected Areas Database, 2013, GreenInfo Networks*
*Esri 2016*

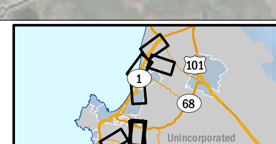
**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA
WATER SUPPLY PROJECT, MPWSP

**FIGURE 2-1**

*Project Footprint*

*Page 5 of 6*


0 1,500
Feet




Pipeline Alignment

Proposed Hidden Hills Pipeline

Ryan Ranch-Bishop Interconnection Improvements

Federal Lands

**Data Source**
**Federal Lands**
*California Protected Areas Database, 2013, GreenInfo Networks*
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 2-1**
*Project Footprint*

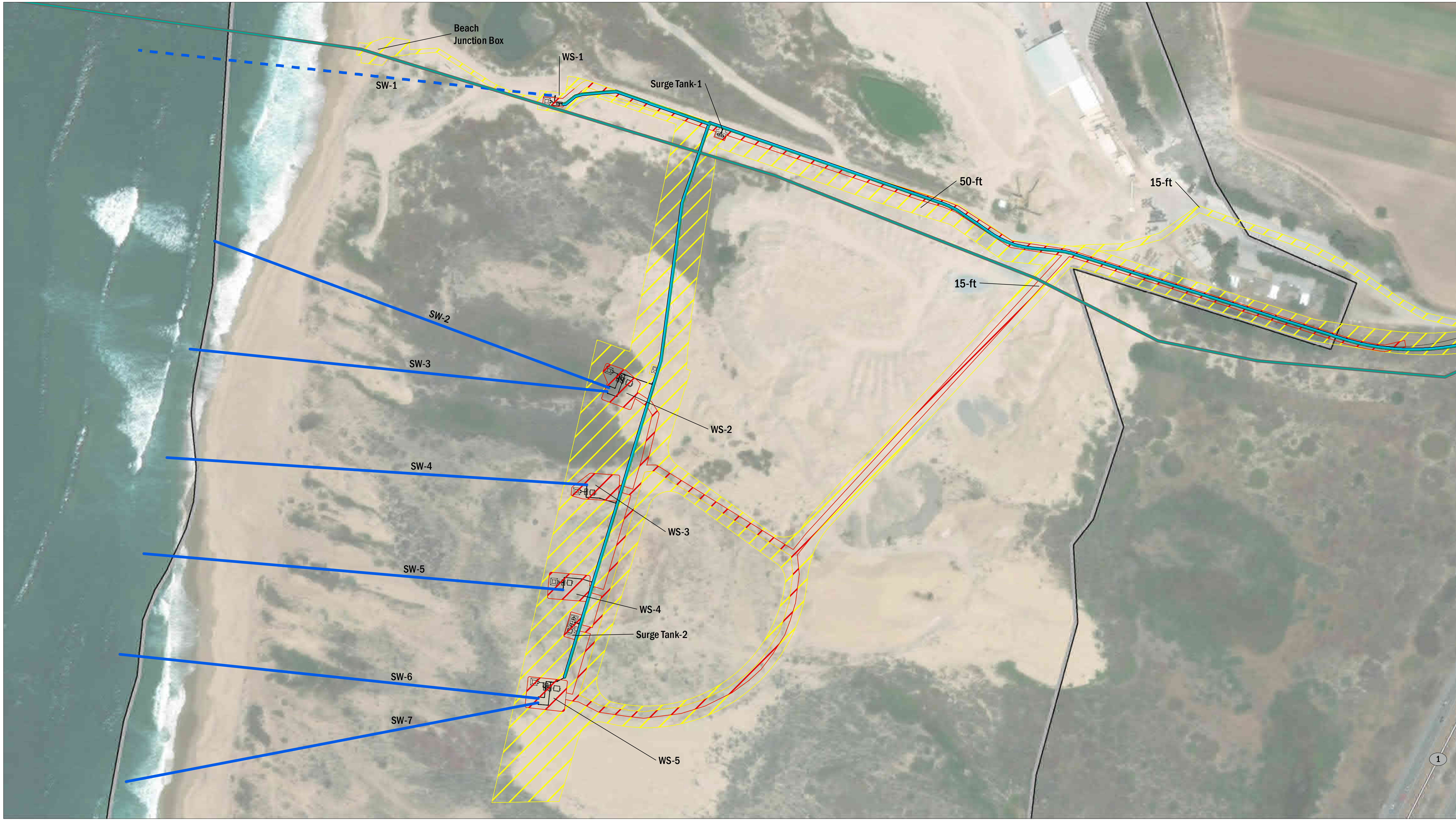
#### *2.1.1.2 Test Slant Well and Long-Term Aquifer Pump Test*

CalAm built a test slant well at the CEMEX Lapis Plant site. The test slant well is currently operating as a pilot program to collect data. The environmental effects associated with construction, operation and decommissioning of the test slant well were evaluated in November 2014 under CEQA and NEPA requirements by the City of Marina/California Coastal Commission (CCC) and MBNMS, respectively. The test well is permitted through February 2019; therefore, construction and operation of the test slant well are not evaluated in this document. The data from the pilot program will inform the final design of the subsurface slant wells, the overall seawater intake system, and the MPWSP Desalination Plant treatment system. MBNMS consulted with USFWS during the NEPA environmental review and received a letter of concurrence on July 7, 2014.

The test slant well facilities include the test well, a submersible well pump, a wellhead vault, electrical facilities and controls, temporary flow measurement and sampling equipment, monitoring wells, and a pipeline connection to the existing, adjacent Monterey Regional Water Pollution Control Agency (MRWPCA) ocean outfall pipeline for discharges of the test water. The test slant well was drilled at 19 degrees below horizontal, is approximately 720 feet (220 meters) long, and is screened for 450 linear feet at depths corresponding to both the Dune Sand Aquifer and the underlying 180-Foot-Equivalent Aquifer of the Salinas Valley Groundwater Basin.

CalAm proposes to convert the test slant well into one of the seven proposed permanent slant wells after testing is done and operate it as part of the MPWSP seawater intake system. The construction of the additional conveyance and treatment facilities needed to convert the test slant well to a permanent well is evaluated in this document. To convert the test slant well into a permanent well, the test well will be shut down and all associated test well infrastructure will be removed, including removal of the above ground mechanical piping, concrete pad, electrical cabinet, and water quality sampling equipment. The only infrastructure that would remain is the valve vault and discharge piping that connects to the MRWPCA ocean outfall junction structure, which will be used for production well development discharge. The existing 100 hp test well submersible pump would be removed and upgraded to a new 250 hp submersible pump to accommodate the larger flow rate (up to 2,500 gpm) and design head. Once the site is clear (except for the well head), the permanent facilities can be installed, including the pump to waste basin, electrical enclosure, below grade mechanical vault, and conveyance pipeline.

The additional slant wells and conveyance and treatment facilities for the source water produced from the subsurface slant wells are described below.




N
0 250
Feet

Permanent Impact
Temporary Impact
City

Pipeline Alignment
MRWPCA Ocean Outfall and Diffuser
Proposed Source Water Pipeline

Existing Slant Well
Proposed Slant Well

Data Source
Federal Lands
*California Protected Areas Database, 2013, GreenInfo Networks*
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA
WATER SUPPLY PROJECT, MPWSP

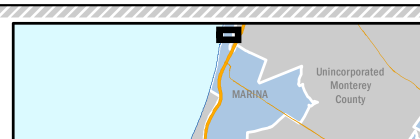



**FIGURE 2-2**
*Intake Slant Wells*

### *2.1.1.3 Permanent Slant Wells*

Six new subsurface slant wells would be drilled from an onshore location and would extend under the seafloor, within MBNMS, using a 22 to 36-inch-diameter (56- to 91-centimeter-diameter) steel casing. The completed pump columns and wellheads would be 10 inches (25 centimeters) in diameter. The six new permanent slant wells would be approximately 900 to 1,000 feet (270 to 300 meters) long and drilled at approximately 14 degrees below horizontal, extending offshore 161 to 356 feet (49 to 109 meters) seaward of the year 2020 mean high water[3] (MHW) line, to a depth of 190 to 210 feet (58 to 64 meters) beneath the seafloor. All construction activities and ground disturbance would occur above mean sea level, landward of the 2020 MHW line. However, the well casings would extend seaward and subsurface of the MHW line, below the seafloor within MBNMS.

The seven slant wells (the converted test slant well plus the six new wells) would be located at four new wellhead sites along the back of the dunes, and the one existing test slant well site. The well sites are numbered sequentially, with Site 1 being the northernmost site and Site 5 the southernmost site. The test slant well site (Site 1) and two new sites (Sites 3 and 4) would each have one slant well, and two sites (Site 2 and 5) would have two slant wells (Figure 2-2). Site 2 would be located about 650 feet (198 meters) south of Site 1. Sites 2 through 5 would be drilled over a total distance of about 975 feet (297 meters). Sites 3, 4 and 5 would be spaced approximately 250 feet (76 meters) apart.

Each of these well sites would include the following aboveground facilities: above ground wellhead(s) (currently existing for the test well at Site 1); a below ground mechanical piping vault (12 by 6 by 6 feet [3.7 by 1.8 by 1.8 meters]) for a meter, valves, and gauges (one per well); an aboveground electrical enclosure (14.5 by 12.5 by 10 feet [4.4 by 3.8 by 3 meters]); and a pump-to-waste basin (12 by 12 feet [3.7 by 3.7 meters]) . Each wellhead would be located aboveground for ease of maintenance. Each slant well would be equipped with a 2,500 gallons per minute (gpm), 300 horsepower (hp) submersible well pump. The electrical controls for operation of the slant wells would be housed in a single-story, 17-foot (5.2-meter)-long, 10-foot (3-meter)-wide, and 10-foot (3-meter)-high concrete enclosure located at each of the five well sites. Each site would also have a pump-to-waste basin for the percolation of turbid water produced during slant well startup and shutdown. The pump-to-waste basin would be constructed of rip rap material on a 2:1 slope, approximately 2 feet (0.6 meters) deep, 12 feet (3.7 meters) long, and 8 feet (2.4 meters) wide and have a sand bottom. Other than two surge tanks, electrical enclosures, and rip rap within each Pump-to-Waste basin, the only physical infrastructure above ground will be the well head, air release valve, and pump to waste discharge pipeline.

The new permanent slant wells and associated infrastructure at Sites 2 through 5 would be constructed on a 5,250– to 6,025-square-foot (488- to 560-square-meter) graded pad located above the maximum high tide elevation on the inland side of the dunes. The seawater pumped from Site 1 would be pumped through the buried Source Water Pipeline located at the existing CEMEX access road. A 750 foot-long (229-meter-long), 42 inch-diameter (1-meter-diameter) buried NSF/ANSI 61-certified pipe would collect the seawater pumped from Sites 2 through 5 and convey it to the proposed Source Water Pipeline.

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[3] The 2020 MHW at the Monterey Tide Gauge NOAA#9413450 equals 5.02 feet NAVD88, considering a high sea level rise scenario of 3.2 inches by 2020 (5.46 feet by 2100).

#### 2.1.1.4 Source Water Pipeline

The proposed Source Water Pipeline would be approximately 2.2-mile (3.5-kilometer) -long, 42-inch (1-meter) -diameter buried pipeline that would convey water from the well clusters to the MPWSP Desalination Plant on Charles Benson Road. From the slant wells, it would generally follow the CEMEX access road and would run parallel to MRWPCA's existing outfall pipeline for approximately 0.7 mile (1.1 kilometer) (Figure 2-1). The Source Water Pipeline would turn northeast approximately 500 feet (150 meters) east of Highway 1 and follow a dirt path for roughly 1,000 feet (300 meters) to Lapis Road. A jack and bore method would be used to install the pipeline under the existing railroad tracks. The pipeline would continue north about 0.5 mile (0.8 kilometer) within the Transportation Agency for Monterey County (TAMC) right-of-way (ROW) along Lapis Road. The pipeline would turn east across Del Monte Boulevard south of the intersection with Lapis Road and continue east for 0.8 mile (1.3 kilometers) to the MPWSP Desalination Plant site at the east end of Charles Benson Road. This segment of pipeline would parallel the north side of Charles Benson Road, outside of the paved road. The pipeline would be installed east-to-west along the north side of the row of mature Monterey cypress and eucalyptus trees that form a boundary between the agricultural land to the north and Charles Benson Road (Figure 2-1). CalAm is negotiating with landowners for an easement for the Source Water Pipeline alignment.

### 2.1.2 MPWSP Desalination Facilities

The Desalination Plant would be sited on approximately 25 acres (10 hectares) of a vacant, 46-acre (19-hectare) parcel of land located along Charles Benson Road in unincorporated Monterey County. The plant would house the seawater desalination infrastructure used to create potable water and would have a 6.4-mgd production capacity (Figure 2-3). The desalination facilities would also include the systems described below.

#### 2.1.2.1 Pretreatment System

The pretreatment system would treat source water to remove suspended and dissolved contaminants that could damage the RO system. Pretreated source water would be conveyed and stored in two 300,000-gallon backwash supply and filtered water equalization tanks.

#### 2.1.2.2 Reverse Osmosis System

The RO system would be housed in a process and electrical building, located in the central portion of the MPWSP Desalination Plant site. The building would also contain an ultraviolet disinfection system (if required) and the cleaning system for the RO membranes.

#### 2.1.2.3 Post-treatment System

The desalinated water would pass through a post-treatment system station after leaving the RO system. This would make the water more compatible with other water supply sources in the CalAm system and provide adequate disinfection prior to distribution to customers. Facility operators would treat the water with various chemicals to ensure the water meets drinking water quality requirements and is compatible with native groundwater in the Seaside Groundwater Basin. These chemicals would be stored onsite in accordance with applicable regulatory requirements.

#### *2.1.2.4 Multi-purpose Pump Station*

A multi-purpose pump station located near the center of the proposed plant would divert waste effluent produced during the RO process to the brine waste stream, and then to be discharged by the existing MRWPCA outfall and diffuser.

#### *2.1.2.5 Administrative Building*

An administrative building at the MPWSP Desalination Plant site would house visitor reception, offices, restrooms, locker rooms, break rooms, conference rooms, a control room, a laboratory, equipment storage and maintenance area, and monitoring and control systems for the RO system, post-treatment system, chemical feed systems, and related facilities.

### 2.1.3 Brine Storage and Disposal Facilities

The brine storage and disposal system would have an uncovered 3-million-gallon brine storage basin with two impermeable liners; two 6 mgd, 40 hp brine discharge pumps; and a brine aeration system to maintain dissolved oxygen concentrations in the brine at 5 milligrams per liter. The RO process would generate approximately 9 mgd of brine, including decanted backwash water. Brine from the RO system would be conveyed through the proposed 3,900-foot (1,189-meter) -long, 36-inch (91-centimeter) -diameter Brine Discharge Pipeline to a proposed Brine Mixing Facility at the MRWPCA wastewater treatment plant. The brine would usually be combined with RO concentrate from the MPWSP and with varying amounts of treated wastewater. The mixture of brine, RO concentrate, and treated wastewater is referred to as the combined discharge. The combined discharge would then be conveyed to the existing MRWPCA ocean outfall that discharges into MBNMS. When temporary storage is needed, brine would be directed to the brine storage basin on the east side of the Desalination Plant, where it can be stored for up to 5 hours, then pumped to the Brine Discharge Pipeline

The existing MRWPCA outfall pipeline is 2.1 miles (3.4 kilometers) long and ends with a 1,100-foot (335-meter) -long, underwater diffuser that rests on rock ballast. The diffuser ports are approximately 6 inches (15 centimeters) above the rock ballast and nominally 54 inches (1.4 meters) above the seafloor. For the dilution calculations, the ports are assumed to be 4 feet (1.2 meters) above the seafloor at approximately 90 to 110 feet (27 to 34 meters) below sea level. The diffuser is equipped with 172 ports (129 open and 43 closed), each 2 inches (5 centimeters) in diameter and spaced 8 feet (2.4 meters) apart on alternating sides of the pipe.

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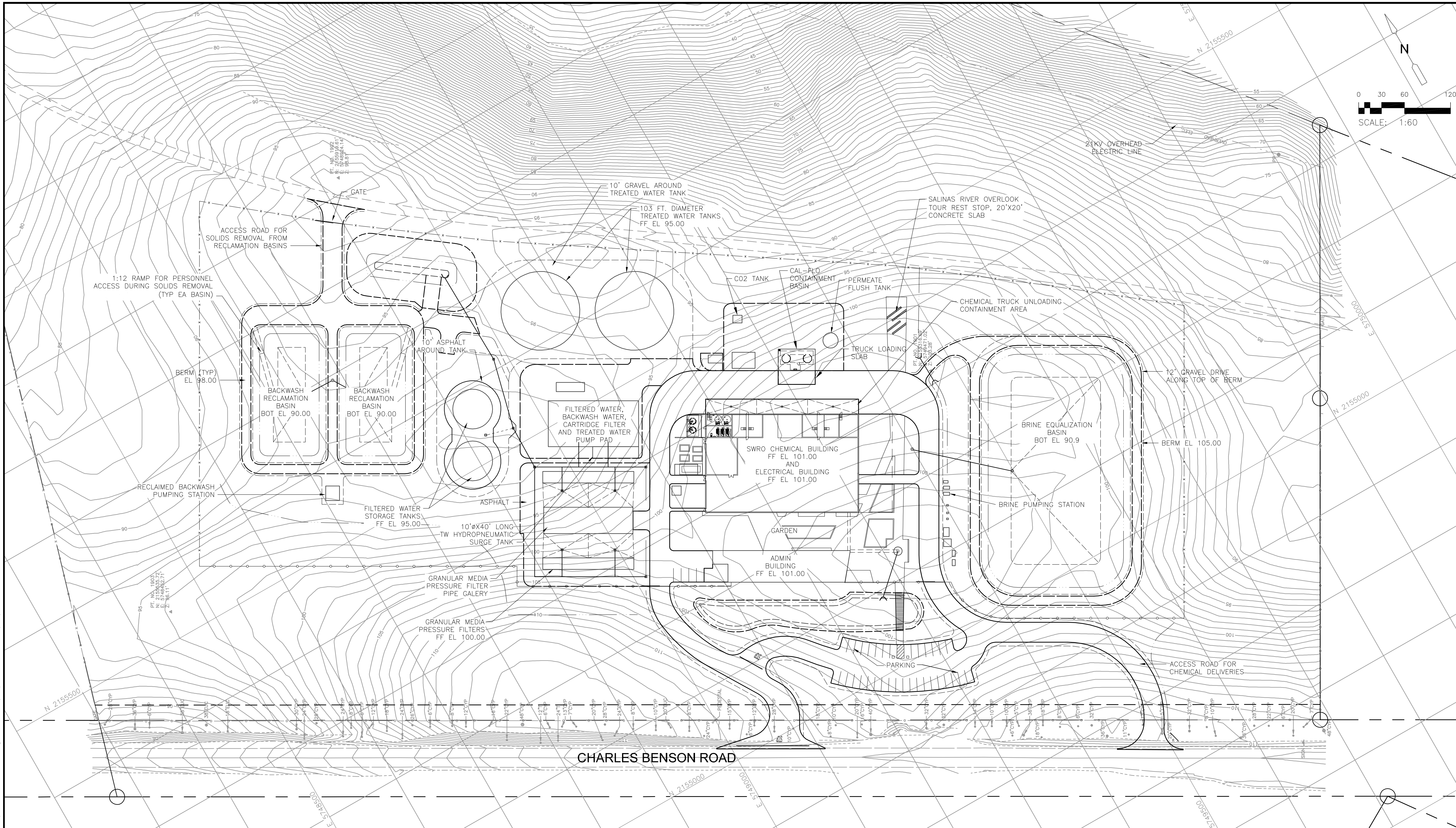




CALIFORNIA AMERICAN WATER

| REVISIONS | REVISIONS |
|---|---|
| | |

CDM Smith
100 Pringle Avenue, Suite 300
Walnut Creek, CA 94596
Tel: (925) 933-2900

####

## LICENSED PROFESSIONAL ENGINEER NO. ####

CDM SMITH
100 PRINGLE AVE., STE 300
WALNUT CREEK, CA

DRAWN BY G. RODRIGUEZ
PROJECT ENG'R D. BROWN

DATE OCTOBER 2014
PROJECT 154001-0191

MPWSP DESALINATION INFRASTRUCTURE PROJECT
CIVIL
SITE PLAN

Figure 2-3

CALIFORNIA AMERICAN WATER CO. | COASTAL DIVISION | USE DIMENSIONS ONLY SCALE AS NOTED

USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES | 60% SUBMITTAL | 154001-0191-C6

154001019106.DWG

### 2.1.4 Desalinated Water Conveyance

Desalinated product water from the MPWSP Desalination Plant would flow south through a series of proposed pipelines (i.e., the Desalinated Water Pipeline and new Transmission Main, described below) to existing CalAm water infrastructure. These pipelines would include surface equipment such as valves and blowoffs.

#### *2.1.4.1 Treated Water Storage Tanks*

Desalinated, post-treatment product water would flow to two covered, aboveground treated-water storage tanks (clearwells). Each tank would be approximately 103 feet (31 meters) in diameter and 35 feet (11 meters) tall, constructed of steel or concrete, and provide 1,750,000 gallons of storage, for a total storage volume of 3.5 million gallons.

#### *2.1.4.2 Desalinated Water Pumps*

The pumps for the desalinated water would be located at the multi-purpose pump station near the center of the Desalination Plant. Salinas Valley return flow pumps would pump desalinated product water (i.e., Salinas Valley return flows) to the Castroville Community Services District (CCSD) and Castroville Seawater Intrusion Project (CSIP) water distribution systems; unless aquifer pump test results at the existing test slant well indicate otherwise. Separate systems would pump desalinated product water to the CalAm water system and to the Salinas Valley.

#### *2.1.4.3 Desalinated Water Pipeline*

The desalinated water pump station would pump desalinated water through the new Desalinated Water Pipeline and new Transmission Main in the CalAm system. The 3.3-mile-long (5.3-kilometer-long), 36-inch-diameter (91-centimeter-diameter) buried new Desalinated Water Pipeline would extend west for approximately 0.8 mile (1.3 kilometer) parallel to the north side of the Charles Benson Road ROW. The Desalinated Water Pipeline would be installed alongside the Source Water Pipeline north of the row of trees separating Charles Benson Road and agricultural land. The Desalinated Water Pipeline would turn north on Del Monte Boulevard for approximately 800 feet (240 meters) to Lapis Road, then continue south within the TAMC ROW along Lapis Road for approximately 1.3 mile (2.1 kilometers) to the southern intersection of Lapis Road and Del Monte Boulevard. From this intersection, the Desalinated Water Pipeline would cross under the Monterey Peninsula Recreational Trail and TAMC ROW using trenchless construction. It would then continue south along the west side of the Monterey Peninsula Recreational Trail and TAMC ROW for approximately 1.4 miles (2.2 kilometers) to Reservation Road (Figure 2-3). The proposed pipeline south of Reservation Road is referred to as the new Transmission Main. The pipeline would include surface equipment such as valves and blowoffs.

#### *2.1.4.4 New Transmission Main*

Water would flow from the Desalinated Water Pipeline and enter the 6-mile-long (10-kilometer-long), 36-inch-diameter (91-centimeter-diameter) new Transmission Main at Reservation Road; it would then continue south along the west side of the Monterey Peninsula Recreational Trail and TAMC ROW. The Transmission Main would cross east, under the Monterey Peninsula Recreational Trail and TAMC ROW, approximately 750 feet (230 meters) north of where it crosses under Highway 1, using trenchless construction. It would continue south on the west side of Del Monte Boulevard, beneath the Highway 1 overpass that crosses above both the onramp from Del Monte Boulevard to Highway 1 and the Monterey Peninsula Recreational Trail, and continue south for approximately 1,000 feet (300 meters). The pipeline would then turn back into the TAMC ROW. The new Transmission Main would turn east-southeast, crossing under Highway 1 approximately 1,000 feet (300 meters) north of the Lightfighter Drive overpass, and continue southeast for approximately 1,400 feet (430 meters), making two turns before reaching the south side of Lightfighter Drive, just east of the intersection of Lightfighter Drive and 1st Avenue. The construction of the crossing under Highway 1 would require an entry pit at the Monterey Peninsula Recreational Trail and TAMC ROW, and an exit pit on the opposite side of Highway 1, between the highway and 1st Avenue. The pits would be approximately 150 feet (46 meters) long by 50 feet (15 meters) wide. The new Transmission Main would continue east along Lightfighter Drive for approximately 0.4 mile (0.6 kilometer) to General Jim Moore Boulevard. It would then turn south along the east side of General Jim Moore Boulevard to Normandy Road. South of Normandy Road the pipeline would be located along the west side of General Jim Moore Boulevard, ending at the existing Phase I ASR Facilities near General Jim Moore and Coe Avenue (Figure 2-1). The pipeline would include surface equipment such as valves and blowoffs.

#### *2.1.4.5 Carmel Valley Pump Station*

The Carmel Valley Pump Station site is located at 26530 Rancho San Carlos Road in unincorporated Monterey County, west of the intersection of Carmel Valley Road and Rancho San Carlos Road. These pipelines are part of the Begonia Iron Removal Plant (BIRP) operation. When operating, BIRP conveys water to both the Forest Lake Reservoir to the west and Segunda Tank to the north through existing interconnecting mains. Currently when BIRP is not operating, no water is being conveyed to the Segunda Tank. The Carmel Valley Pump Station would enable water to be conveyed from Forest Lake Reservoir to the Segunda Tank. The Forest Lake Reservoir would be filled by the Desalination Plant using this Pump Station when BIRP is offline. Additionally, the Carmel Valley Pump Station would provide fire flow indirectly to the Desalination Plant through Crest Tank, which is filled via the existing Segunda Pump Station and tank when BIRP is offline.

The proposed pump station facility would consist of three, 60 hp pumps and approximately 1,000 linear feet (300 meters) of inlet and outlet piping. The mechanical equipment would be housed and raised above the 100-year flood elevation in a proposed concrete 756 square-foot (70-square-meter) structure and 15.00-foot (4.57-meter) tall masonry structure building (Figure 2-1). Construction of the Carmel Valley Pump Station would result in approximately 40,000 square feet (or 0.9 acre) of temporary impacts, and 20,000 square feet (0.46 acre) of permanent impacts.

The Carmel Valley Pump Station would require supply and discharge pipeline connections to the water main in Carmel Valley Road. Three new manual valves would be installed in areas of existing infrastructure. Additionally, three new actuated valves would be installed on the CalAm owned parcel.

#### *2.1.4.6 Castroville Pipeline*

The 4.5-mile-long (7.2-kilometer-long), 12-inch-diameter (30-centimeter-diameter) Castroville Pipeline would convey desalinated Salinas Valley return water from the MPWSP Desalination Plant to the CSIP distribution system and the CCSD Well #3. The Castroville Pipeline would branch off from the Desalinated Pipeline approximately 240 feet (70 meters) south of the intersection of Del Monte Boulevard and Lapis Road. The pipeline would follow Lapis Road north, within the TAMC ROW and along Monte Road, and would cross over the Salinas River at Monte Road by being attached to the underside of the Monte Road Bridge.

The pipeline would continue northeast from the Salinas River, along the TAMC ROW and Monte Road, to Nashua Road. A new pipe connection to the CSIP distribution system would be built at the northern end of Monte Road, where it meets Nashua Road. The Castroville Pipeline would continue north along the TAMC ROW, crossing under Tembladero Slough using horizontal directional drilling (HDD; see Section 2.2.4.2) to Highway 183 (Salinas Road). Entry and receiving pits would be approximately 50 by 50 feet (15 by 15 meters), with one on each side of the crossing. From Highway 183, the pipeline would continue north between Del Monte Avenue and Union Pacific Railroad, turn west across Del Monte Avenue and connect to CCSD Well #3 at the north corner of Del Monte Avenue and Merritt Street (Figure 2-1).

### *2.1.4.7 Pipeline to CSIP Pond*

Salinas Valley return water to be delivered to the CSIP pond would flow through a new 1.2-mile-long (1.9-kilometer-long), 12-inch-diameter (30-centimeter-diameter) pipeline that would connect to the existing CSIP pond at the southern end of the MRWPCA Regional Wastewater Treatment Plant. From the CSIP pond, water would be delivered to Salinas Valley agricultural users through existing CSIP infrastructure (Figure 2-1).

### *2.1.4.8 Interconnections with Highway 68 Satellite Systems*

The proposed project would also improve existing interconnections at three satellite water systems in the unincorporated communities of Ryan Ranch, Bishop, and Hidden Hills, which are located along the Highway 68 corridor (see Figure 2-2).

*Ryan Ranch-Bishop Interconnection Improvements*
The Ryan Ranch–Bishop Interconnection Improvements would install a 1.1-mile-long, 8-inch-diameter pipeline extending between an existing interconnection at Highway 68 and Ragsdale Avenue and a new connection to the Bishop system. The Ryan Ranch improvements are located within existing paved roads, within a business park with landscaping, coast live oak woodland, northern coastal scrub, and non-native annual grassland located adjacent to the roads and parking lots. Construction of the Ryan Ranch–Bishop Interconnection Improvements would occur during daytime hours and would take approximately 4 months to complete.

*Main System-Hidden Hills Interconnection Improvements*
The Main System-Hidden Hills Interconnection improvements would be installed along Tierra Grande Drive, with a connection to the existing Upper Tierra Grande Booster Station, and a new 350 gpm pump would be added to the booster station. The Main System-Hidden Hills Interconnection Improvements site is located along Tierra Grande Drive in a low-density residential area north of Carmel Valley Road. The existing interconnection between the main CalAm distribution system and the Hidden Hills system would be improved by installing approximately 1,200 feet of 6-inch-diameter pipeline along the northern extent of Tierra Grande Drive, within the roadway. The existing pump capacity at the Upper Tierra Grande Booster Station and the Middle Tierra Grande Booster Station would be upgraded. The construction footprint for the Main System-Hidden Hills Interconnection Improvements is 1.1 acre. Construction would occur during daytime hours, would take approximately

**3 months to complete, and would be limited to the road right-of-way and within the existing developed booster stations.**

### *2.1.4.9 Proposed ASR Facilities*

**CalAm proposes to expand the existing Seaside Groundwater Basin ASR system to provide additional injection/extraction capacity for both desalinated product water and Carmel River water supplies. The proposed improvements to the ASR system include two additional injection/extraction wells, ASR-5 and ASR-6, and three parallel, 0.9-mile-long (1.4-kilometer-long), ASR pipelines.**

***ASR Injection/Extraction Wells (ASR-5 and ASR-6 Wells)***

**CalAm would build two additional injection/extraction wells (ASR-5 and ASR-6 wells) on two U.S. Army-owned parcels located east of General Jim Moore Boulevard, south of its intersection with Ardennes Circle, in the Fitch Park Monterey Bay Military Housing (MBMH) area (Figure 2-1). The new injection/extraction wells would be drilled to a depth of approximately 1,000 feet (305 meters) and would be screened in the Santa Margarita sandstone aquifer. Each well would have a permanent 500 hp, multi-stage, vertical turbine pump, Supervisory Control and Data Acquisition (commonly called SCADA)[4] controls for remote operation, and various pipes and valves. Each well pump and electrical control system would be housed in a 900-square-foot (84-square-meter) concrete pump house. A low-voltage, 480-volt, three-phase electrical transformer would be installed at each well site to power the electrical control system. Pacific Gas & Electric Company, the local electrical utility, would own and operate the electrical transformers. Security fencing would encompass an area of approximately 0.4- and 0.5-acre (0.16- and 0.20-hectare) around the ASR-5 and ASR-6 wells, respectively (RBF Consulting 2010).**

**The existing ASR disinfection system is housed within the chemical/electrical control building at the site of the existing ASR-1 and ASR-2 wells. The existing disinfection system has sufficient capacity to treat ASR product water extracted from all six ASR injection/extraction wells (the four existing Phase I and Phase II wells and the two new wells). The disinfection system consists of a 5,000-gallon bulk sodium hypochlorite storage tank, chemical metering pumps, and a chlorine residual analyzer. The disinfection system includes double containment for all chemical storage and dispensing equipment, protective vent-fume neutralizers, safety showers for operations personnel, and a forced-air ventilation system.**

**The ASR-5 and ASR-6 wells would have a combined injection capacity of 2.2 mgd (1,050 gpm) and combined extraction capacity of approximately 4.3 mgd (3,000 gpm) (RBF Consulting 2013). They would be connected via four 16-inch (41-centimeter) diameter pipelines from the ASR wells to three parallel pipelines proposed within General Jim Moore Boulevard (see description below). The ASR-5 and ASR-6 wells would operate in conjunction with the ASR-1, ASR-2, ASR-3, and ASR-4 wells. Any of the six ASR injection/extraction wells could be used to inject desalinated product water and Carmel River water supplies.**

**Maintenance of ASR-5 and ASR-6 wells would involve routine backflushing of the two wells. Backwash effluent, containing elevated levels of sediment and turbidity, would be conveyed through the proposed ASR Pump-to-Waste Pipeline (see description below) to the existing settling basin for**

**4 SCADA is a system for remote monitoring and operations of water supply facilities.**

**the Phase I facilities at the intersection of General Jim Moore Boulevard and Coe Avenue, where it would infiltrate into the ground.**

***ASR Pipelines***

**Three parallel 0.9-mile-long (1.4-kilometer-long), 16-inch-diameter (41-centimeter-diameter), ASR pipelines, (the ASR Recirculation Pipeline, the ASR Conveyance Pipeline, and the ASR Pump-to-Waste Pipeline), would extend along General Jim Moore Boulevard between the proposed ASR-5 and ASR-6 wells and the existing Phase 2, ASR-3 and ASR-4 Wells (between Fitch Park MBMH area and the intersection of Coe Avenue and General Jim Moore Boulevard). The ASR Recirculation Pipeline would circulate water to prevent stagnation during times when no injection or extraction takes place. The ASR Conveyance Pipeline would convey water to/from the ASR-5 and ASR-6 wells for injection/extraction to the Phase 2 ASR facilities. The ASR Pump-to-Waste Pipeline would convey backflush effluent from the ASR-5 and ASR-6 wells to the existing settling basin at the ASR-3 and ASR-4 wells, which is about 2 miles (3 kilometers) south and located just north of the intersection of General Jim Moore Boulevard and Coe Avenue (Figure 2-1). In addition, a 150-foot-long (46-meter-long), 16-inch-diameter (41-centimeter-diameter) pipeline would connect the new Transmission Main to each of the new ASR wells. These pipelines would convey desalinated water to ASR-5 and ASR-6 wells for injection.**

#### *2.1.4.10 Electrical Power Facilities*

**Although CalAm may eventually use renewable energy sources to power the MPWSP Desalination Plant, this assessment assumes that all electrical power for the proposed facilities would be provided via new connections to the local PG&E grid. New underground and aboveground power lines would be installed in the CEMEX active mining area for the subsurface slant wells, at the MPWSP Desalination Plant site, the ASR-5 and ASR-6 Well sites, and Carmel Valley Pump Station to connect the new facilities to the existing power grid.**

## 2.2 Construction

### 2.2.1 Site Preparation and Construction Staging

#### *2.2.1.1 Site Clearing and Preparation*

**Construction workers would clear and prepare the construction work areas in stages, as construction progresses. The contractor would clear and grade the portions of the project area to be worked in before construction starts, removing vegetation and debris, as necessary, to provide a relatively level surface for the movement of construction equipment. The contractor would recontour and restore all temporarily-disturbed construction work areas (i.e., areas disturbed by construction but where permanent structures would not be built) to their original profile upon completion of construction, and would hydroseed or pave the areas, as appropriate.**

#### *2.2.1.2 Staging Areas*

**Construction equipment and materials would be stored within the construction work areas to the extent feasible. Construction staging for the subsurface slant wells at the CEMEX Lapis Plant site, the MPWSP Desalination Plant, and the ASR-5 and ASR-6 wells would be contained within the project area boundary (Figure 2-1). For construction of all other facilities and pipelines, construction workers would use eight strategically located staging areas in the project area vicinity. The proposed staging**

areas are sited with the intent of avoiding sensitive riparian areas or critical habitat for protected species. The designated staging areas are primarily paved parking lots located in highly disturbed areas, except the sandy lot proposed as the staging area near Seaside Middle School. Table 2-1 summarizes the staging area locations and current site conditions.

Because all of the staging areas are either paved or sand, CalAm's contractors would not need to remove vegetation to prepare the staging sites. No gravel would be placed in staging areas. Heavy machinery would not be operated at the staging areas unless it is used to move lighter-duty machinery in and out of the staging area, or to load and unload material onto transportation vehicles for delivery to the construction sites. Only motion-sensored nighttime lighting would be installed at staging areas.

Table 2-1. Construction Staging Areas

| Location | Site Description |
|---|---|
| Monte Road/Neponset Road in unincorporated Monterey County | Paved parking lot (semi-trucks) at Dole Vegetable Processing Plant |
| Beach Road in Marina | Paved parking lot at Walmart |
| Highway 1/1st Street in Marina | Gated paved parking lot |
| 2nd Avenue, between Lightfighter Drive and Divarty Street, in Seaside | Paved parking lot at the Cal State University at Monterey Bay Athletic Fields |
| 2nd Avenue/Lightfighter Drive in Seaside | Paved parking lot |
| West side of General Jim Moore Boulevard, near Gigling Road, in Seaside | Paved parking lot |
| East side of General Jim Moore Boulevard, near Gigling Road, in Seaside | Paved parking lot |
| West side of General Jim Moore Boulevard, near Seaside Middle School, in Seaside | Sandy area |

### 2.2.2 Well Drilling and Development and Related Site Improvements

#### *2.2.2.1 Subsurface Slant Wells*

Well installation would be done in two phases: (1) well drilling and (2) well development. Well development occurs after the wells have been drilled, and is the process of optimizing the water quality and flow into the well. All construction activities for the subsurface slant wells would occur inland of the 2020 mean high water line and in previously disturbed areas, landward of the dunes. Surface construction activities would occur outside of MBNMS. Slant well construction would take approximately 10 to 12 months to complete, and could take place anytime throughout the overall 24-month construction duration for the Proposed Action. Construction activities associated with installation of the six additional subsurface slant wells, including staging, materials storage, and stockpiling, would temporarily disturb approximately 6 acres (2.4 hectares) of land (approximately 1 acre [0.4 hectare] of disturbance per slant well) within the project area boundary. Construction activities would occur 24 hours per day, 7 days per week, with multiple slant wells being built simultaneously. Construction-related trucks and vehicles would access the slant well site via Del Monte Boulevard, Lapis Road, and the existing access roads in the CEMEX Lapis Plant site. The construction contractor would use a temporary field office (mobile trailer) in the southern portion of the CEMEX project area throughout slant well construction activities. The field office and materials receiving and storage would be contained within the 6-acre (2.4-hectare) construction disturbance area.

The proposed slant wells would be built using a dual rotary drilling rig, pipe trailers, portable drilling fluid tanks, Baker tanks (portable holding tanks), haul trucks, flatbed trucks, pumps, air compressors, and welding equipment. The slant wells would be drilled at approximately 14 degrees below horizontal.

Drilling fluids, such as water, bentonite mud, or environmentally inert biodegradable additives, would be used to drill through the first 100 feet (30 meters) of the dry dune sands to prevent the sand from locking up the drill bit inside the conductor casing. The fluid would be recirculated using a mud tank located next to the drill rig. Once the drill bit reaches groundwater, the construction contractor would pump out all of the sand-bentonite mud slurry and put it in a storage container for off-site disposal. The elevation of the groundwater surface would be determined from the existing monitoring wells.

The remaining 900 feet (270 meters) of borehole below the top of the groundwater table would be drilled using water already present in the sand and some potable water. No bentonite mud or other additives would be used to drill this segment of the slant well. The water and sediment mixture generated drilling the lower portion of the slant wells would be placed in settling tanks, as necessary, to allow sediment to settle out. The volume of water produced during this drilling phase would be small, allowing the construction contractor to dispose of the clarified effluent by percolating it into the ground at the CEMEX Lapis Plant site.

To develop the slant wells, a submersible pump would be lowered several hundred feet into each well and would be pumped for 2 to 6 weeks during slant well completion and initial well testing. The water pumped from the wells during well development would be discharged to the ocean, within the waters of MBNMS, through the test slant well discharge pipe and the existing MRWPCA ocean outfall. The wellheads would include 22- to 36-inch-diameter (56- to 91-centimeter-diameter) discharge piping (i.e., flow meter, isolation valve, check valve, pump control valve, air valve, and pressure gauge). The discharge mechanical piping would be located in a below-ground vault (12 by 6 foot [4 by 2 meter]). The discharge piping would then connect to the buried source water pipeline. The wellheads would be accessible at grade level.

#### *2.2.2.2 ASR Injection/Extraction Wells*

Construction activities for new ASR injection/extraction wells would include grading, installation and removal of temporary sound walls; well drilling, installation of pipeline connections to the proposed ASR Conveyance Pipelines along General Jim Moore Boulevard, and installation of electrical equipment, pumps, and an access road from General Jim Moore Boulevard. Construction equipment would include drill rigs, water tanks, pipe trucks, flatbed trucks, and several service vehicles. The new ASR injection/extraction wells would be drilled using the reverse rotary drilling method. Bentonite drilling fluids would not be used during well drilling, but non-corrosive, environmentally inert, biodegradable additives may be used to keep the borehole open if necessary. Most construction activities would extend from 7 a.m. to 7 p.m., 5 days per week; however, continuous 24-hour construction would be necessary for approximately 4 weeks, per well, of the initial well drilling until final depth is reached and the borehole is stabilized. Construction of both wells is expected to take 12 months.

Water produced during development of the ASR-5 and ASR-6 wells at the Fitch Park MBMH housing area would be expelled to the existing surface water drainage system or direct to water transport trucks. The well development water would be disposed of in accordance with Central Coast Regional Water Quality Control Board (RWQCB) Resolution No. R3-2008-0010, General Waiver for Specific Types of Discharges (RWQCB 2008). Any waste material generated during construction of the proposed ASR facilities that requires off-site disposal would be transported to an approved landfill facility.

Water would be discarded during pipeline testing or following long periods of pipeline stagnation. During operations, discarded water would be sent via a proposed dedicated pipeline to an existing open receiving pit in use adjacent to the existing Santa Margarita ASR-3 and ASR-4 Well location. This receiving pit is currently available for use by the project proponent.

### 2.2.3 Desalination Plant Construction

Construction activities would include site preparations and grading; pouring concrete footings for foundations, tanks, and other support equipment; constructing walls and roofs; cutting, laying, and welding pipelines and pipe connections; assembling and installing major desalination process components; installing piping, pumps, storage tanks, and electrical equipment; testing and commissioning facilities; and finish work such as paving, landscaping, and fencing the perimeter of the site.

Construction workers would access the MPWSP Desalination Plant site by Charles Benson Road and existing access roads. Construction equipment would include excavators, backhoes, graders, pavers, rollers, bulldozers, concrete trucks, flatbed trucks, boom trucks or cranes, forklifts, welding equipment, dump trucks, air compressors, and generators. Pretreatment, RO, and post-treatment facilities would be prefabricated and delivered to the site for installation. Approximately 25 acres (10 hectares) of the 46-acre (19-hectare) site would be disturbed during construction. Construction activities at the Desalination Plant site are expected to occur over 24 months.

### 2.2.4 Pipeline Installation

Approximately 21 miles (34 kilometers) of pipelines would be installed within the paved roadway, or adjacent to roads and the Monterey Peninsula Recreational Trail. Most pipeline segments would be installed using conventional open-trench technology; however, where it is not feasible or desirable to perform open-cut trenching, trenchless methods would be used.

Typical construction equipment for pipeline installation would include flatbed trucks, backhoes, excavators, pipe cutting and welding equipment, haul trucks for spoils transport, trucks for materials delivery, compaction equipment, Baker tanks, pickup trucks, arc-welding machines, generators, air compressors, cranes, drill rigs, and skip loaders. Pipeline segments would typically be delivered and installed in 6- to 40-foot-long (2- to 12-meter-long) sections. Soil removed from trenches and pits would be stockpiled and reused, to the extent feasible, or hauled away for offsite disposal. Topsoil would be stockpiled separately and replaced last. Under typical circumstances, the width of the disturbance corridor for pipeline construction would vary from 50 to 100 feet (15 to 30 meters), depending on the size of the pipe being installed. Multiple pipelines would be built simultaneously. Although most pipeline construction would occur over a 15-month period, pipeline construction could occur any time throughout the entire 24-month construction period. The construction durations for most individual pipelines would be much shorter than 15 months. Pipeline installation would be sequenced to minimize land use disturbance and traffic disruption to the extent possible.

#### *2.2.4.1 Open-Trench Construction*

The construction sequence for pipeline installed using open-trench methods would typically include:

- Clearing and grading the ground surface along the pipeline alignments;
- Excavating the trench;
- Preparing and installing pipeline sections;
- Installing vaults, manhole risers, manifolds, and other pipeline components;
- Backfilling the trench with non-expansive fills;
- Restoring preconstruction contours; and
- Revegetating or paving the pipeline alignments, as appropriate.

A conventional backhoe, excavator, or other mechanized equipment would be used to excavate trenches. The typical trench width would be 6 feet (2 meters); however, vaults, manhole risers, and other pipeline components could require wider excavations. Work crews would install trench boxes or shoring, or would lay back and bench the slopes, to stabilize the pipeline trenches and prevent the walls from collapsing during construction. After excavating the trenches, the contractor would line the trench with pipe bedding; that is, sand or other appropriate material shaped to support the pipeline. Construction workers would then place pipe sections (and pipeline components, where applicable) into the trench, weld the sections together as trenching proceeds, and then backfill the trench. Most pipeline segments would have 8 feet (2.4 meters) of cover. Open-trench construction would generally proceed at a rate of about 150 to 250 feet (46 to 76 meters) per day. Steel plates would be placed over trenches to maintain access to private driveways. Some pipeline installation would require construction in existing roadways and could result in temporary lane closures or detours.

#### *2.2.4.2 Trenchless Technologies*

Where it is not feasible or desirable to perform open-cut trenching, workers would use trenchless methods such as jack-and-bore, drill-and-burst, HDD, or microtunneling. Pipeline segments located within heavily congested underground utility areas or in sensitive habitat areas would likely be installed using HDD or microtunneling. Jack-and-bore methods would likely be used beneath railroad crossings. HDD would likely be used for pipeline segments that cross beneath Highway 1 (new Transmission Main) and beneath drainages (Castroville Pipeline). Trenchless methods of pipeline installation would be required at nine identified locations (additional locations may be identified during final pipeline design):

1. installation of the Castroville Pipeline under Tembladero Slough.
2. installation of the Castroville Pipeline under the TAMC ROW and the Dole Driveway adjacent to Monte Road, south of the Salinas River.
3. installation of the Source Water Pipeline beneath the TAMC ROW at Lapis Road, just north of the CEMEX Plant access road.

4. installation of the new Desalinated Water Pipeline beneath the TAMC ROW near the southern intersection of Lapis Road and Del Monte Boulevard.
5. installation of the New Transmission Main beneath the TAMC ROW near Seaside Avenue and Del Monte Boulevard.
6. installation of the New Transmission Main beneath the TAMC ROW and Reservation Road.
7. installation of the New Transmission Main beneath the TAMC ROW near Marina Drive, Del Monte Boulevard, and Reindollar Avenue in the City of Marina.
8. installation of the New Transmission Main beneath the spur railroad line west of Highway 1 and north of 1st Street in Seaside, CA.
9. installation of the New Transmission Main at Highway 1 and Lightfighter Drive.

#### *2.2.4.3 Jack-and-Bore and Microtunneling Methods*

The jack-and-bore and microtunneling methods entail excavating an entry pit and an egress pit at either end of the pipe segment. A horizontal auger is used to drill a hole, and a hydraulic jack is used to push a casing through the hole to the egress pit. As the boring proceeds, a steel casing is jacked into the hole and pipe is installed in the casing.

#### *2.2.4.4 Drill-and-Burst Method*

The drill-and-burst method involves drilling a small pilot hole at the desired depth through a substrate, and then pulling increasingly larger reamers through the pilot hole until the hole reaches the desired diameter.

#### *2.2.4.5 Horizontal Directional Drilling*

HDD requires the excavation of a pit on either end of the pipe segment. A surface-launched drilling rig is used to drill a small horizontal boring at the desired depth between the two pits. The boring is filled with drilling fluid and enlarged by a back-reamer to the required diameter. The pipeline is then pulled into position through the boring. Entry and receiving pits range in size depending on the length of the crossing, but typically have dimensions of approximately 50 by 50 feet (15 by 15 meters).

#### *2.2.4.6 Pipeline Installation at the Salinas River Crossing*

At the Salinas River crossing, the pipeline would be attached to an existing trellis on the Monte Road Bridge with the assistance of long-reach cranes parked on the bridge. Construction is expected to take up to one month, with construction equipment moved to various positions along the span of the bridge. Construction of the overwater crossing would require trimming of upland vegetation so that the undersurface of the bridge could be accessed to attach the new pipeline. There are no trees in this area, so the trimming would be limited to shrubby arroyo willows, blackberry, and coyote bush. Within the riparian area leading up to the overhead portion of the pipeline on each bank, the majority of the trenching would be done within an existing unvegetated access road. Ground disturbance of vegetated areas would be limited to an area on either bank where the pipeline turns from the existing access road and goes to the point where it would be built vertically up from the ground to the undersurface of the bridge.

### 2.2.5 Disinfection of Existing and Newly Installed Pipelines

Before connecting existing and new pipelines, CalAm would drain and disinfect the existing pipeline segments. Similarly, upon completing construction activities, facility operators would disinfect the newly installed pipelines and pipeline connections before bringing the pipelines into service. Effluent produced during the pipeline disinfection process would be discharged to the local stormwater drainage system in accordance with the Central Coast RWQCB *General Waste Discharge Requirements for Discharges with Low Threat to Water Quality* (Order No. R3-2011-0223, NPDES Permit No. CAG993001) (RWQCB 2011).

### 2.2.6 Carmel Valley Pump Station

The contractors would clear and grade the construction areas prior to the onset of construction activities, including temporary staging areas, as necessary. Construction activities would include the following: clearing, excavation and cutting, laying, and welding of pipelines and pipe connections; pouring concrete footings for foundations, tanks, and other support equipment; constructing walls and roofs; assembling and installing major components; installing piping, pumps, storage tanks, and electrical equipment; testing and commissioning facilities; and finish work such as paving, landscaping, and fencing the perimeter of the site.

Typical construction equipment would include excavators, backhoes, graders, pavers, rollers, bulldozers, concrete trucks, flatbed trucks, boom trucks and/or cranes, forklifts, welding equipment, dump trucks, air compressors, and generators. Access to the site would be provided from Carmel Valley Road. Construction-related Best Management Practices would be implemented to minimize soil erosion, soil loss from construction sites, and prevent stormwater and other pollutants from leaving the construction sites. Construction is estimated to begin in June 2018 and conclude by September 2018. Construction would occur 8 hours per day, 5 days a week over the 4 month construction period.

### 2.2.7 Installation of Powerlines

All electrical power for the proposed project facilities described above would be provided via connections to the local Pacific Gas and Electric (PG&E) power grid. New powerlines would be built underground and aboveground between the existing PG&E powerlines in the area and the proposed project facilities. Installation of overhead powerlines would be done in two phases: (1) installing the poles, and (2) installing and tensioning the powerline. Power poles would be installed approximately 300 feet (90 meters) apart. The poles would be set by digging a hole 10 feet (3 meters) deep, placing the pole in the hole, and backfilling. An area approximately of 50 square feet (4.6 square meters) would be needed at each of the pole locations for laydown and assembly. A limited amount of vegetation may be removed, but grading would not be needed. Construction workers would use standard rubber-tired line trucks to access the alignment, and to install and tension the new overhead powerlines. The puller/tensioner would be mounted on a utility truck or on a double-axle trailer. Workers may need to trim or remove some vegetation along the alignment to keep vegetation away from the overhead powerlines.

Installation of the new underground powerlines would require excavation of a trench approximately 1-foot-wide (0.3-meter-wide) by 3-foot-deep (0.9-meter-deep) along their alignments. Construction workers would backfill the trench and restore the ground surface after installation of the underground powerline is completed.

### 2.2.8 Construction Schedule

Construction is expected to start summer 2019 and continue through the end of 2022 (42 months total).

## 2.3 Project Operations

CalAm would operate the subsurface slant wells and MPWSP Desalination Plant 24 hours a day, 365 days per year. Up to five subsurface slant wells would run at any given time, with each well producing approximately 3 mgd of source water for the MPWSP Desalination Plant, for a combined total of up to 15.5 mgd of source water. At least two wells would stay on standby. Approximately 25 to 30 facility operators and support personnel would be on site 24 hours a day to operate the desalination facilities.

The slant wells would require maintenance every 5 years. During maintenance, workers would access the well from the wellhead, and would lower mechanical brushes into the wells to clean the screens. If chemical cleaning products are needed for maintenance, only environmentally inert products would be used. Well operations and maintenance will use much of this same area as well construction. However, if additional area is needed to service one well site, disturbed areas at other wells sites and the access road will be used. For instance, the main well maintenance rig can be set up at the well being worked on, while locating ancillary support material/equipment at an adjacent well site while running hosing between and transporting equipment across existing disturbed access roads.

The disturbance area associated with periodic maintenance of the subsurface slant wells would be roughly 3.75 acres (1.5 hectares). This acreage assumes that planned well maintenance activities would be performed simultaneously at each well site, therefore, for 5 well sites at less than 0.4 acre per site is, this area is no more than 2.0 acres at all well sites. This is based on experience with maintenance at the existing test well. Approximately 1.73 acres is also estimated for at 15-foot wide, long-term access route and has been included as permanent impact area, for a conservative total of 3.75 acres (1.5 hectares). All disturbance would occur on the back side of the dunes at the graded pad/wellheads. Accounting for all of the slant wells, maintenance activities within the area would last between 9 and 18 weeks every 5 years.

The MPWSP Desalination Plant would operate at an overall recovery rate of 42 percent. Approximately 15.5 mgd of raw seawater would be needed to produce 6.4 mgd of desalinated product water. The RO process would generate approximately 8.99 mgd of brine. The salinity of the brine is expected to range between 57 and 58 parts per thousand (ppt), which is roughly 71 to 74 percent higher than seawater (Flow Science Inc. 2014). The brine stream would be discharged to Monterey Bay within MBNMS via the existing MRWPCA ocean outfall and diffuser.

Brine would be mixed with treated wastewater from the MRWPCA Regional Wastewater Treatment Plant during some times of the year before being discharged through the ocean outfall. During the agricultural irrigation season (April through October) the treated wastewater is diverted to the Salinas Valley Reclamation Project’s tertiary treatment facility for additional advanced treatment and then used to irrigate crops as part of the CSIP. During irrigation season, the project’s brine stream would be discharged to Monterey Bay without dilution if the MRWPCA treated wastewater flows are equal to or less than the CSIP demand for irrigation water. During the non-irrigation season (November through March), when the CSIP is not operating, the brine stream would be mixed with treated wastewater from the MRWPCA Regional Wastewater Treatment Plant before being discharged to the ocean.

Year-round, the desalination brine stream would be blended with 0.94 mgd of RO concentrate from the Pure Water Monterey Groundwater Replenishment Project (GWR). Together, the brine from the Proposed Action, GWR concentrate, and treated wastewater effluent are referred to as the "combined discharge". The MRWPCA's existing diffuser would disperse the combined discharge along its multiport length, increasing the initial dilution and thereby minimizing salinity differences between the discharges and the surrounding seawater.

## 2.4 Action Area

The project footprint is comprised of the pipeline alignments; the boundaries of all permanent infrastructure (Intake Slant Wells, Desalination Plant, ASR wells, source water and desalinated water pipelines, and the Carmel Valley Pump Station) (Figure 2-1); and all work areas, access routes, and staging areas necessary for construction. The Action Area, as defined in 50 CFR §402.2, includes all areas directly or indirectly affected by the federal action, as well as interrelated and interdependent actions. The Action Area is comprised of the project footprint as well as all areas that could be directly and indirectly affected by the Proposed Action. The Action Area includes the project footprint plus a 50-foot (15 meter) buffer around the project footprint. The size of the Action Area has been calculated using this buffer and the total acreage, plus the acreage by project component is given below in Table 2-2. The size of this buffer is based on the extent of expected construction activities and is relatively small due to the avoidance and minimization measures (Section 3) identified for the project, which include measures to prevent erosion and hazardous materials spills, limit mobilization of dust, and limit noise disturbance from construction equipment.

**Table 2-2. Total Acreages within the Action Area**

| Project Component | Total area within the Action Area(acres) |
|---|---|
| Intake Slant Wells | 33.05 |
| Source Water Pipeline | 1.56 |
| Desalination Plant | 23.26 |
| Desalinated Water Pipeline | 11.12 |
| Transmission Main Pipeline | 36.20 |
| Pipeline to CSIP Pond, Brine Discharge Pipeline combined area* of segments | 7.15 |
| Castroville Pipeline | 28.25 |
| ASR Wells | 1.24 |
| Carmel Valley Pump Station | 0.90 |
| Castroville Pipeline, Desalinated Water Pipeline, Source Water Pipeline – combined area* of these segments along Charles Benson Road | 8.37 |
| *Total* | 151.11 |

*combined area is given where pipelines run parallel for a given distance

# 3 Avoidance and Minimization Measures

The following avoidance and minimization measures are presented as part of the Proposed Action.

General avoidance and minimization measures associated with the Proposed Action are included in Section 3.1, and species-specific avoidance and minimization measures are described in Section 3.2. Both general and species-specific avoidance and minimization measures will be implemented for the duration of the Proposed Action. These measures have been adapted from the 2017 DEIR/EIS for the CalAm Monterey Peninsula Water Supply Project (ESA 2017) and are subject to change pending finalization of the EIR/EIS.

## 3.1 General Avoidance and Minimization Measures

### 3.1.1 Construction Worker Environmental Awareness Training and Education Program

Prior to starting work, all construction workers at the project areas will attend a Construction Worker Environmental Awareness Training and Education Program developed and presented by the Lead Biologist[5] , appointed qualified biologist, and/or qualified biological monitor[6]. The program will include information on each federal and state-listed species, as well as other special-status wildlife and plant species and sensitive natural communities that may be encountered during construction activities. The training will include: information on special-status species' life history and legal protections; the definition of "take" under the ESA and the California Endangered Species Act (CESA); the measures CalAm and/or its contractors have committed to implementing to protect special-status species and sensitive natural communities; reporting requirements and communication protocols; specific measures that each worker will employ to avoid "take" of special-status species; and penalties for violation of ESA and/or CESA. Training will be documented as follows:

1. An acknowledgement form will be signed by each worker indicating that environmental training has been completed.
2. A sticker will be placed on hard hats indicating that the workers have completed the environmental training. Construction workers will not be permitted to operate equipment within the construction area unless they have attended the training and are wearing hard hats with the required sticker.
3. A copy of the training transcript/training video and/or DVD, as well as a list of the names of all personnel who attended the training and copies of the signed acknowledgement forms will be submitted to the CPUC.

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5 The terms "Lead Biologist" and "qualified biologist" are defined as an individual who possesses, at a minimum, a bachelor's degree in biology, ecology, wildlife biology, or closely related field and has demonstrated prior field experience using accepted resource agency techniques for surveys prescribed, and who possesses all appropriate USFWS, NMFS, and CDFW permits.

6 The term "biological monitor" is defined as holding similar education credentials to those of a Lead Biologist and who has functioned as an environmental inspector or monitor on at least two construction projects within the preceding two years.

### 3.1.2 Preconstruction Surveys and Biological Monitoring

Prior to initiation of construction, CalAm and/or representatives of CalAm will retain a qualified Lead Biologist to oversee compliance with Avoidance and Minimization Measures for all special-status species and sensitive habitats. The Lead Biologist will be onsite, or will appoint qualified biologists and/or qualified biological monitors to be onsite, during all fencing and ground disturbance activities. The Lead Biologist, qualified biologists, and biological monitors will be subject to approval by USFWS prior to conducting the monitoring work. Only the Lead Biologist and/or qualified biologists may lead protocol surveys and relocate special-status species, as authorized by the resource agencies with jurisdiction over these species.

In the event that construction-related activities have the potential to accidentally violate the prescribed special-status species and habitat protection measures, the project Lead Biologist, or other appointed qualified biological monitors will report to construction or operational site supervisors with authority to stop work to prevent any violations. Work will proceed only after the construction-related hazards to special-status species and habitats are removed and the species is no longer at risk. Violations will be thoroughly documented as part of compliance monitoring activities.

The Lead Biologist will ensure that all compliance monitoring activities are documented on a daily basis, and will prepare a summary monitoring report on a monthly basis to be submitted to regulatory agencies upon their request. The monthly summary monitoring report will provide information regarding the worker awareness training (see Section 3.1.1 above), surveys, and any observed special-status species, including any accidental injuries or fatalities. The monthly report will also document the effectiveness and practicality of the prescribed avoidance and minimization measures and recommend modifications to the measures if needed. The Lead Biologist will supply agency staff with copies of compliance records, including any reports of non-compliance, upon request.

The Lead Biologist will have in her/his possession a copy of all compliance measures while work is being conducted onsite, and will ensure that CalAm's onsite representatives and contractors also maintain copies of the compliance measures on the site. To facilitate the Lead Biologist's role, CalAm will ensure that the Lead Biologist is fully apprised of all decisions that change or materially affect the schedule, methods, and location of work that is subject to the protective measures for biological resources.

### 3.1.3 General Best Management Practices

CalAm's construction contractor(s) will implement the following general avoidance and minimization measures to protect special-status species and sensitive natural communities in the Action Area during construction:

1. The construction footprint, staging areas, equipment access routes, and areas for disposal or temporary placement of spoils, will be delineated with stakes and flagging prior to construction to avoid natural resources where possible. Any construction-related disturbance outside of these boundaries, including driving, parking, temporary access, sampling or testing, or storage of materials, will be prohibited without explicit approval of the Lead Biologist.

2. New access driveways will not extend beyond the delineated construction work area boundary. Construction vehicles will pass and turn around only within the delineated construction work area boundary or local road network. Where new access is required outside of existing roads or the construction work area, the route will be clearly marked (i.e., flagged and/or staked) prior to being used, subject to review and approval of the Lead Biologist.
3. Vehicle speeds within the project footprint will not exceed 15 miles per hour (24 kilometers per hour) on roads within the sites.
4. Work will be conducted during daylight hours to the extent practicable.
5. Excavated soils will be stockpiled in disturbed areas lacking native vegetation. Stockpile areas will be marked by the Lead Biologist to define the limits where stockpiling can occur.
6. Standard best management practices (such as setbacks and use as silt fence and fiber rolls) will be employed to prevent loss of habitat due to erosion caused by project related impacts (i.e., grading or clearing for new roads). All detected erosion will be remedied immediately upon discovery.
7. Fueling of construction equipment will take place within existing paved areas, and at least 50 feet (15 meters) from drainages (including streams, creeks, ditches, culverts, or storm drain inlets) and native habitats. Contractor equipment will be checked for leaks prior to operation and repaired when leaks are detected. Fuel containers will be stored within appropriately-sized secondary containment barriers.
8. The introduction of exotic plant species by equipment will be avoided through physical or chemical removal and prevention. Measures to prevent the introduction of exotic plants into the construction site via vehicular sources will include implementing track clean or other method of vehicle cleaning for vehicles coming to the site and leaving the site. Earthmoving equipment will be cleaned prior to transport to the project area. Weed-free rice straw or other certified weed-free straw will be used for erosion control. Weed populations introduced into the site during construction will be eliminated by chemical and/or mechanical means approved by CDFW and USFWS.
9. Use of herbicides as vegetation control measures will be used only when mechanical means have been deemed ineffective. All uses of such herbicidal compounds will observe label and other restrictions mandated by the U.S. Environmental Protection Agency, California Department of Food and Agriculture, and state and federal legislation as well as additional project-related restrictions deemed necessary by CDFW and/or USFWS. No rodenticides will be used.
10. Prior to the start of construction at any proposed facility site where special-status amphibians, reptiles, and mammals have a moderate or high potential to occur, the construction work area boundary will be fenced with a temporary exclusion fence to prevent special-status wildlife from entering the site during construction. The exclusion fencing will be constructed of metal flashing, plastic sheeting, or other materials that will prohibit California tiger salamander (*Ambystoma californiense*), California red-legged frog (*Rana draytonii*), and other special-status reptiles, amphibians, and rodents from climbing or going under the fence. The fencing will be buried a minimum of 6 inches below grade to secure the fence and extend a minimum of 30 inches (76 centimeters) above grade. The fencing will be inspected by the

**Lead Biologist or qualified biological monitor on a daily basis during construction activities to ensure fence integrity. Any needed repairs to the fence will be performed on the day of their discovery. Fencing will be installed and maintained during all phases of construction. Final fence design and location will be determined in consultation with USFWS and CDFW. Exclusion fencing will be removed once construction activities are complete.**

11. **If special-status wildlife species are found on the site during project construction, construction activities will cease in the vicinity of the animal until the animal moves on its own outside of the project area (if possible). The USFWS will be consulted regarding any additional avoidance and minimization measures that may be necessary if the animal does not move on its own. A report will be prepared by the Lead Biologist to document the activities of the animal within the site; all fence construction, modification, and repair efforts; and movements of the animal once it is again outside the exclusion fence. This report will be submitted to the CPUC and USFWS.**
12. **Immediately prior to conducting vegetation removal or grading activities inside fenced exclusion areas, the Lead Biologist or a qualified biologist will survey within the exclusion area to ensure that no special-status species are present. The Lead Biologist or a qualified biologist will also monitor vegetation removal or grading activities inside fenced exclusion areas for the presence of special-status species.**
13. **To prevent the inadvertent entrapment of special-status wildlife during construction, all excavated, steep-walled holes or trenches more than 2 feet (0.6 meter) deep will be covered with plywood or similar materials at the close of each working day, or escape ramps constructed of earth fill or wooden planks will be positioned within the excavations to allow special-status wildlife to escape on their own. Before such holes or trenches are filled, they will be thoroughly inspected for trapped animals. If trapped animals are observed, escape ramps or structures will be installed immediately to allow escape. If listed species are trapped, the USFWS will be contacted to determine the appropriate method for relocation.**
14. **All construction pipes, culverts, or similar structures that are stored at a construction site for one or more overnight periods and with a diameter of 4 inches (10 centimeters) or more will be inspected for special-status wildlife before the pipe is subsequently buried, capped, or otherwise used or moved in any way. If a special-status animal is discovered inside a pipe, that section of pipe will not be moved until the appropriate resource agency, with jurisdiction over that species, has been consulted to determine the appropriate method for relocation. If necessary, under the direct supervision of the biologist, the pipe may be moved once to remove it from the path of construction activity until the animal has escaped.**
15. **All vertical tubes used in project construction, such as chain link fencing poles or signage mounts, will be temporarily or permanently capped at the time they are installed to avoid the entrapment and death of special-status birds.**
16. **Water used for dust abatement will be minimized to the extent feasible in an effort to avoid the formation of puddles that could attract common ravens and other predators to the construction work areas.**
17. **No vehicle or equipment parked in the project area will be moved prior to inspecting the ground beneath the vehicle or equipment for the presence of wildlife. If present, the animal will be left to move on its own.**

18. All vehicles and equipment will be in proper working condition to ensure that there is no potential for fugitive emissions of motor oil, antifreeze, hydraulic fluid, grease, or other hazardous materials. The Lead Biologist will be informed of any hazardous spills within 24 hours of the incident. Hazardous spills will be immediately cleaned up and the contaminated soil will be properly disposed of at a licensed facility.
19. A trash abatement program will be implemented during construction. Trash and food items will be contained in closed containers and removed from the construction site daily to reduce the attractiveness to sensitive wildlife species and opportunistic predators such as common ravens, coyotes, and feral dogs.
20. Workers will be prohibited from feeding wildlife and bringing pets and firearms to the construction work areas.
21. Intentional killing or collection of wildlife species, including special-status species in the project area and surrounding areas will be prohibited.
22. All temporarily disturbed areas will be returned to pre-project conditions or better.

### 3.1.4 General Noise Controls for Construction Equipment

The construction contractor(s) will assure that construction equipment with internal combustion engines have sound control devices at least as effective as those provided by the original equipment manufacturer. No equipment will be permitted to have an unmuffled exhaust.

Impact tools (i.e., jack hammers, pavement breakers, and rock drills) used for project construction will be hydraulically or electrically powered wherever possible to avoid noise associated with compressed air exhaust from pneumatically powered tools. Where use of pneumatic tools is unavoidable, an exhaust muffler will be placed on the compressed air exhaust to lower noise levels by up to approximately 10 decibels (dBA). External jackets will be used on impact tools, where feasible, in order to achieve a further reduction of 5 dBA. Quieter procedures will be used, such as drills rather than impact equipment, whenever feasible.

The construction contractor(s) will locate stationary noise sources as far from nearby sensitive special-status species habitat as possible, and will muffle and enclose them in temporary sheds, incorporate noise barriers, or implement other noise control measures to the extent feasible. The noise controls will be sufficient to reduce noise levels during drilling and development of ASR-5 and ASR-6 Wells, and pump station construction activities below the threshold of 70 dBA equivalent sound level (Leq).

### 3.1.5 Noise Control Plan for Nighttime Pipeline Construction

CalAm or a representative of CalAm will submit a Noise Control Plan for all nighttime pipeline work to the CPUC for review and approval prior to the commencement of project construction activities. The Noise Control Plan will identify all feasible noise control procedures to be implemented during nighttime pipeline installation in order to reduce noise levels to the extent practicable at the nearest noise sensitive special-species habitat. At a minimum, the Noise Control Plan will require use of moveable noise screens, noise blankets, or other suitable sound attenuation devices be used to reduce noise levels during nighttime pipeline installation activities below 60 dBA Leq.

### 3.1.6 Vibration Reduction Measures

**Construction practices will be utilized that do not generate vibration levels at the closest sensitive land uses above 0.1 inch per second (0.25 centimeter per second) peak particle velocity. Vibration monitoring will be conducted for the first 500 feet (152 meters) of pipeline construction for each segment to confirm vibration levels do not exceed the above vibration threshold. If vibration levels exceed the limits of this avoidance and minimization measure, construction practices will be modified to use smaller types of construction equipment, operate the equipment in a manner to reduce vibration, or use alternate construction methods, and monitoring will continue for an additional 200 feet (60 meters) or until construction practices meet the required vibration levels. The monitoring in this measure will be repeated if the construction methods change in a manner that would increase vibration.**

### 3.1.7 Site-Specific Construction Lighting Measures

**To prevent exterior lighting from affecting special-status species, the design, construction, and operation of lighting at MPWSP facilities will adhere to the following requirements:**

1. **Use of low-intensity street lighting and low-intensity exterior lighting will be required.**
2. **Lighting fixtures will be cast downward and shielded.**
3. **Lighting fixtures will be designed and placed to minimize glare.**
4. **Fixtures and standards will conform to state and local safety and illumination requirements.**

**CalAm will ensure these measures are implemented at all times during nighttime construction and for the duration of all required nighttime construction activity.**

### 3.1.8 Frac-Out Contingency Plan

**CalAm will retain a licensed geotechnical engineer to develop a Frac-out[7] Contingency Plan. CalAm will submit the plan to the appropriate resource agencies (CDFW, RWQCB, USACE, USFWS, NMFS, and local agencies with land use jurisdiction) for approval prior to the start of construction of any pipeline that will use HDD installation. The plan will be implemented at all areas where HDD installation under a waterway would occur to avoid, minimize, or mitigate for project impacts either prior to, concurrently with, or following HDD installation, as specified in the plan. The plan will include, at a minimum:**

1. **Measures describing training of construction personnel about monitoring procedures, equipment, materials and procedures in place for the prevention, containment, clean-up (such as creating a containment area and using a pump, using a vacuum truck, etc.), and disposal of released bentonite slurry, and agency notification protocols;**
2. **Methods for preventing frac-out including maintaining pressure in the borehole to avoid exceeding the strength of the overlying soil.**

[7] A frac-out is the condition where drilling mud is released through fractured bedrock or soils into the surrounding rock or soil and travels toward the surface.

3. Methods for detecting an accidental release of bentonite slurry that include: (a) monitoring by a minimum of one biological monitor throughout drilling operations to ensure swift response if a frac-out occurs; (b) continuous monitoring of drilling pressures to ensure they do not exceed those needed to penetrate the formation; (c) continuous monitoring of slurry returns at the exit and entry pits to determine if slurry circulation has been lost; and (d) continuous monitoring by spotters to follow the progress of the drill bit during the pilot hole operation, and reaming and pull back operations.
4. Protocols CalAm and/or its contractors will follow if there is a loss of circulation or other indicator of a release of slurry.
5. Cleanup and disposal procedures and equipment CalAm and/or its contractors will use if a frac-out occurs.
6. If a frac-out occurs, CalAm and/or its contractors will immediately halt work and notify and consult with the staffs of the agencies listed above regarding appropriate incident-specific actions to be undertaken before HDD activities can begin again

### 3.1.9 Avoid, Minimize, and Compensate for Construction Impacts on Sensitive Communities

The following measures will be implemented to reduce direct impacts on sensitive natural communities and the special-status species that utilize these sensitive communities. To the extent feasible, the construction contractor(s) will implement the following avoidance and minimization measures:

1. Project facilities will be sited and designed to avoid disturbance of central maritime chaparral, central dune scrub, coast live oak woodland, and riparian woodland and scrub, any areas defined as environmentally sensitive habitat areas (ESHA) by the CCC, any sensitive communities defined by local jurisdictions, and any other sensitive natural communities, including DCH, identified within the project area.
2. Any areas used for staging, laydown, material storage, equipment storage, job trailers, employee parking, or other project-related support activities that do not need to be located to the active construction area will be located away from jurisdictional areas, sensitive communities, and will be protected from stormwater runoff using temporary perimeter sediment barriers such as berms, silt fences, fiber rolls, covers, sand/gravel bags, and straw bale barriers.
3. All potential contaminants will be stored on impervious surfaces, plastic ground covers, or in secondary containment to prevent any spills or leakage from contaminating the ground, and will be located at least 100 feet (30 meters) from adjacent habitat where practicable.
4. Any spillage of pollutants or construction material will be contained immediately in accordance with the project Stormwater Pollution Prevention Plan. The contaminated area will be cleaned and any contaminated materials properly disposed of. The Lead Biologist will be notified of all spills.
5. Where direct impacts on sensitive natural communities, including DCH cannot feasibly be avoided, CalAm will implement the following measures:

   Any temporarily impacted sensitive natural communities, including DCH, will be restored to previous conditions or better at the end of construction. To the extent feasible, topsoil will be salvaged during grading and earthmoving activities, stockpiled separately from subsoil, and protected from erosion (e.g., covered or watered). Composting additives will be used to amend the soil, if needed, and compacted topsoil will be properly prepared prior to reuse for post-construction restoration of temporarily disturbed areas. A minimum of 12 inches (30 centimeters) of topsoil will be salvaged (or if there is less than 12 inches [30 centimeters] of topsoil initially, as much as practicable). Restoration will be conducted in conformance with the terms of the Habitat Mitigation and Monitoring Plan (HMMP) described in Section 3.1.10.

Compensatory mitigation for permanent impacts on sensitive natural communities will occur at a ratio of 3:1. All compensatory mitigation will be conducted in accordance with the terms of the HMMP, as described in Section 3.1.10. Where applicable, compensatory mitigation will be developed onsite. Alternatively, subject to approval by the appropriate agencies, offsite mitigation may be developed, or credits purchased through an approved mitigation bank, or approved Habitat Conservation Plan.

CalAm proposes mitigating for impacts to listed amphibian species, California tiger salamander and California red-legged frog, through purchase of credits with the Sparling Ranch Conservation Bank. Their agency approved service area includes the northern part of Monterey County and the MPWSP project area. Purchase of mitigation credits for permanent impacts to amphibian habitat is proposed at a ratio of 3:1; there is expected to be pemanent impacts to 14.73 acres of habitat for California tiger salamander and 0.47 acre of permanent impacts for California red-legged frog.

In light of the CEMEX Settlement agreement with the California Coastal Commission to cease operation at the CEMEX Lapis Plant by December 31, 2020, and its provisions for restoration and reclamation activities to encourage the recovery of the habitat values, a deed restriction to be placed on the property at sale to protect it in perpetuity, and the transfer of the site at a reduced price to a non-profit or governmental agency approved by the Commission, CalAm will work with the involved stakeholders to implement their proposed mitigation by cooperating with CEMEX to protect and manage restoration areas at the Lapis Sand Plant property for conservation of Smith's blue butterfly, western snowy plover, and listed dune plants. Again, CalAm is proposing restoration of temporary impacts to habitat at a ratio of 1:1; mitigation for permanent impacts is proposed at 3:1.

Note that the acreages of impacts in Table 5-1 (see Section 5.2) are not necessarily cumulative, especially for listed plants. Some of the acreages of affected habitat overlap in that the same affected habitat may be suitable for more than one species.

### 3.1.10 Habitat Mitigation and Monitoring Plan

CalAm will develop and submit a HMMP to the resource agencies as appropriate (CCC, CDFW, RWQCB, USACE, USFWS, and local agencies that require a habitat mitigation and monitoring plan) for approval prior to project construction. The HMMP will be implemented at all areas where special-status species habitat or special-status natural communities will be restored, created, or enhanced to mitigate for project impacts either prior to, concurrently with, or following project construction, as specified in the HMMP. Final project impact acreages will be calculated after the 100 percent design is complete, and these acreages will be used to calculate the amount of mitigation required. The HMMP will outline measures to be implemented, depending on the mitigation requirements, to restore, improve, or re-establish special-status species habitat, sensitive communities, and critical habitat on the site, and will include the following elements, as applicable:

1. Name and contact information for the property owner of the land on which the mitigation will take place
2. Identification of the water source for supplemental irrigation
3. Identification of depth to groundwater
4. Site preparation guidelines to prepare for planting, including coarse and fine grading
5. Plant material procurement, including assessment of risk of introduction of plant pathogens through use of nursery-grown container stock vs. collection and propagation of site-specific plant materials, or use of seeds
6. Planting plan outlining species selection, planting locations and spacing, for each vegetation type to be restored
7. Planting methods, including containers, hydroseed or hydromulch, weed barriers and cages, as needed
8. Soil amendment recommendations
9. Irrigation plan, with proposed rates (in gallons per minute), schedule (i.e. recurrence interval), and seasonal guidelines for watering
10. Site protection plan to prevent unauthorized access, accidental damage and vandalism
11. Weeding and other vegetation maintenance tasks and schedule, with specific thresholds for acceptance of invasive species
12. Performance standards by which successful completion of mitigation can be assessed in comparison to a relevant baseline or reference site, and by which remedial actions will be triggered; all success criteria to be summarized in tabular form
13. Monitoring methods and schedule
14. Reporting requirements and schedule
15. Adaptive management and corrective actions to achieve the established success criteria
16. Educational outreach program to inform operations and maintenance departments of local land management and utility agencies of the mitigation purpose of restored areas to prevent accidental damages
17. Description of any other compensatory mitigation in the form of land purchase, establishment of conservation easements or deed restrictions, contribution of funds in lieu of active restoration, or purchase of mitigation bank credits, or other means by which the mitigation site will be preserved in perpetuity.

## 3.2 Species-Specific Avoidance and Minimization Measures

### 3.2.1 Federally listed plants

Prior to construction, CalAm or its contractor will conduct focused botanical survey(s) for special-status plants in all potentially suitable habitat during the appropriate blooming period for each species and in accordance with the guidelines established by California Department of Fish and

Game in *Protocols for Surveying and Evaluating Impacts to Special Status Native Plant Populations and Natural Communities* (CDFG 2009). Maps depicting the results of these surveys will be prepared for use in final design. If more than two years elapse between the focused botanical surveys and commencement of ground disturbance activities, a final set of appropriately-timed, focused botanical surveys will be conducted and populations mapped. The results of these final surveys will be combined with previous survey results to produce habitat maps showing habitat where the special-status plants have been observed during the focused botanical surveys conducted for each facility site. The following measures to avoid and minimize adverse effects on special-status plants will be implemented:

1. To the extent feasible, project facilities will be sited to avoid permanent and temporary adverse effects on special-status plants and their required constituent habitat elements.
2. Special-status plants located within temporary construction areas will be fenced or flagged for avoidance (if feasible) prior to construction. The Lead Biologist or the appointed biological monitor will ensure compliance with off-limits areas. If avoidance is not feasible, seasonal avoidance measures (i.e., limited operating periods based on timing of annual plant dormancy), or temporarily placing heavy fabric or wooden mats over the affected habitat will be applied as appropriate. Topsoil salvage and site restoration may also be implemented, to be determined by the Lead Biologist and USFWS and CDFW, as appropriate.
3. Compensation for temporary or permanent loss of special-status plant occurrences, in the form of land purchase or restoration, will be provided at a 1:1 ratio for temporary losses and a 3:1 ratio for permanent losses. Compensatory measures will be determined on a case-by-case basis in consultation with the resource agencies with jurisdiction over those species.
4. CalAm will prepare a HMMP, as described in Section 3.1.10, which will describe either onsite or offsite restoration.

### 3.2.2 Smith's blue butterfly

CalAm or its construction contractor(s) will implement the following measures to reduce adverse effects on endangered Smith's blue butterfly (*Euphilotes enoptes smithi*) during construction:

1. Floristic botanical surveys of all suitable habitat for coast buckwheat (*Eriogonum latifolium*) and seacliff buckwheat (*Eriogonum parvifolium*), both of which are host plants to the Smith's blue butterfly, will be conducted by a qualified biologist during project design and prior to project implementation. Maps depicting the results of these surveys will be prepared to document the location of the host plants within or adjacent to the project area.
2. Construction of project elements will be planned to avoid mapped host plants for Smith's blue butterfly whenever feasible.
3. If it is not feasible to avoid disturbance to host plants during project construction, the following will be implemented.
    a. Prior to the start of construction activities and before conducting preconstruction surveys for Smith's blue butterfly, the Lead Biologist or an appointed qualified biologist will prepare a protect-in-place and/or relocation plan for Smith's blue butterfly and its host plants. If either is found in areas subject to permanent habitat or plant loss, then

plants would be salvaged and relocated in accordance with the plan. The relocation plan will be submitted to USFWS for approval. The relocation plan will define the study area, describe appropriate handling and relocation methods (such as digging up and removing individual plants, duff, and/or soil and moving them to a new location), and identify appropriate relocation sites.

b. If preconstruction surveys identify butterflies or host plants in areas subject only to temporary disturbance that do not require plant removal, then the plants, and leaf litter and soil which may hold dormant butterfly pupae, would be protected in place with heavy fabric, plywood or other mats (depending on the stability of the underlying soil) to allow construction vehicles to pass over. Following construction, the fabric or mats would be carefully removed and the area allowed to recover. Short-term damage to buckwheat populations is expected to be low.

c. A qualified biologist will survey the work area no more than 30 days before the onset of ground disturbance. If any life stage of the Smith's blue butterfly or its host plants is found within the project area boundary, the Lead Biologist or qualified biologist will relocate plants, duff, and/or soil, from the site before construction begins per the relocation plan described above.

4. Upon completion of construction activities, CalAm will restore Smith's blue butterfly habitat temporarily removed during construction. Compensatory mitigation for permanent losses of habitat will be provided either onsite or offsite at a ratio of 3:1. Restoration and mitigation activities will be described in the HMMP (Section 3.1.10).

### 3.2.3 Tidewater goby

1. A biological monitor will monitor all work within 500 feet of potential tidewater goby (*Eucyclogobius newberryi*) habitat (Salinas River and Tembladero Slough). The biological monitor will monitor compliance with all avoidance and minimization measures and will have the authority to halt any action which may result in take of tidewater goby.
2. No equipment will be permitted to enter wetted portions of any channel, except the barge which is needed to hang the pipeline from the Monte Road Bridge over the Salinas River. When work is occurring within 500 feet of potential tidewater goby habitat, the biological monitor will pay particular attention to ensure that no equipment or material inadvertently enters the wetted channel from shore or from the barge.
3. If a tidewater goby is harassed, injured, or killed by the Proposed Action, work will immediately stop and USFWS will be contacted. Work will not resume until advised by USFWS.

### 3.2.4 California tiger salamander and California red-legged frog

A preconstruction survey for California tiger salamander and California red-legged frog will be conducted by a qualified biologist in suitable habitat where there is a moderate to high potential for these species to occur prior to vegetation removal or grading, as specified below:

1. Prior to conducting the surveys, the qualified biologist will prepare a relocation plan that describes the appropriate survey and handling methods for California tiger salamander and California red-legged frog, and identifies nearby relocation sites where individuals would be

relocated if found during the preconstruction surveys. The relocation plan will be submitted to USFWS and CDFW for approval prior to the start of construction activities.

2. Preconstruction surveys will be conducted within 5 days prior to, and again immediately prior to, vegetation removal, grading, or installation of exclusion fence to identify any California tiger salamander, California red-legged frog, and any small mammal burrows.
3. Small mammal burrows within the project footprint identified during preconstruction surveys will be surveyed (through hand-excavation, scoping, or other suitable methods to be determined in consultation with USFWS and CDFW) to identify any California tiger salamander or California red-legged frog. Once the burrow is confirmed to be vacant of any animals, the burrow will be collapsed.
4. If California tiger salamander or California red-legged frog are observed within the project footprint, a qualified biologist will relocate the individual according to the relocation described plan above and only with authorization from USFWS and CDFW.
5. Exclusion fencing will be installed around construction areas where there is a moderate to high potential for these species to occur as specified in Section 3.1.3.
6. The qualified biologist will monitor vegetation removal and grading inside the exclusion fence as specified in Section 3.1.3.

Upon completion of construction activities, CalAm will restore any California tiger salamander and California red-legged frog habitat temporarily modified during construction. Compensatory mitigation for permanent adverse effects on suitable habitat will be provided either onsite or offsite at a minimum ratio of 3:1. Restoration and mitigation activities will be described in the HMMP (Section 3.1.10).

### 3.2.5 Western snowy plover

Construction contractors will be required to implement the following measures to avoid adverse effects on western snowy plover (*Charadrius nivosus*):

1. Construction work at the Intake Slant Wells and along the segment of the Source Water Pipeline located west of the CEMEX Lapis Plant site will begin during the western snowy plover non-nesting season (defined as October 1 through February 28), unless no snowy plover are present during the nesting season (as determined from nesting surveys performed by a USFWS-approved biologist) and work during the nesting season in specified locations has previously been approved by the USFWS.
2. For work that cannot be completed during the non-nesting season, and thus will need to be conducted during nesting season, the following steps to obtaining USFWS approval will be implemented:
    a. CalAm will engage the services of Point Blue or another qualified western snowy plover biologist (subject to approval by USFWS) to perform one year of surveys during the nesting season preceding construction to determine whether nesting is occurring within sight or audible range of the slant well head locations or Source Water Pipeline.
    b. If findings from the nesting season survey are negative, then the qualified western snowy plover biologist will conduct additional pre-construction nesting surveys within 24 hours of initiation of construction activities within 300 feet (91 meters) of all

**construction work areas to determine if any snowy plover nests are present. If there is a break of 3 days or more in construction activities, a survey will be conducted before construction begins again.**

   c. **If nests are observed within 300 feet (91 meters) of construction activities, the qualified biologist will notify and consult with USFWS to determine whether construction may proceed, based on detailed information on location of nest(s), proximity to construction, site lines and topography, and noise environment. Any additional avoidance or minimization measures will be implemented prior to initiating construction activities.**

3. **For construction during the breeding season that is approved by USFWS, visual barriers will be installed around any work area located within line of sight of potential nesting habitat. Visual barriers will be constructed at an adequate height and width to visually block construction equipment and construction crews from snowy plover nesting habitat. Final designs of the visual barriers will be coordinated with USFWS. Existing sand dunes may serve as visual barriers. Signage will be placed along a roped or fenced buffer zone around habitat adjacent to construction activities. Signs will show pictures of snowy plovers, their nests, and warn workers of their potential presence. The USFWS-approved monitor will be onsite during the nesting season, and required to provide environmental training to all construction workers prior to their starting work.**
4. **For work conducted during the non-nesting season, a qualified biologist will evaluate the nature and extent of wintering plover activity in the project area several days prior to construction and inform CalAm so they can make construction decisions that avoid or minimize disturbance to plovers. The biologist will conduct periodic monitoring during construction to ensure that minimization measures are implemented to avoid or minimize disturbance to plovers. The USFWS-approved monitor will be onsite during the nesting season and required to provide environmental training to all construction workers prior to their starting work.**
5. **CalAm will restore all temporarily affected potential snowy plover habitat following construction. Restoration and mitigation activities will be described in the HMMP (Section 3.1.10).**
6. **Anti-perching devices, such as bird spikes or wire strips, will be installed and maintained on the top of the proposed electrical control panel to discourage potential plover predators.**
7. **Permanent loss of western snowy plover habitat will be compensated, at a minimum ratio of 3:1 through actions to enhance existing degraded habitat according to one of the following approaches, or a combination thereof:**
   a. **Prior to project implementation, CalAm will prepare a HMMP, as described in Section 3.1.10, which will describe either onsite or offsite restoration. The plan will include actions to benefit western snowy plover, in conjunction with providing mitigation for special-status plants. The plan will be subject to USFWS input and approval. It will describe restoration methods that may include, but not be limited to, removal of ice plant and planting, seeding, or other means of re-establishing native plant species. CalAm will identify and secure access rights and other approvals to implement the plan, and will execute the plan. CalAm will conduct, or will support a qualified third party**

monitor to conduct annual monitoring of restoration performance measures, such as cover, density and diversity of native plant species, thresholds of non-native plant abundance, and stability of dune sands.

b. Alternatively, and also subject to USFWS input and approval, in lieu of undertaking restoration actions described above, CalAm may contribute funds to either a mitigation bank authorized to sell credits for western snowy plover habitat or dunes scrub vegetation, or to an existing restoration program in areas where recreational effects on plovers are adequately managed, such as those undertaken by the Monterey Peninsula Regional Park District. Sites where recreation may adversely affect plovers should not be considered suitable mitigation sites for western snowy plovers unless management is improved.

### 3.2.6 Birds covered by the MBTA

A qualified biologist will conduct preconstruction avian nesting surveys prior to initiation of construction activities at all facility sites, unless otherwise indicated below.

1. No preconstruction surveys or avoidance measures are required for construction activities that would be completed entirely during the non-nesting season (September 16 to January 31).
2. For all construction activities scheduled to occur during the nesting season (February 1 to September 15), a qualified biologist will conduct a preconstruction avian nesting survey within 14 days of site clearing and/or ground disturbance. Copies of the survey results will be submitted to the CPUC.
3. If construction activities at any given facility site begins in the non-breeding season and proceeds continuously into the breeding season, no surveys are required. However, if there is a break of 14 days or more in construction activities during the breeding season, a new nesting bird survey will be conducted before reinitiating construction.
4. The surveying biologist will be capable of determining the species and nesting stage without causing intrusive disturbance. The surveys will cover all potential nesting sites within 500 feet (152 meters) of the project area for raptors and within 300 feet (91 meters) for other birds.
5. If active nests are found, a no-disturbance buffer (at least 300 to 500 feet [91 to 152 meters] for raptors and 50 to 100 feet (15 to 30 meters) for other birds [or as otherwise determined in consultation with USFWS and CDFW] will be created around the active nests). If the nest(s) are found in an area where ground disturbance is scheduled to occur, the project operator will require that ground disturbance be delayed until after the birds have fledged.

Bird deterrents (such as reflective flagging, whistles, or a falconer) will be utilized at the Brine Storage Basin. The type of bird deterrent will be determined by the Lead Biologist and will be modified if, through monitoring (as described below), the bird deterrents are either not sufficient at deterring birds from the Brine Storage Basin or pose a risk to wildlife.

Monitoring of the Brine Storage Basin will include the following:

1. **Daily Monitoring: Cal Am operational staff will monitor the brine pond on a daily basis as part of their regular routine. If staff see regular use of the pond by birds, any dead animals, or any unusual sighting, the Lead Biologist and USFWS will be notified within one working day.**
2. **Monthly Monitoring: A qualified biologist and/or qualified biological monitor will regularly survey the Brine Storage Basin at least once per month starting with the first month of operation of the Brine Storage Basin. The purpose of the surveys will be to determine if the bird deterrents are effective in excluding birds and to assess whether the deterrents serve as a hazard to birds or wildlife. The monthly surveys will be conducted in one day for a minimum of two hours following sunrise (i.e., dawn), a minimum of one hour mid-day (i.e., 1100 to 1300), and a minimum of two hours preceding sunset (i.e., dusk) in order to provide an accurate assessment of bird and wildlife use of the ponds during all seasons. Operations staff at the MPWSP Desalination Plant will also report finding any dead birds or other wildlife at the Brine Storage Basin to the Lead Biologist within one day of the detection of the carcass. The Lead Biologists will report any bird or other wildlife deaths or entanglements within two days of the discovery to CalAm, CDFW, and USFWS.**
3. **Quarterly Monitoring: If after 12 consecutive monthly site visits (described above) no bird or wildlife deaths are detected at the Brine Storage Basin by or reported to the Lead Biologist, monitoring can be reduced to quarterly visits.**
4. **Biannual Monitoring: If after 12 consecutive quarterly site visits (described above) no bird or wildlife deaths are detected by or reported to the Lead Biologist, future surveys may be reduced to two surveys per year, during the spring nesting season and during fall migration.**
5. **Modification of Monitoring Program: As appropriate, the Lead Biologist will modify the monitoring program based on information acquired during monitoring, and may also suggest adaptive management measures to remedy any problems that are detected during monitoring or modifications if bird impacts are not observed.**

# 4 Affected Environment

This section describes the habitat and species present, and the affected environment. The information presented in this section is focused on the terrestrial environment and the Salinas River in the Action Area. These areas correspond to the project components that could affect resources under the jurisdiction of the USFWS.

The jurisdictional responsibilities and listing procedures for federally listed species were established in 1974 through a Memorandum of Understanding between the USFWS and the NMFS (NMFS and USFWS 1974).

The Director, U.S. Fish and Wildlife Service has jurisdictional responsibility for the following classes, orders, or groups of animals: "all members of the classes Mammalia (except members of the order Cetacea, and members of the order Pinnepedia, other than Walruses), Aves, Reptilia (except marine turtles of the families Cheloniidae and Dermochelyidae), Amphibia, and all other species (except species of the orders Cetacea and Pinnipedia, other than Walruses) which either (i) spend the major portion of their lifetimes on land and/or in fresh water; or (ii) are species which spend part of their lifetimes in estuarine waters, if the major portion of the remaining time (the time which is not spent in estuarine waters) is spent on land and/or in fresh water." (NMFS and USFWS 1974).

A separate BA for potential project-related effects on species that are under the jurisdiction of the NMFS has been prepared. The NMFS BA contains a summary of the affected environment, potential adverse effects on federally listed species under NMFS jurisdiction, proposed avoidance and minimization measures, and meets requirements for a BA identified in 50 CFR §402.12(f).

Some of the species covered in this USFWS BA are jointly managed with the NMFS. The NMFS and USFWS share jurisdiction over marine sea turtles in the Cheloniidae and Dermochelyidae families (NMFS and USFWS 1974). NMFS has lead responsibility in the marine environment, while USFWS has responsibility for sea turtles on land. Because marine sea turtles do not nest on terrestrial areas in Monterey County, these species are not discussed in this USFWS BA and are included only in the NMFS BA.

Section 4.1 describes the methods used to assess the Action Area. Section 4.2 describes the affected environment in the Action Area. Sections 4.3 and 4.4 present the life history of each of the federally listed, proposed, and candidate species, and evaluates the potential for the species to occur in the Action Area. Section 4.5 discusses species covered under the Migratory Bird Treaty Act.

## 4.1 Methods

### 4.1.1 Background Review

Before field surveys were initiated, existing background information was reviewed to identify the locations of special-status plant and wildlife species, special-status plant communities, and federally designated or proposed critical habitat units recorded or potentially occurring in the Action Area.

A list of special-status species, designated and proposed critical habitat, and special-status plant communities known to or potentially occurring in the Action Area was reviewed based on existing federal, state, and private databases. Database queries included all reported occurrences within 10 miles (16 kilometers) of the Action Area in order to capture species that occur in the region and that may be present in the Action Area but have not been directly observed and reported to occur in the Action Area. The following data sources were reviewed:

- USFWS Field Office Web Sites: A list of federal candidate, proposed, threatened, and endangered special-status wildlife and plant species, and their federally designated or proposed critical habitats, known or having the potential to occur within Monterey County was generated (Appendix A).
- California Natural Diversity Database (CNDDB)/RareFind: A list of special-status plant and wildlife species was prepared through an inquiry using the RareFind program and a GIS mapping of all occurrences within 10 miles (16 kilometers) of the project footprint. This was performed to ensure that all special-status species, whose geographic location data had been suppressed, were captured in the query (CNDDB 2016).
- USFWS Recovery Plans, Federal Register publications, public agency technical reports, survey guidelines, and other published reports.

### 4.1.2 Field Surveys

This section provides the dates of field surveys that were conducted in the Action Area and summarizes the methods used to complete the field surveys. Information gathered during the background review and data collected during field surveys were used to make preliminary determinations of federally listed species' potential to occur in the Action Area (Appendix B). Table 4-1 lists the survey dates of the various biological resources surveys described in this section.

Table 4-1. Biological Resource Survey Dates

| Survey Type | Survey Dates | |
|---|---|---|
| Reconnaissance Field Trip | July 24, 2013 | |
| Wildlife habitat mapping | September 3-5, 2013;<br>March 19-21, 2014;<br>April 22-24, 2014;<br>June 11-18, 2014;<br>March 14-17, 2016; | April 25-29, 2016;<br>May 16-17, 2016;<br>May 23-24, 2016;<br>May 31-June 1, 2016;<br>June 15-16, 2016 |
| Botanical Surveys | September 3-5, 2013;<br>March 17-21, 2014;<br>April 22-24, 2014;<br>June 11-18, 2014;<br>April 7-9, 2015;<br>May 20-22, 2015; | June 10, 2015;<br>June 15-18, 2015;<br>March 14-18, 2016;<br>April 25-29, 2016;<br>June 6-10, 2016 |

#### *4.1.2.1 Reconnaissance Field Trip*

A reconnaissance field trip was conducted to review and obtain preliminary information for the purpose of planning the various field survey efforts and to determine health and safety hazards, resources present, and potential biological issues. The reconnaissance survey was conducted on July 24, 2013 and included a biking tour as well as driving tour of the portions of the project footprint.

#### *4.1.2.2 Wildlife Habitat Assessment*

Wildlife habitat assessment field surveys were conducted throughout the Action Area to identify and map California Wildlife Habitat Relationship (CWHR) habitat types using the wildlife habitat descriptions presented in *A Guide to Wildlife Habitats of California* (CDFG 1988). The wildlife habitat assessment was general in nature; it was not intended to be a substitute for protocol-level surveys. Wildlife habitat assessment surveys were conducted by a combination of meandering pedestrian transect surveys of the Action Area and windshield surveys from existing public roads and where permitted, from individual parcels, depending on their permission-to-enter status.

Primary activities of the wildlife habitat assessment included the following:

- Investigating specific habitat elements (e.g., rock outcrops, north facing slopes, burrow concentrations) that may be suitable for special-status wildlife species.
- Confirming, identifying, and describing known or previously unreported suitable wildlife habitat.
- Identifying and mapping locations of observed special-status wildlife species.

The locations of special-status wildlife species observed in the Action Area were recorded using a Trimble GeoXH GPS unit or were hand-mapped, as appropriate. Observations included those species that were directly observed and those species whose presence can be inferred based on diagnostic signs such as burrows, fresh tracks, bird songs or calls, scat, or nests. All wildlife species observed, regardless of listing status, were identified to the species level and recorded according to nomenclature found in *Complete List of Amphibian, Reptile, Bird, and Mammal Species in California* (CDFW 2016) (Appendix C).

#### *4.1.2.3 California Red-Legged Frog Surveys*

Site assessments were conducted for all aquatic features within California red-legged frog dispersal distance (1.0 mile [1.6 kilometers]) from the Action Area following the 2005 USFWS *Revised Guidance on Site Assessments and Field Surveys for the California Red-Legged Frog*. Following the site assessments, field surveys were conducted at aquatic features in the Action Area that were determined to contain potential California red-legged frog habitat (i.e., Locke-Paddon Lake and Reservation Road Pond). The site assessment and field survey report is included in Appendix D.

#### *4.1.2.4 Botanical Surveys*

Botanical surveys were conducted to map plant communities throughout the Action Area and to identify any federally listed plant species present in the Action Area. Botanical surveys were conducted according to the methods described in the California Native Plant Society (CNPS) *Botanical Survey Guidelines* (CNPS 2001), the *Protocols for Surveying and Evaluating Impacts on Special-Status Native Plant Populations and Natural Communities* (CDFG 2009), and *Guidelines for Conducting and Reporting Botanical Inventories for Federally Listed, Proposed and Candidate Plants* (USFWS 1996).

##### *Special-Status Plants*

All observed plants, including special-status plants located within the Action Area, were identified to the finest taxonomic level possible using the Jepson Manual, 2nd Edition (Baldwin 2012) and *The Plants of Monterey County, An Illustrated Field Key*, 2$^{nd}$ Ed. (Matthews and Mitchell 2015). All special-status plant occurrences were mapped as contiguous populations (groups of individuals which fell within no greater than 0.25 mile [0.40 kilometer] from each other). Contiguous populations were recorded on a Trimble GeoXH GPS and CNDDB forms were generated. Individual rare plants were marked with a single point locus on the GPS, and given a 20-foot (6-meter) buffer on the maps. Populations of rare plants or colonial shrubs greater than 20 feet (6 meters) in diameter were mapped as polygons.

Special-status plants bloom at varying times of the year, particularly in coastal Monterey County. Because the majority of species can only be identified by their flowers or fruits, a minimum of three separate seasonal survey periods were required to adequately capture all potential bloom periods for special-status plants. The first surveys were conducted in the fall of 2013 and continued into the spring and summer of 2014. However, because 2014 was considered a drought year in California, and because low rainfall can change bloom periods or even prevent a species from being detectable, staff at CDFW suggested that reference population surveys were necessary in conjunction with rare plant surveys. Reference population surveys are also recommended as part of the CNPS *Rare Plant Program's Botanical Survey Guidelines* (CNPS 2001).

The reference population surveys included visiting known extant populations of these species occurring within a 10-mile (16-kilometer) radius of the Action Area. To ensure that these plants were detectable during the same time frame surveys were being conducted, reference population surveys were conducted throughout the Action Area within the same week as rare plant surveys. Additionally, biologists depended on bloom reports from other professional botanists and firms (such as Arcadis and Denise Duffy & Associates) who had access to areas (i.e. Fort Ord) not otherwise attainable for this project.

Rare plant surveys continued in 2015 and 2016, when rainfall conditions were more conducive to blooms and all of the highest-priority special-status plant species had been detected at reference populations.

*Plant Communities*

All plant communities in the Action Area were identified using the keys in Sawyer et al. (2009) and hand-drawn on the field map book, which was at a scale of 1 inch = 200 feet (2.5 centimeters = 61 meters; 1:2,400). Communities were mapped if they were the same size or greater than the minimum mapping unit of 0.5 acre (0.2 hectare).

### 4.1.3 Ecological Modeling

Ecological modeling was conducted for all special-status species with potential to occur in the Action Area. MaxEnt software was used to help determine areas with moderate to high species occurrence potential. GIS specialists and qualified biologists input CNDDB records and other occurrence records, project survey data, and species range for all special-status species with potential to occur in the Action Area.

MaxEnt uses a collection of locations where a species has been found (such as CNDDB records and project survey findings), along with environmental parameters such as soil, precipitation, and temperature data, to produce an estimate of the species' distributions throughout the Action Area with differentiated layers indicating where the species has a greater or lesser likelihood to occur.

### 4.1.4 Limitations that May Influence Results

Several limitations were encountered during field surveys that resulted in reduced access within the Action Area and may influence the results of the studies. These limitations are associated with the following issues:

- Lack of permissions to enter some private property,
- Lack of access to all portions of certain properties,
- Timing of seasonal surveys, and
- Inclement weather.

Due to the inaccessibility of some portions of the Action Area and the possibility that certain species were missed because of survey timing or inclement weather, it is possible that some special-status species in the Action Area were not directly observed during surveys. A lack of observation of a species during AECOM's surveys therefore does not indicate that the species is not present in the Action Area. Instead, for all areas where field access was limited, conservative assumptions regarding the presence of special-status species and plant communities were made based on assessments from adjacent areas, aerial photo interpretation, and/or post-survey GIS analysis.

## 4.2 Environmental Baseline

The following sections describe the climate, geology, hydrology, soils, and wildlife habitat and land use types in the Action Area and the surrounding area.

### 4.2.1 Climate

The region has a moderate Mediterranean climate, receiving 90 percent of its average 19.7 inches (50.0 centimeters) of annual precipitation from November through April (WRCC 2014). Watersheds associated with the Action Area include the Alisal-Elkhorn Sloughs, Salinas, and Carmel watersheds (Hydrologic Unit Code units 18060011, 18060005 and 18060012 respectively (USGS 2014).

### 4.2.2 Geology

The Action Area is located within the Coast Ranges, which are characterized by a series of northwest-trending mountain ranges and valleys that are generally fault controlled and is an area considered seismically active. The Monterey area is bounded to the east by the San Andreas Fault and to the west by the San Gregorio (Sur) fault (Ninyo and Moore 2014).

The Action Area is characterized by uplifted rock deposits in the urban Monterey peninsula, stabilized sand dunes in the portion of the Action Area adjacent to Monterey Bay and west of State Highway 1, and flat alluvial deposits used for agricultural areas in the northern portion of the Action Area. More specifically, the northeastern portion of the Action Area, north of the active Salinas River channel, is comprised of a relatively broad, low-lying alluvial floodplain. The central Action Area consists of eolian deposits that form moderately elevated, rolling hills extending several miles inland from the coastline and south from the Salinas River channel to Canyon del Rey (Ninyo and Moore 2014).

### 4.2.3 Soils

The soils in most of the Action Area are characteristically medium-grained sand of low organic content. The soils are low in fertility and water-holding capacity, highly erodible, and excessively well drained. The soils in the Action Area north of the Salinas River are loams used primarily for agriculture. Although there are some minor inclusions of other soils, most of the soils in the Action Area are represented in eight major soil series (Alviso, Baywood, Diablo, Metz, Oceano, Pacheco, Pico, and Santa Ynez) and one general classification (Dune land) (NRCS 2017).

### 4.2.4 Wildlife Habitat and Land Use Types

The following sections describe wildlife habitat and land use types in the Action Area. Wildlife habitat types are based on the CWHR. Table 4-2 summarizes the typical vegetation and associated plant communities for each habitat type in the Action Area. Wildlife species observed within each habitat type in the Action Area during AECOM's field surveys are included in Appendix C.

**Table 4-2. CWHR Habitat Types, Land Uses, and Typical Vegetation**

| CWHR Habitat Type/Land Use Type | Typical Vegetation | Associated Plant Communities |
|---|---|---|
| **Tree-Dominated Habitats** | | |
| Coastal Oak Woodland | Coast live oak (*Quercus agrifolia*) | Coast live oak woodland |
| Closed-Cone Pine-Cypress | Monterey pine (*Pinus radiata*), Monterey cypress (*Hesperocyparis macrocarpa*) | Monterey pine forest, Monterey cypress stands |
| Eucalyptus | Bluegum eucalyptus (*Eucalyptus globulus*) | Eucalyptus groves |
| Montane Hardwood Forest | California buckeye (*Aesculus californica*) | California buckeye groves |
| Valley Foothill Riparian | Arroyo willow (*Salix lasiolepis*), shining willow (*Salix lasiandra*), Fremont cottonwood (*Populus fremontii*), black cottonwood (*Populus trichocarpa*), red willow (*Salix laevigata*), boxelder (*Acer negundo*), California sycamore (*Platanus racemosa*) | California sycamore woodland, shining willow groves, Fremont cottonwood woodland, black cottonwood forest, arroyo willow thickets, box elder forest |
| **Shrub-Dominated Habitats** | | |
| Unknown Shrub Type | Acacias (*Acacia* spp.) | Acacia Shrubland |
| Chamise-Redshank Chaparral | Chamise (*Adenostoma fasciculatum*), woollyleaf manzanita (*Arctostaphylos tomentosa*), Monterey ceanothus (*Ceanothus rigidus*), Eastwood's goldenbush (*Ericameria fasciculata*), toyon (*Heteromeles arbutifolia*) | Chamise chaparral |
| Coastal Scrub | Coyote brush (*Baccharis pilularis*), California sagebrush (*Artemisia californica*), mock heather (*Ericameria ericoides*), silver dune lupine (*Lupinus chamissonis*), yellow bush lupine (*Lupinus arboreus*), ice plant (*Carpobrotus* spp.), poison oak (*Toxicodendron diversilobum*), California black sage (*Salvia mellifera*), California blackberry (*Rubus ursinus*), California buckwheat (*Eriogonum fasciculatum*), Island buckwheat (*Eriogonum giganteum* var. *giganteum*), seacliff buckwheat (*Eriogonum parvifolium*), seaside (coast) buckwheat (*Eriogonum latifolium*), golden yarrow (*Eriophyllum confertifolium*), California coffeeberry (*Frangula californica*), deerweed (*Acmispon glaber* var. *glaber*), common yarrow (*Achillea millefolium*), coastal sand verbena (*Abronia latifolia*), beach burr (*Ambrosia chamissonis*), coastal sagewort (*Artemisia pycnocephala*), bracken fern (*Pteridium aquilinum*), Nuttall's milkvetch (*Astragalus nuttallii* var. *nuttallii*), Monterey coast paintbrush (*Castilleja latifolia*), Monterey spineflower (*Chorizanthe pungens* var. *pungens*) | California coffeeberry scrub, California sagebrush scrub, California sagebrush-California black sage scrub, California sagebrush-California buckwheat scrub, California buckwheat scrub, silver dune lupine-mock heather scrub, coyote brush scrub, deerweed scrub, island buckwheat scrub, poison oak scrub, coastal brambles, yellow bush lupine scrub, ice plant mats, dune mat |

**Table 4-2. CWHR Habitat Types, Land Uses, and Typical Vegetation**

| CWHR Habitat Type/Land Use Type | Typical Vegetation | Associated Plant Communities |
|---|---|---|
| Mixed Chaparral | Sandmat manzanita (*Arctostaphylos pumila*), woolly-leaf manzanita (*Arctostaphylos tomentosa*), Monterey ceanothus (*Ceanothus rigidus*), California sagebrush, chamise, California sagebrush, California buckwheat, California coffeeberry, coastal biscuitroot (*Lomatium parvifolium*), spider lupine (*Lupinus benthamii*), coast silktassel (*Garrya elliptica*), Eastwood's goldenbush, poison oak, golden yarrow, toyon (*Heteromeles arbutifolia*), coast live oak, poison oak | sandmat manzanita chaparral, woolly-leaf manzanita, California sagebrush-California black sage scrub, California sagebrush-California buckwheat scrub, California buckwheat scrub, California coffeeberry scrub, chamise chaparral |
| **Herbaceous-Dominated Habitats** | | |
| Annual Grassland | Bromes (*Bromus* spp.), wild oats (*Avena* spp.), barley (*Hordeum* spp.), lupines (*Lupinus* spp.), California poppy (*Eschscholzia californica*), mustards (*Brassica* spp.), cheeseweeds (*Malva* spp.), stinkwort (*Dittrichia graveolens*), cudweed (*Pseudognaphalium* spp.) | California annual grassland, upland mustards, ruderal, |
| Freshwater Emergent Wetland | California bulrush (*Schoenoplectus californicus*), duckweed (*Lemna minor*), perennial pepperweed (*Lepidium latifolium*), smartweed (*Persicaria* spp.), cocklebur (*Xanthium* spp.), water parsley (*Oenanthe sarmentosa*), cattail (*Typha* spp.), yellow monkeyflower (*Mimulus guttatus*) | California bulrush marsh, duckweed blooms, perennial pepperweed patches, smartweed-cocklebur patches, water parsley marsh, cattail marshes |
| Saline Emergent Wetland | Pacific silverweed (*Potentilla anserina*), pickleweed (*Salicornia pacifica*), marsh jaumea (*Jaumea carnosa*), salt grass (*Distichlis spicata*), California bulrush, alkali bulrush (*Bolboschoenus maritimus*), perennial pepperweed | Pacific silverweed marsh, pickleweed mat, salt grass flats, perennial pepperweed patches |
| **Aquatic Habitats** | | |
| Lacustrine | Algae, duckweed, mosquito fern (*Azolla filiculoides*) | duckweed blooms |
| Riverine | Algae, duckweed, mosquito fern | duckweed blooms |
| Marine | None | None |
| **Developed Habitats** | | |
| Irrigated row and field crops | Artichoke (*Cynara cardunculus* var. *scolymus*), strawberry (*Fragaria* x *ananassa*), cauliflower/broccoli/cabbage/Brussels sprouts (*Brassica oleracea*), sorghum (*Sorghum bicolor*), asparagus (*Asparagus officinalis*) | Agricultural |
| Urban | Monterey cypress, Monterey pine, coast live oak, coastal redwood (*Sequoiadendron sempervirens*), and numerous non-native species, ngaio tree (*Myoporum laetum*), crystalline iceplant (*Mesembryanthemum crystallinum*), Fescue (*Festuca* spp.), bluegrass (*Poa* spp.), and others | Developed, landscaped trees, landscaped shrubbery |
| **Non-Vegetated Habitats** | | |
| Barren | NA | Bare dune |

#### *4.2.4.1 Tree-Dominated Habitats*

Five tree-dominated habitats were identified in the Action Area and are described below.

***Coastal Oak Woodland***

Coastal Oak Woodland is the most prevalent tree-dominated habitat within the Action Area and encompasses one vegetation alliance, coast live oak woodland. The dominant tree, coast live oak (*Quercus agrifolia*), often forms monotypic stands within the Action Area, but may be joined by Monterey pine (*Pinus radiata*) and Monterey cypress (*Hesperocyparis macrocarpa*), particularly near developed areas. Coastal oak woodland co-occurs in suburban regions throughout the Action Area.

Some species found in valley riparian woodland are shared with coastal oak woodland within the Action Area, as narrow water feature zones may lack a true riparian corridor and, instead, have oaks. No federally listed species were observed in the coastal oak woodland habitat within the Action Area during AECOM's field surveys. Federally listed species with potential to occur in coastal oak woodland include California red-legged frog (*Rana draytonii*) and California tiger salamander which may use coastal oak woodlands for dispersal or upland habitat.

***Closed-Cone Pine-Cypress***

Closed-cone pine-cypress forest within the Action Area primarily consists of semi-natural stands of Monterey cypress forest and Monterey pine forest. Monterey cypress is a widely-planted windbreak and is not native within the Action Area, in spite of its prevalence. Monterey pine may be native in some parts of the Action Area, but is typically found as planted or escaped volunteers. Because no truly natural forests of either species exist within the Action Area, closed-cone pine-cypress does not support a diverse range of wildlife, except for those which occur incidentally. No federally listed species were observed and there is low potential for any federally listed species to occur in this habitat type in the Action Area.

***Eucalyptus***

Eucalyptus within the Action Area is limited to row plantings in urban areas or parks. The only plant community associated with this type is Eucalyptus groves, comprised of blue gum (*Eucalyptus globulus*). Few wildlife species occur within these non-native groves, in part because they occur in urban areas within the Action Area, but also because the ecology of Eucalyptus is associated with lower biodiversity in general, even though they may be used by nesting or foraging birds (McBride et al. 1988, Cal-IPC 2016, Watson 2000). No federally listed species were observed and there is low potential for any federally listed species to occur in this habitat type in the Action Area.

***Montane Hardwood Forest***

Montane hardwood forest within the Action Area is limited to a single vegetation type, California buckeye groves. California buckeye (*Aesculus californica*), occurs very minimally within the Action Area and is surrounded by urban plantings and coastal oak woodland. No federally listed species were observed and there is low potential for any federally listed species to occur in this habitat type in the Action Area.

***Valley Foothill Riparian***

Valley foothill riparian within the Action Area includes several plant communities: arroyo willow thickets, shining willow groves, California sycamore woodland, Fremont cottonwood woodland, black cottonwood forest, and boxelder forest. Associated trees include arroyo willow (*Salix lasiolepis*), shining willow (*Salix lasiandra*), Fremont cottonwood (*Populus fremontii*), black cottonwood (*Populus trichocarpa*), red willow (*Salix laevigata*), boxelder (*Acer negundo*), alder (*Alnus* spp.), and California sycamore (*Platanus racemosa*). The Action Area crosses relatively few aquatic features; however, the Salinas River is the most prominent and contains dense stands of valley foothill riparian on both banks. Valley foothill riparian is also present at the Carmel Valley Pump Station, and along Locke Paddon. No federally listed species were observed; however, valley foothill riparian may provide foraging, upland, and dispersal habitat for the California red-legged frog and California tiger salamander, and breeding and foraging habitat for the least Bell's vireo (*Vireo bellii pusillus*).

### 4.2.4.2 Shrub-Dominated Habitats

Four shrub-dominated habitats were identified in the Action Area and are described below.

*Unknown Shrub Type*

The unknown shrub type habitat is represented by only one plant community within the Action Area: acacia scrubland. Acacia scrubland is not recognized by Sawyer et al. (2009), but black wattle (*Acacia decurrens*), blackwood acacia (*Acacia melanoxylon*), golden wattle (*Acacia longifolia*), and other species of acacia, all non-native shrubs, were prevalent enough in the Action Area that they warranted its own classification. Typically, acacia scrubland occurred on disturbed soils along railroad tracks, bike paths, and roadsides, creating a buffer between these man-made areas and natural coastal scrub habitats. No federally listed species were observed and there is low potential for any federally listed species to occur in this habitat type in the Action Area.

*Chamise-Redshank Chaparral*

Chamise-redshank chaparral within the Action Area consists of the plant community chamise chaparral, dominated by its namesake chamise (*Adenostoma fasciculata*) and associates woolly-leaf manzanita (*Arctostaphylos tomentosa*), Monterey ceanothus (*Ceanothus rigidus*), California coffeeberry (*Frangula californica*), and other native shrubs. Redshank (*Adenostoma sparsifolium*) does not occur in Monterey County, and is not present within the Action Area.

Chamise-redshank chaparral was generally found on stabilized dunes on Fort Ord just east of General Jim Moore Boulevard, surrounded by other chaparral types. It was generally found undisturbed by anthropogenic activity and had high potential for wildlife. No federally listed species were observed; however, California tiger salamander and California red-legged frog may use the area for dispersal or upland habitat since this community is within dispersal range from potential breeding areas.

*Coastal Scrub*

Within the Action Area, coastal scrub is by far the most abundant natural habitat, and is comprised of numerous vegetation communities, including California coffeeberry scrub, California sagebrush scrub, California sagebrush-California black sage scrub, California sagebrush-California buckwheat scrub, California buckwheat scrub, silver dune lupine-mock heather scrub, coyote brush scrub, deerweed scrub, island buckwheat scrub, poison oak scrub, coastal brambles, yellow bush lupine scrub, ice plant mats, and dune mat. The dominant plant species within coastal scrub are coyote brush (*Baccharis pilularis*), California sagebrush (*Artemisia californica*), mock heather goldenbush (*Ericameria ericoides*), silver dune lupine (*Lupinus chamissonis*), yellow bush lupine (*Lupinus arboreus*), ice plant (*Carpobrotus* spp.), poison oak (*Toxicodendron diversilobum*), California black sage (*Salvia mellifera*), California blackberry (*Rubus ursinus*), California buckwheat (*Eriogonum* *fasciculatum*), Island buckwheat (*Eriogonum giganteum* var. *giganteum*), seacliff buckwheat, seaside (coast) buckwheat, golden yarrow (*Eriophyllum confertifolium*), California coffeeberry (*Frangula californica*), deerweed (*Acmispon glaber* var. *glaber*), common yarrow (*Achillea millefolium*), coastal sand verbena (*Abronia latifolia*), beach burr (*Ambrosia chamissonis*), coastal sagewort (*Artemisia pycnocephala*), bracken fern (*Pteridium aquilinum*), Nuttall's milkvetch (*Astragalus nuttallii* var *nuttallii*), Monterey coast paintbrush (*Castilleja latifolia*), Monterey spineflower (*Chorizanthe pungens* var. *pungens*).

Coastal scrub encompasses much of the natural, stabilized, and disturbed dune vegetation within the Action Area, but is also present as a pioneering community on disturbed habitats and is found on the edges of the TAMC right of way and along roadsides. It may also be found in association with chamise-redshank chaparral, coastal oak woodland, and is prevalent in urban areas that have not been planted. It occurs as a planted community in some restoration areas in the town of Marina, such as at Locke Paddon.

Western snowy plover, which breed in the dunes at the CEMEX Lapis Plant site, were mapped in the coastal scrub habitat in the Action Area. The host plants for Smith's blue butterfly, seaside (coast) buckwheat and seacliff buckwheat, were mapped as habitat for the species throughout this coastal scrub community, even though the butterfly itself was not observed. Coastal scrub may provide dispersing or upland habitat to California tiger salamander and California red-legged frog.

*Mixed Chaparral*

Within the Action Area, mixed chaparral encompassed the following plant communities: sandmat manzanita chaparral, woolly-leaf manzanita, California sagebrush-California black sage scrub, California sagebrush-California buckwheat scrub, California buckwheat scrub, and California coffeeberry scrub, chamise chaparral. These are dominated by sandmat manzanita (*Arctostaphylos pumila*), woolly-leaf manzanita, Monterey ceanothus, California sagebrush, chamise, California sagebrush, California buckwheat, California coffeeberry, coastal biscuitroot (*Lomatium parvifolium*), spider lupine (*Lupinus benthamii*), coast silktassel (*Garrya elliptica*), Eastwood's goldenbush (*Ericameria fasciculata*), poison oak, golden yarrow, toyon (*Heteromeles arbutifolia*), coast live oak, and poison oak. The majority of the mixed chaparral found within the Action Area is on Fort Ord, but this habitat type sometimes occurs along the TAMC right of way adjacent to Marina Dunes State Park in the form of sandmat manzanita chaparral.

No federally listed species were observed; however, the host plants for Smith's blue butterfly were mapped as habitat for the species throughout this community. California tiger salamander and California red-legged frog may use the area for dispersal or upland habitat since this community is within dispersal range from potential breeding areas.

### *4.2.4.3 Herbaceous Habitats*

Three herbaceous habitats were identified in the Action Area and are described below.

*Annual Grassland*

Within the Action Area, annual grassland is associated with the following plant communities: California annual grassland, upland mustards, ruderal; and dominated by low-growing herbaceous species such as Bromes (*Bromus* spp.), wild oats (*Avena* spp.), barley (*Hordeum* spp.), lupines (*Lupinus* spp.), California poppy (*Eschscholzia californica*), mustards (*Brassica* spp.), cheeseweeds (*Malva* spp.), stinkwort (*Dittrichia graveolens*), cudweed (*Pseudognaphalium* spp.). Annual grassland occurs in large stretches of the pipeline alignment north of Marina, on the Proposed Desalination Plant Site, and in ruderal stretches along highways and bike paths. No federally listed species were observed; however, California tiger salamander and California red-legged frog may use the area for dispersal or upland habitat.

*Freshwater Emergent Wetland*

Freshwater emergent wetland within the Action Area includes the plant communities of California bulrush marsh, duckweed blooms, perennial pepperweed patches, smartweed-cocklebur patches, water parsley marsh, and cattail marshes. These occur in association of agricultural canals; the Salinas River; and sloughs like Alisal and Tembladero; and Locke Paddon.

Freshwater emergent wetland may occur in the form of dense, impenetrable bulrush growing 10 feet high, or it may be a surface coating just 0.1 inches thick of duckweed, so a large variety of aquatic wildlife is found in association with it. No federally listed species were observed. Federally listed species with the potential to occur in freshwater emergent wetland are California red-legged frog and California tiger salamander.

*Saline Emergent Wetland*

Saline emergent wetland within the Action Area is represented by the pacific silverweed marsh, pickleweed mat, salt grass flats, and perennial pepperweed patches plant communities. It is rare within the Action Area, but narrow strips of it are found along Tembladero Slough and in some parts of Locke Paddon. No special-status species were observed, but these communities have the potential to harbor tidewater goby.

#### *4.2.4.4 Aquatic Habitats*

Two aquatic habitats were identified in the Action Area and are described below.

*Lacustrine*

Lacustrine (lake) habitats within the Action Area contain few plant communities, other than duckweed blooms. Floating, unrooted plants such as duckweed, mosquito fern (*Azolla filiculoides*), and algae comprise the vegetation within lacustrine habitats, and lacustrine habitats are represented by surface water of lakes or ponds such as Locke Paddon. Very little of these lacustrine habitats fall within the Action Area. No federally listed species were observed; however, California red-legged frog and California tiger salamander have the potential to occur in these areas.

*Riverine*

Similar to lacustrine habitats, riverine features have little to no vegetation by definition. However, duckweed blooms containing floating duckweed, mosquito fern, and algae may also cover the surface of the Salinas River. The Salinas River is the only true riverine feature within the Action Area. No federally listed species were observed. Federally listed species under USFWS jurisdiction with the potential to occur in riverine habitats are tidewater goby and California red-legged frog.

*Marine*

Marine habitat is defined as areas within the ocean, which includes MBNMS. In the Action Area, marine habitat is limited to the Ocean Intake and Brine Discharge. There are no vegetation communities in these areas. One federally listed species was observed in the marine habitat in the Action Area during AECOM's field surveys: southern sea other (*Enhydra lutris nereis*).

#### *4.2.4.5 Developed Habitats*

***Irrigated Row and Field Crops***

Irrigated row and field crops, as used by the CWHR, refer to herbaceous crops such as strawberries, broccoli, cauliflower, tomatoes, cotton, and asparagus. It corresponds with the agricultural plant type. Within the Action Area, irrigated row and field crops generally include artichoke (*Cynara cardunculus* var. *scolymus*), strawberry (*Fragaria* x *ananassa*), cauliflower/broccoli/cabbage/Brussels sprouts (*Brassica oleracea*), sorghum (*Sorghum bicolor*), and asparagus (*Asparagus officinalis*), which are planted in parallel rows with little space between. Within these croplands are irrigation canals which may be important to wildlife.

Wildlife observed within irrigated row and field crops were few because of the developed nature of this habitat type, and also due to active efforts to keep animals away from crops. No federally listed species were observed, but California red-legged frog and California tiger salamander have the ability to travel over irrigated field and row crop habitat as they disperse (either through cropland or via canals) to breeding ponds and upland habitats.

***Urban***

Urban habitat is defined as lawns, ornamental trees, and hedges. It corresponds with three plant communities mapped within the Action Area: developed, landscaped trees, and landscaped shrubbery. Within the Action Area, the most typical urban landscaping contained trees such as coast live oak, Monterey pine, Monterey cypress, ngaio tree (*Myoporum laetum*), and many others. Shrubbery was highly variable, but often consisted of rock rose (*Cistus* spp.), Carmel ceanothus (*Ceanothus griseus*), and crystalline iceplant (*Mesembryanthemum crystallinum*). Lawns or grassy areas contained fescue (*Festuca* spp.), bluegrass (*Poa* spp.), and clovers (*Trifolium* spp.). No federally listed species were observed; however, there is potential for California red-legged frog to occur in urban habitats within the Action Area while dispersing.

#### *4.2.4.6 Unvegetated Habitats*

***Barren***

Barren habitats are defined as bare rock or other landscapes lacking vegetation. In the Action Area, this is limited, at least naturally, to bare dune areas along the bay, such as at the CEMEX Lapis Plant. Barren dune habitats typically occur between coastal scrub. One special status species was observed on barren habitat in the Action Area during AECOM's field surveys: western snowy plover. This species is also known to nest on dunes at the CEMEX Lapis Plant. No other federally listed species have potential to occur in barren habitat in the Action Area.

### 4.2.5 Ongoing Projects in the Action Area

As described in Section 2.1.1.2, CalAm built, and is currently operating, a test slant well at the CEMEX Lapis Plant active sand mining area. The test well is permitted through February 2018; therefore, construction and operation of the test slant well are not evaluated in this document. The test slant well facilities include the test well, a submersible well pump, a wellhead vault, electrical facilities and controls, temporary flow measurement and sampling equipment, monitoring wells, and a pipeline connection to the adjacent MRWPCA ocean outfall pipeline for discharges of the test water. CalAm proposes to convert the test slant well into a permanent well after testing is done and operate it as part of the MPWSP seawater intake system. The construction of the additional conveyance and treatment facilities needed to convert the test slant well to a permanent well is evaluated in this document.

The Dunes on Monterey Bay is a mixed-use development project comprised of 1,237 residential rental units, 500 hotel rooms, and retail and office space on 297 acres (120 hectares). This ongoing development project overlaps with the Action Area along Highway 1 between Lightfighter Drive and Imjin Parkway. Phase 1 (a 378,000-square-foot [35,100-square-meter] retail center) was built in 2007 and 2008. Recently completed projects include: (1) 108 low- and very low-income affordable apartments developed and built by South County Housing in spring/summer 2014; (2) a Cinemark multiple screen movie theater completed in 2015; and (3) two approximately 15,000-square-foot (1,400-square-meter) retail buildings built near the movie theater. A Veterans Affairs Monterey Health Care Center is planned on a 14.31-acre (5.79-hectare) project site within the Dunes on Monterey Bay Specific Plan area (City of Marina 2011a, FORA 2013).

## 4.3 Federally Listed Plants

The discussions of federally listed plants with moderate or high potential to occur in the Action Area are based on CNDDB records, survey observations, aerial photographs, vegetation communities, and soil types, but do not incorporate results of the MaxEnt modeling. MaxEnt modeling results are discussed in Section 5 in order to refine the evaluation of the effects of the project on federally listed plants. The biological survey team did not take detailed information on the number of specimens mapped within the Action Area because repeated surveys completed over several years showed great variation.

### 4.3.1 Monterey spineflower

Monterey spineflower (*Chorizanthe pungens* var. *pungens*) was listed as threatened under the ESA on February 4th, 1994 (59 FR 5499). It is an annual herb in the buckwheat family (Polygonaceae) that occurs along the Monterey Bay. Monterey spineflower flowers from April to August (CNPS 2016).

Monterey spineflower is mainly distributed along the edge of Monterey Bay, from the Monterey Peninsula northward to southern Santa Cruz County. Three occurrences have also been documented more inland, in the Salinas Valley, but only one of these has been seen in recent decades (CNDDB 2016). Historical collections from San Simeon in northern San Luis Obispo County also indicate that the plant formerly had a more widespread range (USFWS 1998a).

Monterey spineflower is primarily a coastal plant, growing almost always in sandy soils on coastal dunes and coastal scrub habitats. This plant, like many dune-adapted species, exhibits significant turnover in both distribution and population size as a result of the frequently-shifting sands that characterize its habitat. Monterey spineflower's affinity for a disturbance-driven ecosystem extends beyond its natural sandy habitats to sites that have undergone human-induced disturbance. For example, it is found in fire-breaks, along roadsides, and in areas with heavy disturbance from equipment and foot traffic. Where it occurs further inland, such as in the Salinas Valley, Monterey spineflower is found on ancient stabilized dunes within maritime chaparral (USFWS 1998a).

#### *4.3.1.1 Designated Critical Habitat*

Critical habitat was designated for the Monterey spineflower on January 9, 2008 (73 FR 1525). The critical habitat consists of nine units, distributed near the coast from southern Santa Cruz County to the Monterey Peninsula, and at two inland sites in the Salinas Valley. None of the DCH units overlap with the Action Area, although the Marina Unit (Unit 3) occurs on Fort Ord Dunes State Park, near the new Transmission Main.

Primary constituent elements (PCEs) are those physical and biological features that are essential for conservation of the species, and are used to determine the species' critical habitat. The PCE essential to the conservation of this plant is: areas with sandy soils and a mosaic vegetation structure with openings between the dominant elements (trees, shrubs, and other herbs). The mosaic structure of the vegetation is maintained by physical processes such as windblown sands and fire. The bare openings that support populations of Monterey spineflower also serve as habitat for ground-nesting pollinators. Human-caused disturbance, such as road maintenance, can temporarily enhance populations of Monterey spineflower, but may cause the spread of non-native invasive species and may not support populations long-term (73 FR 1525).

#### *4.3.1.2 Potential to Occur*

Monterey spineflower occurs in high numbers throughout the Action Area, on almost all pipeline alignments containing sandy soils, sun exposure, and some stabilization. It is one of the dominant groundcover types within the new Transmission Main, Source Water Pipeline, and Desalinated Water Pipeline alignments, and scattered individuals were found at the Proposed Desalination Plant Site on valley and foothill grassland habitat with sandy soils. Outside of these areas, it has been observed in disturbed areas, including erosion control slopes, lawns, and sidewalk plantings in areas adjacent to the Action Area. In areas where Monterey spineflower was present in the BSA, it was present as a ground cover, carpeting areas where it was observed. Densities of roughly 40,000 plants per acre were observed, for an approximate total of 184,000 plants within 4.60 acres, observed in the BSA. It has the potential to occur in areas of the Project where it was not observed during the surveys.

### 4.3.2 Menzies' wallflower

Menzies' wallflower (*Erysimum menziesii*) was listed as endangered under the ESA on June 22, 1992 (57 FR 27848). It is a perennial herb in the mustard family (Brassicaceae) known from the Monterey Peninsula and the coast along the Monterey Bay. The plant flowers from March to September (CNPS 2016).

Menzies' wallflower has three main areas of occurrence, and was listed by the USFWS (1992) as three distinct subspecies: in Monterey County on the Monterey Peninsula (ssp. *menziesii*) and near the town of Marina (ssp. *yadonii*); in Mendocino County near Fort Bragg and MacKerricher State Park (ssp. *menziesii*); and in Humboldt County near Humboldt Bay (ssp. *eurekense*). However, the subspecies were never validly published and therefore are not recognized under the International Code of Botanical Nomenclature (CNPS 2016). The plants formerly attributed to ssp. *yadonii* are within 0.25 mile (0.4 kilometer) of the Action Area at Marina State Beach, while ssp. *menziesii* plants are within 5 to 10 miles (8 to 16 kilometers) of the Action Area, on the seaward edge of the Monterey Peninsula.

In Monterey County, Menzies' wallflower grows on sparsely-vegetated, semi-stable coastal dunes where organic matter and nutrients are largely lacking. It is often found close to the high tide line (USFWS 1998a), but extends up to 0.25 mile (0.4 kilometer) inland where coastal dunes are present (CNDDB 2016). The plant grows in areas exposed to strong wind, salt spray, and occasional wave action from storms and high tides (USFWS 1998a).

#### *4.3.2.1 Designated Critical Habitat*

No critical habitat has been designated or proposed for Menzies' wallflower.

#### *4.3.2.2 Potential to Occur*

Menzies' wallflower has a moderate potential to occur within the Action Area. It was not observed by AECOM biologists in surveys conducted from 2014 to 2016, and at least one survey per year was conducted during its flowering period. It was found flowering during visits to reference populations at Marina State Beach in April of 2014, May of 2015, and April 2016.

Suitable coastal dune habitat is only found within the Action Area at the Intake Slant Wells. Zander Associates reported two rosettes indicative of the species at this Site in April 2014. During subsequent surveys in April and June of 2016, however, specimens at the marked locations were identified as coast wallflower (*Erysimum ammophilum*). Menzies' wallflower was reported to be locally abundant on foredunes at the mouth of the Salinas River, and within 1 mile (1.6 kilometers) south of the Intake Slant Wells (see Johnson s.n. UCD115017, collected on June 19, 1979, CCH 2016). Menzies' wallflower was confirmed, during reference population surveys, to be abundant within 1.5 miles (2.4 kilometers) south of the Intake Slant Wells, at Marina State Beach. These habitats are similar to the coastal dunes at the Intake Slant Wells, which are not known to support populations of Menzies' wallflower. However, this species, like many other dune-adapted species, likely undergoes turnover in distribution and population size that could result in it being found in new locations in the future.

### 4.3.3 Monterey gilia

Monterey gilia (*Gilia tenuiflora* ssp. *arenaria*) was listed as endangered under the ESA on June 22, 1992 (57 FR 27848). It is a perennial herb in the phlox family (Polemoniaceae) that is restricted to coastal areas along the Monterey Bay and Monterey Peninsula. Monterey gilia flowers from April to June (CNPS 2016).

Monterey gilia is distributed in coastal dunes of Monterey County, from Spanish Bay on the Monterey Peninsula in the south, to Moss Landing in the north (USFWS 1998a). It grows in close proximity to the coast, as well as on dunes that are up to 8 miles (13 kilometers) inland at Fort Ord (CNDDB 2016). Monterey gilia inhabits coastal dunes, coastal scrub, maritime chaparral, and cismontane woodland communities on sandy dune soils, at elevations from sea level up to 150 feet (46 meters) (CNPS 2016). While it tolerates some drifting sand, it usually occurs in stable sites with minimal sand accretion or deflation. It is usually found on cooler north-, east-, or west-facing slopes, but can occasionally be found on drier south-facing slopes in wet years (USFWS 1998a).

#### *4.3.3.1 Designated Critical Habitat*

No critical habitat has been designated or proposed for Monterey gilia.

#### *4.3.3.2 Potential to Occur*

Monterey gilia occurs in a few small populations in the Action Area, in maritime chaparral and coastal scrub around the ASR pipelines and the new Transmission Main pipeline along General Jim Moore Boulevard. Additional appropriate habitat, consisting of coastal scrub, maritime chaparral, and cismontane woodlands on modified old dunes, is found throughout the Action Area: on the new Desalinated Water Pipeline, Castroville Pipeline, and Source Water Pipeline alignments. Potential habitat is also found in the coastal dunes at the Intake Slant Wells. There is a low to moderate potential for additional populations of Monterey gilia to be found in these sections of the Action Area, as it may (like many annual species) spend years dormant in the seed bank, then germinate following a disturbance, or when specific environmental conditions are suitable. However, it was not detected in these areas during surveys within its flowering period during surveys in 2014, 2015, and 2016. Monterey gilia was found flowering at a site visit to a nearby reference population in May 2016.

### 4.3.4 Yadon's piperia

Yadon's piperia (*Piperia yadonii*) was listed as endangered under the ESA on August 12, 1998 (63 FR 43100). It is a slender perennial herb in the orchid family (Orchidaceae) known from the Monterey Peninsula. Yadon's piperia flowers from February to August (CNPS 2016).

Nearly all occurrences of Yadon's piperia are from northern Monterey County, primarily on the Monterey peninsula. It also occurs in several other locations, from near the border of Santa Cruz and Monterey Counties in the north, to Palo Colorado Canyon in the south (USFWS 2004). Yadon's piperia is restricted to sandy soils and sandstone within maritime chaparral and Monterey pine forest (CNPS 2016). It occurs in Monterey pine forest when the understory is sparse, and when succession hasn't led to the understory being dominated by poison oak or other shrubs. When it occurs in maritime chaparral, it often grows in shallow soils beneath dwarfed Hooker's manzanita (*Arctostaphylos hookeri*) shrubs (USFWS 2004). It is associated with a variety of other species including Pacific reedgrass (*Calamagrostis nutkaensis*), common yarrow, coast live oak, chamise (*Adenostoma fasciculatum*), and Monterey ceanothus (CNDDB 2016). A 2004 census found that the Monterey pine forest on the peninsula supports approximately 113,000 plants, with lower numbers occurring in other areas of northern Monterey County (USFWS 2004, Ecosystems West Associates 2004).

#### *4.3.4.1 Designated Critical Habitat*

Critical habitat was designated for Yadon's piperia in 8 units totaling 2,117 acres (857 hectares) in 2007, including land in Point Lobos, the Monterey Peninsula, and the hills north of Prunedale (72 FR 60410). No critical habitat units overlap the Action Area. PCEs of the critical habitat for this species include: 1) Monterey pine forest with a canopy cover of 20 to 70 percent and a sparse herbaceous understory with sandy-loamy soils and a clay hardpan; 2) maritime chaparral ridges with dwarfed shrubs (primarily Hooker's manzanita); and 3) Presence of nocturnal, short tongued moths in the families Pyralidae, Geomedtridae, Nocturnidae and Pterophoridae (72 FR 60410

#### *4.3.4.2 Potential to Occur*

Yadon's piperia has a moderate potential to occur within the Action Area. It was not observed in surveys conducted from 2014 to 2016, and at least one survey per year was conducted during its flowering period. It was found flowering during a visit to a reference population in June 2016. Marginally suitable closed-cone coniferous forest dominated by Monterey pines is found in patches throughout the Action Area. However, these tree stands were likely planted or naturalized, and are not part of the natural Monterey pine forests on the Monterey peninsula where Yadon's piperia is primarily found. Patches of suitable maritime chaparral habitat also occur throughout much of the Action Area, but this species was not observed in those areas during surveys, and no records of Yadon's piperia have previously been reported within them. Additionally, the Action Area does not contain maritime chaparral on exposed sandstone ridges dominated by dwarfed Hooker's manzanita, which is a PCE for Yadon's piperia.

## 4.4 Federally Listed Animals

The discussions of federally listed animals with moderate or high potential to occur are based on CNDDB records, survey observations, aerial photographs, and vegetation communities, but do not incorporate results of the MaxEnt modeling. MaxEnt modeling results are discussed in Section 5 in order to refine the evaluation of the effects of the project on federally listed animal species.

### 4.4.1 Smith's blue butterfly

Smith's blue butterfly (*Euphilotes enoptes smithi*) was federally listed as endangered by the USFWS in 1976 (41 FR 22041). Each year, the butterflies emerge from their pupal cases at the same time as the peak flowering of their host plants, coast buckwheat and seacliff buckwheat, in order to take one flight season from mid-June until early-September (USFWS 2006a). Their time spent active varies by year and location, but is generally between 4 to 10 weeks (USFWS 2006a). The butterflies are dependent upon the host plants, which all life stages use as food (USFWS 2006a). There is insubstantial data on population trends, therefore population estimates are inferred from the presence of habitat and host plants. As their habitat is decreasing, it is inferred that the population of Smith's blue butterfly is also decreasing (USFWS 2006a).

The current range of Smith's blue butterfly includes dune habitats along Monterey Bay (encompassing the City of Monterey north to the Salinas River), and the coast of Monterey County and of northern San Luis Obispo County (encompassing the San Carpoforo Creek north to the Carmel River) (USFWS 2006a). There is a population of Smith's blue butterfly within the Action Area along Fort Ord Dunes State Park. During a site survey conducted by AECOM biologists, numerous host plants were found within and adjacent to the Action Area at this site. Additionally, there are CNDDB occurrences of Smith's blue butterfly at Ford Ord Dunes State Park between Highway 1 and the beach. Smith's blue butterfly host plants can exist in various types of habitats including scrub, chaparral, and grassland (USFWS 2006a). Seacliff and coast buckwheat require windblown sand in order to disperse their seeds, as well as occasional low-intensity wildfires for germination (USFWS 2006a).

#### *4.4.1.1 Designated Critical Habitat*

No critical habitat has been designated or proposed for Smith's blue butterfly.

#### *4.4.1.2 Potential to Occur*

The current range of Smith's blue butterfly encompasses the Action Area. There is appropriate habitat as well as numerous recorded occurrences of Smith's blue butterfly and its host plants within the Action Area, and many more in the vicinity. During AECOM's field surveys, Smith's blue butterfly host plants (coast buckwheat and seacliff buckwheat) were mapped in the coastal scrub and mixed chaparral habitat in the Action Area, but the species was not observed. Host plants occurred in Action Area in the following locations:

- Numerous occurrences along Highway 1 at Fort Ord Dunes State Park from the southern intersection of Stilwell Hall and Beach Range Road north to the start of Del Monte Boulevard, a distance of approximately 1.6 miles (2.6 kilometers).
- Scattered occurrences in the city of Marina and the community of Neponset along Del Monte Boulevard from the intersection of Del Monte Boulevard and Reservation Road north to the intersection of Lapis Road and Del Monte Boulevard.

- **Numerous occurrences at the CEMEX Lapis Plant in the city of Marina.**

**Smith's blue butterfly are likely to occur in these areas where host plants were mapped, but they may also occur in any of the coastal scrub and mixed chaparral habitat in the Action Area. Based on the presence of the species' host plants and reported occurrences within the Action Area, there is high potential for Smith's blue butterfly to occur in the Action Area.**

### 4.4.2 Tidewater goby

**Tidewater goby (*Eucyclogobius newberryi*) was listed as endangered under the ESA on February 4, 1994 (59 FR 5494). The species inhabits coastal wetlands and lagoons from Tillas Slough at the mouth of the Smith River, Del Norte County, California to approximately 9 miles (14 kilometers) north of Agua Hedionda Lagoon in northern San Diego County, California (USFWS 2007a). The USFWS has determined that essential habitat components for tidewater goby consist of persistent, shallow (in the range of approximately 0.3 to 6.6 feet [0.1 to 2 meters]), still-to-slow-moving lagoons, estuaries, and coastal streams with salinity up to 12 ppt, which provide adequate space for normal behavior and individual and population growth that contain one or more of the following: (a) substrates (e.g., sand, silt, mud) suitable for the construction of burrows for reproduction; (b) submerged and emergent aquatic vegetation, such as *Potamogeton pectinatus*, *Ruppia maritima*, *Typha latifolia*, and *Scirpus* spp., that provides protection from predators and high flow events; or (c) presence of a sandbar(s) across the mouth of a lagoon or estuary during the late spring, summer, and fall that closes or partially closes the lagoon or estuary, thereby providing relatively stable water levels and salinity (78 FR 8746).**

#### *4.4.2.1 Designated Critical Habitat*

**Critical habitat was designated for tidewater goby on February 6, 2013, and includes 12,156 acres (4,919 hectares) of coastal habitat spanning the length of California (78 FR 8746). The Salinas River, which overlaps with the Action Area, is classified as tidewater goby DCH (Critical Habitat Unit MN-2). No other portion of the Action Area contains tidewater goby DCH.**

#### *4.4.2.2 Potential to Occur*

**Tidewater gobies are present in the Salinas River, including the portion of Salinas River within the Action Area. Two tidewater gobies were collected near the mouth of the Salinas River Lagoon in October 2013 (Hagar Environmental Science 2014). Fifty-eight tidewater gobies were captured in the Salinas River between its mouth and the railroad bridge just east of Highway 1 in April 2014 (Hagar Environmental Science 2015). Tidewater gobies were particularly abundant just upstream of Highway 1 within the Action Area: 53 individuals were caught in 2 seine hauls (Hagar Environmental Science 2015).**

**There is an extant population of tidewater goby in Moro Cojo Slough, located north of the Action Area and south of Elkhorn Slough (78 FR 5494). The Action Area intersects with Tembladero Slough, which first converges with the Old Salinas River then with Moro Cojo Slough. Tembladero Slough is hydrologically connected to Moro Cojo Slough, so it is possible that tidewater gobies could occur in the portion of the Action Area that intersects with Tembladero Slough. However, the Action Area is approximately 5.5 miles (8.9 kilometers) upstream from the confluence with Moro Cojo Slough and tidewater gobies would have to travel through low quality habitat consisting of a narrow slough lacking vegetative cover to reach the Action Area. Therefore, it is unlikely that tidewater gobies would occur in this portion of the Action Area.**

There are no other portions of the Action Area that contain potentially suitable tidewater goby habitat or where tidewater gobies may occur.

### 4.4.3 California tiger salamander

The Central California DPS of California tiger salamander (*Ambystoma californiense*) was federally listed as threatened by the USFWS in 2004 (69 FR 47212). Breeding habitat for California tiger salamander consists of aquatic features such as vernal pools or seasonal and perennial ponds; upland habitat includes grassland and oak savannah (69 FR 47212). The species also requires small mammal burrows or other underground refuges where it spends the majority of its life (USFWS 2014). They occupy elevation ranges from sea level up to about 3,940 feet (1,200 meters) (USFWS 2014). The species' coastal range extends from Santa Rosa in Sonoma County, to San Mateo County and San Luis Obispo County, as well as Santa Barbara County. They also occur along the Central Valley through the Sierra Nevada foothills, to Yolo County, Kern County, Tulare County, and Kings County (69 FR 47212). The maximum possible dispersal distance for California tiger salamander is 1.5 miles (2.4 kilometers), which is the second longest migration distance of any salamander species (USFWS 2015a).

#### *4.4.3.1 Designated Critical Habitat*

There is no DCH within the Action Area (70 FR 49380). The three regions of DCH closest to the Action Area are in city of Soledad, Monterey County; in the city of Hollister, San Benito County; and along East Carmel Valley Road in Carmel Valley, Monterey County (70 FR 49380). The PCEs for California tiger salamander are: 1) standing bodies of fresh water (both natural and manmade) holding water at least 12 weeks of the year; 2) uplands adjacent to the body of water containing underground habitat (ex. small mammal burrows) for shelter, food, and cover; and 3) upland dispersal habitat allowing movement between breeding sites (70 FR 49380).

#### *4.4.3.2 Potential to Occur*

There have been many occurrences of California tiger salamander within 5 miles (8 kilometers) of the Action Area, specifically near Moss Landing, Laguna Seca Raceway, Moro Cojo Slough, and Seaside. California tiger salamanders have the potential to use coastal oak woodland, valley foothill riparian, and coastal scrub habitats within the Action Area as dispersal or upland habitat. Annual grasslands with small mammal burrows within the Action Area also provide suitable upland habitat, and numerous burrows were mapped along the MPWSP during AECOM's field surveys. California tiger salamanders may use chamise-redshank chaparral and mixed chaparral habitat as upland or dispersal habitat and these communities occur within dispersal range from potential breeding areas. Individuals may also disperse through irrigated field and row crop agricultural habitat within the Action Area as they move (either through cropland or via canals) to breeding ponds and upland habitats. The Action Area contains abundant suitable upland habitat for California tiger salamander and there is a high potential for the species to occur along the new Desalinated Water Pipeline, Source Water Pipeline, Brine Discharge Pipeline, and the Pipeline to CSIP Pond. In particular, there is high potential for California tiger salamanders to occur in the portion of the alignment from the intersection of Marina Green Drive and Del Monte Boulevard north along Lapis Road to the Salinas River. There is also high potential for the species to occur around the Proposed Desalination Plant Site, including around the wetland on Neponset Road.

California tiger salamanders typically breed in still water (e.g., vernal pools and ponds); however they may occasionally breed in slow-moving water (USFWS 2015a). There is no high quality breeding habitat in the Action Area, but it is possible that California tiger salamanders could breed in the portion of Tembladero Slough within the Action Area. Breeding habitat quality at Tembladero Slough is low due to high levels of agriculture and disturbance in the surrounding area, periodic high flows through Tembladero Slough that could wash out egg masses, and lack of nearby breeding habitat. If successful breeding occurred at Tembladero Slough, these factors would likely cause the area to be a population sink.

Because protocol-level surveys for California tiger salamanders were not performed in the Action Area, it is assumed that the species is present in any potential aquatic or upland habitat, including in all small mammal burrows, in the Action Area.

### 4.4.4 California red-legged frog

The California red-legged frog has been listed as federally threatened by the USFWS since 1996 (71 FR 19244). This species is the largest frog native to the United States, and often has a pink or red coloring on its hind legs and abdomen (75 FR 12816). The California red-legged frog can be found in elevations up to 5,000 feet (1,525 meters), and is endemic to California and Baja California, Mexico (75 FR 12816). The species range occurs throughout Baja Mexico, in the Sierra Nevadas from Calaveras County to Butte County, and along the coast from Riverside County to Mendocino County (75 FR 12816). The breeding season generally occurs from November through April, with most mating occurring in February or March, but this can vary depending on climate variance between seasons (75 FR 12816). Tadpoles feed on algae until metamorphosing into juveniles after 11 to 20 weeks. Juveniles are active throughout the day, and are less specific concerning habitat, whereas adults are nocturnal and primarily occupy deep pools (75 FR 12816). California red-legged frogs use a variety of habitat types, including upland, riparian, and aquatic (75 FR 12816). In the breeding season they require pools with adequate emergent vegetation on which to lay eggs (71 FR 19244). Some individuals will remain in one area throughout their entire life cycle, while others move to other areas within their dispersal distance. They are sensitive to salinity, as eggs cannot exist in salinity levels higher than 4.5 ppt, and larvae cannot exist in levels higher than 7.0 ppt (USFWS 2002).

The population size and range is highly dependent on rainfall amounts: in times of heavy rainfall, the population and range increases, and in times of drought, the population and range shrinks (75 FR 12816). Dispersal distances for California red-legged frog range from 0.25 to 2 miles (0.4 to 3.2 kilometers), and this large variation in dispersal distance suggests that avoiding use of an average dispersal distance for this species is best, as the individuals that disperse longer distances would be lost in that mean (Fellers and Kleeman 2007).

#### *4.4.4.1 Designated Critical Habitat*

Critical habitat was designated for California red-legged frog in March 2010 (75 FR 12816). DCH is present within the Action Area at the Carmel Valley Pump Station and the Hidden Hills Interconnection Imprrovement; no other portions of the Action Area overlap DCH. California red-legged frog PCEs consist of: 1) aquatic breeding habitat providing space, food, and cover which contains water for at least 20 weeks per year (excluding very dry years), including low-gradient fresh water bodies, but not deep, large bodies of water; 2) non-breeding aquatic habitat providing space, food and cover, including wetland habitats and those aquatic habitats in PCE 1; 3) upland and riparian habitat providing food and shelter; and 4) dispersal habitat connecting various habitat patches (71 FR 19244).

#### *4.4.4.2 Potential to Occur*

There is high potential for the California red-legged frog to occur within the Action Area, as there have been many occurrences within a 5-mile (8-kilometer) radius (CNDDB 2016). There is suitable habitat for California red-legged frog along portions of the Action Area, including essential components of aquatic breeding and upland habitats. Fourteen aquatic features within a 1-mile (1.6-kilometer) radius of the Action Area were assessed for potential California red-legged frog habitat (Appendix D). Of these 14 features, three sites were eliminated as habitat using desktop analyses, four sites were eliminated as habitat following site visits, and five sites were presumed California red-legged frog habitat. Protocol level surveys were performed at the two remaining sites: Locke-Paddon Lake and Reservation Road Pond. California red-legged frogs were not observed during protocol level surveys and the species is not expected at either site. Many of these sites had potentially suitable hydroperiods but were degraded due to high levels of urbanization and habitat fragmentation, were inhabited by non-native invasive species such as bullfrogs (*Lithobates catesbeianus*) and predatory gamefish, or may be too saline to support California red-legged frogs.

The five sites that may provide California red-legged frog habitat are Tembladero Slough, Neponset Road Pond, the Desalination Plant Wetland, the Salinas River, and the Carmel Valley Pump Station (see Appendix D). These areas have potential to support breeding California red-legged frogs. Oak woodlands, annual grasslands, irrigated field and row crops adjacent to these aquatic breeding habitats may provide suitable dispersal or upland habitat for the species. Based on the occurrences within 5 miles (8 kilometers) of the Action Area and the presence of suitable breeding, upland, and dispersal habitat, there is moderate potential for California red-legged frogs to occur in the Action Area.

### 4.4.5 Western snowy plover

The Pacific Coast DPS of western snowy plover (*Charadrius alexandrinus nivosus*) was listed as federally threatened in 1993 (77 FR 36727). The Pacific Coast DPS’s range is from Baja California, Mexico, north to Damon Point, Washington (USFWS 2007b). There is also an interior snowy plover population, which winters along the California coast and the Baja California coast and intermingles with the Pacific Coast DPS (USFWS 2007b). The Pacific Coast DPS can be found year round in California (USFWS 2007b). Habitat includes sandy coastal beaches with little to no vegetation above the high tide line; the dry salt flats of lagoons, beaches of rivers, lakes, and ponds; dunes with little vegetation; dredged spoils on beaches; dry salt ponds; and river bars (Cornell 2015, USFWS 2007b). The nesting season usually occurs from March through September, but can vary by location. Chicks hatch between April and August, with fledging occurring a month after hatching (USFWS 2007b). Nesting occurs in depressions on dry ground, often lined with vegetation or shell fragments, bones, mud chips, or pebbles (Cornell 2015). Plovers feed on terrestrial and aquatic invertebrates by seizing prey from the beach surface or tide flat, or probing in the sand (Cornell 2015).

#### *4.4.5.1 Designated Critical Habitat*

DCH for western snowy plover is not within the Action Area; however, there is DCH along the coast of Monterey Bay from Moss Landing down to Seaside, as close as 320 feet (97 meters) outside of the Action Area (77 FR 36727). PCEs consist of sandy beaches, dune systems immediately inland of an active beach face, salt flats, mud flats, seasonally exposed gravel bars, artificial salt ponds and adjoining levees, and dredge spoil sites which have: 1) areas below heavily vegetated or developed areas that are above high tides; 2) shoreline habitat with little vegetation for feeding between annual low and high tides; 3) organic debris which attracts prey items; and 4) minimal disturbance by human activity (77 FR 36727).

#### *4.4.5.2 Potential to Occur*

Western snowy plover are known to breed in the sand dunes at the CEMEX Lapis Plant, and have been observed by Point Blue Conservation Science (formerly PRBO) biologists since they began surveys in 2008 (PRBO 2008, PRBO 2010, PRBO 2011, PRBO 2012, Point Blue 2014, Point Blue 2015). AECOM biologists also observed western snowy plovers at the CEMEX Lapis Plant during surveys conducted from 2013 to 2016. Point Blue Conservation Science mapped numerous nests within 500 feet (150 meters) of the Action Area, and it is likely that nesting may occur within the Action Area. Western snowy plover are therefore present within the Action Area and may be found in the coastal scrub and sand dune habitat at the CEMEX Lapis Plant near the Intake Slant Wells. Point Blue Conservation Science noted that recent intense winter storms have caused the beach to become narrower and lower in elevation, reducing the available habitat for western snowy plovers. The loss of this beach habitat, which is expected to worsen with climate change, may cause western snowy plovers to utilize the Action Area more frequently than historically recorded.

In addition to the CEMEX Lapis Plant site, there is potential for western snowy plover to occur along the coast at Fort Ord Dunes State Park adjacent to the new Transmission Main. Western snowy plovers at Fort Ord Dunes State Park may travel through the Action Area, which is approximately 0.25 mile (0.4 kilometer) east of the nearest sand dunes, but are unlikely to inhabit this portion of the Action Area for extended periods of time.

### 4.4.6 Least Bell's vireo

The least Bell's vireo (*Vireo bellii pusillus*) was federally listed as endangered on June 27, 1980 (51 FR 16474). Breeding habitat for this migratory songbird consists of riparian woodlands along streams, including oak woodlands, cottonwood-willow forests, and mule fat scrub (USFWS 1998b). During winter, the species can be found in mesquite scrub vegetation, and even palm groves or hedgerows on agricultural fields and rural areas (USFWS 1998b). The historical range of the least Bell's vireo was in the Central Valley and low elevation valleys in California and in Baja California (USFWS 1998b). Currently in California, this range has diminished to primarily southern California with 99 percent of the population residing there, despite occurrences of least Bell's vireo in California as far north as San Jose (USFWS 2006b, 59 FR 4845). They feed on a variety of insects including caterpillars, beetles, grasshoppers, and moths, and will forage primarily at the lower to mid-canopy layer (USFWS 1998b). Nesting typically occurs within 3 feet of the ground, in various species of trees and shrubs, at a fork or branch (USFWS 1998b). A major threat to least Bell's vireo is parasitism by brown-headed cowbird (USFWS 1998b).

#### *4.4.6.1 Designated Critical Habitat*

The DCH closest to the Action Area is along the Santa Ynez River in Santa Barbara County, California, about 150 miles (240 kilometers) south of the Action Area (59 FR 4845). The PCEs are riparian woodland vegetation with canopy and shrub layers, and nearby upland habitat (59 FR 4845).

#### *4.4.6.2 Potential to Occur*

In the USFWS 1998 *Draft Recovery Plan for the Least Bell's Vireo*, the least Bell's vireo range was restricted to southern California counties. However, it was stated that the vireo population has been growing, and is repopulating its historical range, with potential to eventually repopulate central and northern regions (USFWS 1998b). There have been occurrences of least Bell's vireo within 10 miles (16 kilometers) of the Action Area in Watsonville and Andrew Molera State Park. The occurrence in Watsonville was in 1996 of one active individual, and was the first in Santa Cruz County (eBird 2012). There have been 5 occurrences in Andrew Molera State Park, from 1995 to 2013 of single individuals (eBird 2012). There are small areas of potentially suitable habitat for least Bell's vireo within the Action Area in riparian habitat along the Salinas River and at the Carmel Valley Pump Station; however, the likelihood that an individual would occur in these areas during construction is low due to their rarity in Central California.

### 4.4.7 Southern sea otter

The southern Sea otter (*Enhydra lutris nereis*) was listed as federally threatened on January 14, 1977 (42 FR 2965). Within the nearshore areas of the North Pacific Ocean, sea otters are considered keystone species, and have a strong influence on the composition of their ecosystems (USFWS 2015b). Southern sea otters have high energetic requirements due to little body fat, and must consume 20 to 25 percent of their body mass per day (USFWS 2015b). Therefore southern sea otters spend between 20 to 50 percent of their time foraging for marine invertebrate prey items (USFWS 2015b). This species breeds throughout the year, however there are two peak periods of pupping, one from October to January, the other from March to April (USFWS 2015b). Females care for their pups until they are weaned at about 6 months (USFWS 2015b). Sea otters will rest in groups consisting of between 2 to 20 individuals, called "rafts", but they are also found alone (USFWS 2015b). Generally, they prefer to rest in areas with surface kelp, but are found in open water as well (USFWS 2015b). Additionally, southern sea otters have been found to haul-out on land (USFWS 2015b). Most sea otters will remain within 1.2 miles (1.9 kilometers) of shore in California, and southern sea otters utilize rocky areas and soft-sediment areas up to 82 feet (25 meters) in depth for foraging (USFWS 2015b). Rocky habitats contain the most diverse prey items for southern sea otters, and therefore contain high densities of individuals (USFWS 2015b).

The current range of the southern sea otter is along the Central California coast from Half Moon Bay in San Mateo County to Coal Oil Point in Santa Barbara County, with the highest population abundance occurring in the center of this range. However, southern sea otters can often be found outside of this range (USFWS 2015b). In general, those areas that are rocky and are dominated by kelp contain stable populations of southern sea otters, while sandy and soft-bottom habitats contain variable populations (USFWS 2015b). Home range size and movement patterns are dependent on individual factors, including sex and reproductive strategy, as well as resource accessibility and water depth (USFWS 2015b). In general, females travel less than males and will not often disperse beyond 12 miles (19 kilometers) (USFWS 2015b). Males that are territorial will travel less than males that are non-territorial (USFWS 2015b).

#### *4.4.7.1 Designated Critical Habitat*

There is no DCH for the southern sea otter.

#### *4.4.7.2 Potential to Occur*

Southern sea otter may occur in the brine discharge portion of the Action Area briefly during foraging or while moving through the area. But it is unlikely that they would occur in the Action Area for extended periods of time due to the depth at which the brine would be discharged (89 to 112 feet [27 to 34 meters]), which is deeper than typical foraging depth for southern sea otter. The Action Area also does not contain kelp, making the area low quality habitat for foraging and resting. The discharge outfall is also located approximately 2 miles (3.2 kilometers) from the coastline, further than sea otters typically range. Overall, the potential for this species to occur in the combined discharge area is low and transitory in nature.

## 4.5 Migratory Bird Treaty Act

Most bird species in California fall under the protection of the Migratory Bird Treaty Act (MBTA). Birds excluded from the treaty include the European starling, house sparrow, and Eurasian collared dove, among others. Under the MBTA, it is unlawful, unless expressly authorized by permit pursuant to federal regulations, to "pursue, hunt, take, capture, kill, attempt to take, capture or kill, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export at any time, or in any manner, any migratory bird, or any part, nest, or egg of any such bird." This includes direct and indirect acts, with the exception of harassment and habitat modification, which are not included unless they result in direct loss of birds, nests, or eggs.

Numerous species of birds protected by the MBTA were observed during AECOM's field surveys and are documented in Appendix C. In addition, several active and inactive nests were found within the Action Area or immediately outside of the Action Area. The Action Area contains suitable nesting and foraging habitat and there is high potential for MBTA-covered birds to nest in the Action Area.

# 5 Potential Effects on Federally Listed Species

## 5.1 Direct, Indirect and Beneficial Effects

The definition of direct effects is the "the direct or immediate effects of the project on the species or its habitat" (USFWS and NMFS 1998). Indirect effects are defined as those "that are caused by the Proposed Action and are later in time, but still are reasonably certain to occur" (50 CFR §402.2).

To the maximum extent practicable, adverse effects on federally listed species will be avoided and minimized during construction and operation of the Proposed Action. The DEIR/EIS for the project developed general construction best management practices as well as species-specific mitigation measures that are incorporated into the Proposed Action and reduce the potential for adverse effects on listed species by limiting the construction period to be outside of species activity periods, installing exclusion fencing to deter species from entering work areas, and requiring regular monitoring of the site by qualified biologists, along with other measures. Despite implementation of these measures, the Proposed Action has the potential to directly and indirectly adversely affect federally listed species. In particular, direct effects on suitable habitat for in the Action Area may be unavoidable during construction of project components. MaxEnt modeling of species presence and site occupancy was used to derive detailed species-specific impact footprints. These impact areas, presented in Section 5.2, form the spatial basis of the detailed discussions of potential adverse effects on federally listed plant and animal species provided below.

The following direct effects could occur as a result of the construction activities:

- Direct disturbance to habitat, including crushing or removing vegetation;
- Crushing or injuring of species by construction equipment;
- Permanent loss of suitable upland habitat where the new desalination plant is constructed;
- Noise or light disturbance, which could deter nesting birds and nocturnal animals.

Indirect effects, including decreases in water quality from construction related erosion and sedimentation, as well as habitat degradation from increases in human visitation and trash, could result from construction of the proposed project. However, with the implementation of avoidance and minimization measures presented in Section 3, indirect effects of the proposed action are considered to be insignificant and discountable. They are therefore not discussed further in the document.

## 5.2 Temporary and Permanent Impact Areas

Temporary impacts are defined as effects on potentially suitable or occupied habitat that will be restored to pre-project condition within one annual growing season while permanent impacts are defined as effects on potentially suitable or occupied habitat requiring more than one annual growing season to return to pre-project condition. Temporary and permanent impact areas were calculated for each of the federally listed species determined to have moderate or high potential to occur in the Action Area. Impact areas for most species were calculated by overlaying the mapped MaxEnt model output with the Action Area. Impact areas for tidewater goby were calculated by overlaying the Salinas River and Tembladero Slough with the Action Area. Impact areas are presented in Table 5-1.

In order to increase the accuracy of temporary and permanent impact calculations, the following steps were taken to refine MaxEnt model results:

1. Any "Suitable Habitat" that overlaps with urban/developed areas was removed.
2. Any "Suitable Habitat" that overlaps with agricultural fields was removed, for all species other than amphibians.
3. Predictive power was added by including species locations collected during the 2014 to 2016 field surveys.
4. For amphibians, "Suitable Habitat" in uplands was further limited by the following maximum dispersal distances from suitable aquatic habitat:
    a. California tiger salamander: 1.3 miles (2.1 kilometers) (Orloff 2011)
    b. California red-legged frog: 1.0 mile (1.6 kilometers) (USFWS 2002)

Table 5-1. Areas of Temporary and Permanent Impact on Habitat for Federally Listed Species

| Species | Temporary Impact Area acres (hectares) | Permanent Impact Area acres (hectares) |
|---|---|---|
| Monterey spineflower | 78.24 (31.66) total<br>10.36 (4.19) on federal land | 17.29 (7.00) total<br>0.04 (0.02) on federal land |
| Menzies' wallflower | 24.52 (9.92) total<br>0.59 (0.24) on federal land | 1.04 (0.42) total<br>0.00 (0.00) on federal land |
| Monterey gilia | 67.04 (27.13) total<br>10.36 (4.19) on federal land | 12.95 (5.24) total<br>0.04 (0.02) on federal land |
| Yadon's piperia | 22.99 (9.30) total<br>1.99 (0.80) on federal land | 0.58 (0.23) total<br>0.00 (0.00 ) on federal land |
| Smith's blue butterfly | 79.97 (32.36) | 17.65 (7.14) |
| tidewater goby | 0.26 (0.10) | 0 |
| California tiger salamander | 35.04 (14.18) | 14.73 (5.96) |
| California red-legged frog | 3.93 (1.59) | 0.47 (0.19) |
| western snowy plover | 8.83 (3.57) | 1.93 (0.78) |
| least Bell's vireo | 0 | 0 |
| southern sea otter | Impacts discountable; areas not calculated | Impacts discountable; areas not calculated |

## 5.3 Federally listed plants on federal lands

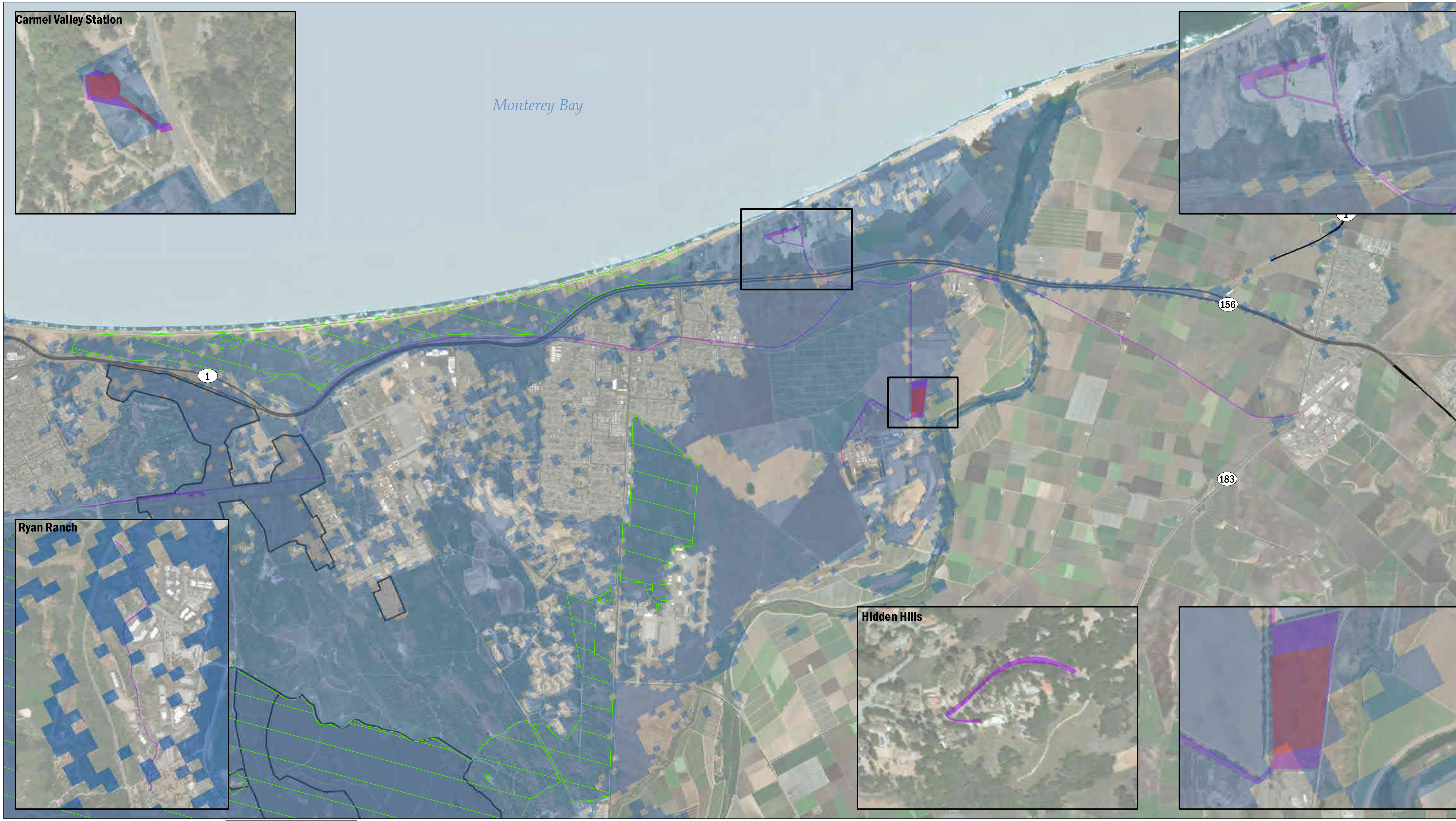
Three federally listed plants have potential to occur on federal lands: Monterey spineflower (federally threatened, Figure 5-1), Monterey gilia (federally endangered, Figure 5-2), and Yadon's piperia (federally endangered, Figure 5-3). ESA Sections 7(b)(4) and 7(o)(2), which describe the conditions for issuance of a biological opinion and an incidental take statement, generally only apply to federally-endangered plants on federal lands (in this case, Monterey gilia and Yadon's piperia). However, since the effects of the Proposed Action on plants on federal lands would be similar for all three species, Monterey spineflower is also included in this discussion. MaxEnt model results show suitable habitat on U.S. Army land around General Jim Moore Boulevard. The portion of the Proposed Action that would occur on federal lands consists of installation of the pipeline along General Jim Moore Boulevard and would involve clearing, grubbing, grading, and trenching. These activities would cause temporary direct adverse effects in the form of habitat disturbance and mortality on federally listed plants (Table 5-1). Construction activities would also mobilize dust in the Action Area, which could harm federally listed plants on federal lands. The ASR wells would permanently eliminate a small area of suitable habitat for Monterey spineflower and Monterey gilia (Table 5-1).

There is suitable habitat for Monterey spineflower, Monterey gilia, and Yadon's piperia within the Action Area on federal lands and the Proposed Action is likely to cause disturbance and mortality through vegetation clearing, grubbing, grading, and trenching along the pipeline alignment. The Proposed Action would also permanently eliminate habitat at the ASR well sites. The Avoidance and Minimization Measures described in Section 3 will limit habitat disturbance and mortality to the greatest extent practicable. In addition, temporarily-disturbed habitat will be restored at a 1:1 ratio and permanently-disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for mortality during construction, the Proposed Action *may affect, and is likely to adversely affect* Monterey spineflower, Monterey gilia, and Yadon's piperia on federal lands.

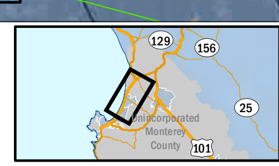
There is no DCH for federally listed plants on federal lands within the Action Area. Therefore, the Proposed Action would have *no effect* on federally listed plant DCH on federal lands.

## 5.4 Federally listed plants on non-federal lands

Numerous federally listed plants have been documented in the Action Area outside of federal lands, or have a high potential to occur in the Action Area on non-federal lands. The MaxEnt models for federally listed plants showed suitable habitat within the Action Area on non-federal lands for Monterey spineflower (Figure 5-1), Monterey gilia (Figure 5-2), and Yadon's piperia (Figure 5-3), Menzies' wallflower (Figure 5-4). Suitable habitat for federally listed plants is present, and was mapped, in the Action Area in both the BSA and the project footprint. Table 5-2 presents the amount of mapped habitat for federally listed plants.





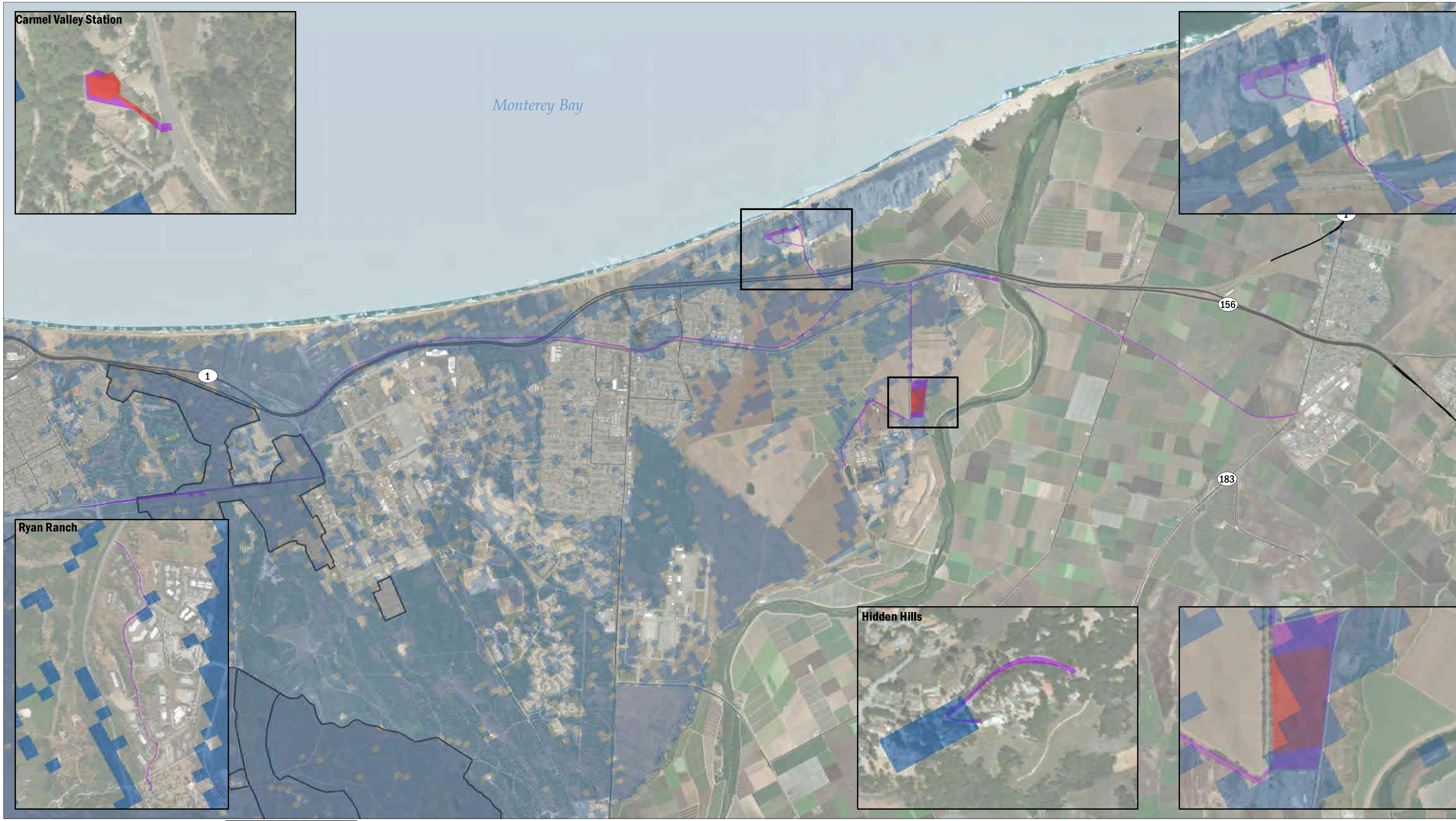



Federal Lands
Permanent Impact
Temporary Impact
Unsuitable Habitat
Suitable Habitat
Critical Habitat

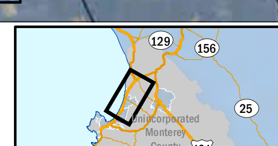
**Data Source**
**Federal Lands**
*California Protected Areas Database, 2013, GreenInfo Networks*
**Critical Habitat**
*USFWS,2016*
**Maxent Environmental Inputs**
*Soil - US Department of Agriculture (USDA), 2016*
*Climate - WorldClim.org, 2016*
*Water(NHD) - USGS, 2016*
*Habitat(GAP) - USGS, 2016*
**Maxent Species Locality Inputs**
*CNDDB, 2016*
*VertNet, 2016*
*iNaturalist, 2016*
*eBird, 2016*
*Calflora, 2016*
*Consortium of California Herbaria, 2016*
**Imagery**
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE** 5-1
*Suitable Habitat for Monterey Spineflower*





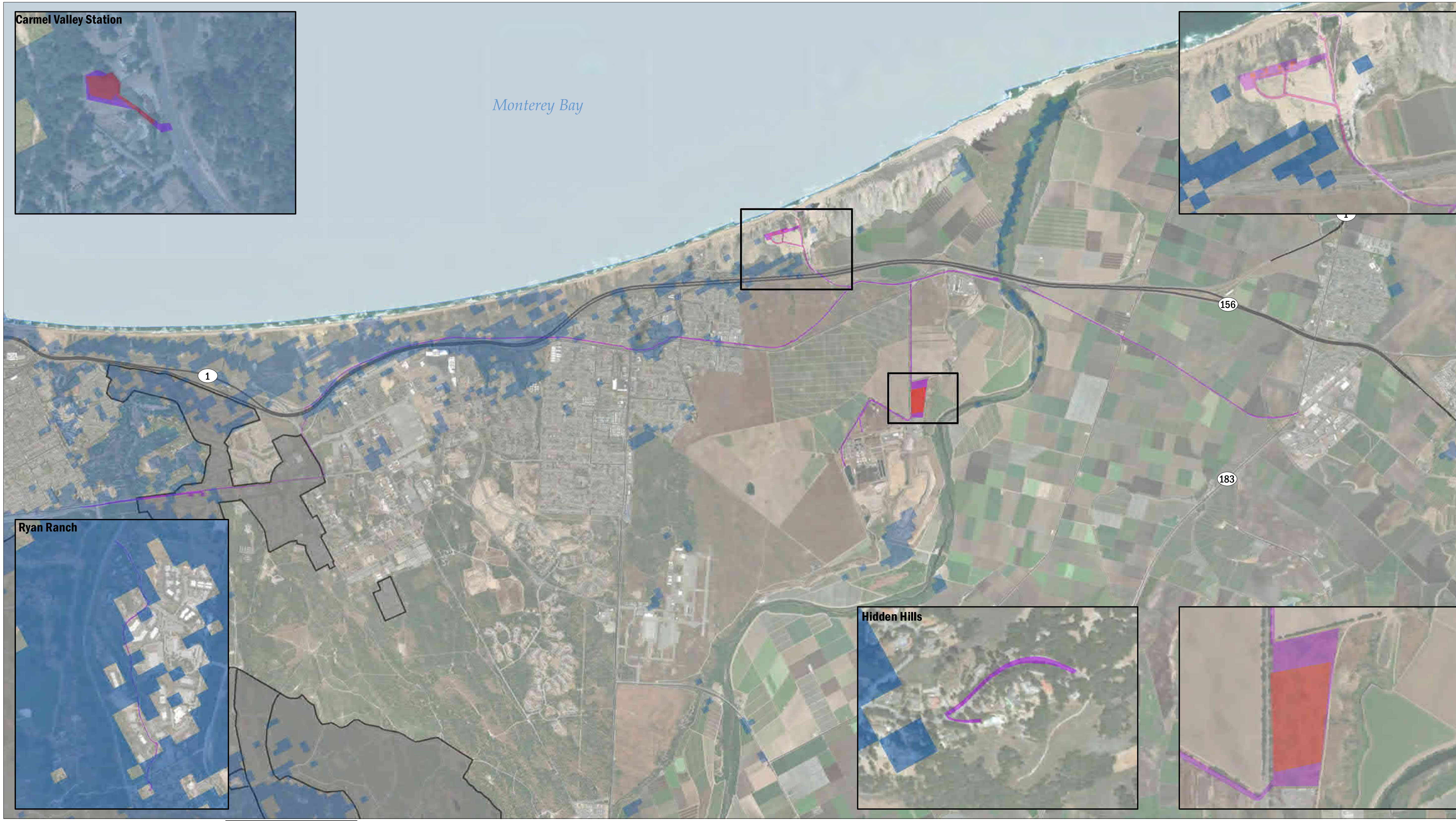



Federal Lands
Permanent Impact
Temporary Impact
Unsuitable Habitat
Suitable Habitat

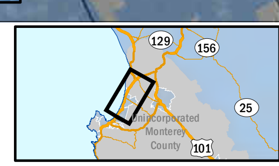
**Data Source**
**Federal Lands**
*California Protected Areas Database, 2013, GreenInfo Networks*
**Maxent Environmental Inputs**
*Soil - US Department of Agriculture (USDA), 2016*
*Climate - WorldClim.org, 2016*
*Water(NHD) - USGS, 2016*
*Habitat(GAP) - USGS, 2016*
**Maxent Species Locality Inputs**
*CNDDB, 2016*
*VertNet, 2016*
*iNaturalist, 2016*
*eBird, 2016*
*Calflora, 2016*
*Consortium of California Herbaria, 2016*
**Imagery**
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 5-2**
*Suitable Habitat for Monterey Gilia*








Federal Lands
Permanent Impact
Temporary Impact
Unsuitable Habitat
Suitable Habitat

**Data Source**
**Federal Lands**
*California Protected Areas Database, 2013, GreenInfo Networks*
**Maxent Environmental Inputs**
*Soil - US Department of Agriculture (USDA), 2016*
*Climate - WorldClim.org, 2016*
*Water(NHD) - USGS, 2016*
*Habitat(GAP) - USGS, 2016*
**Maxent Species Locality Inputs**
*CNDDB, 2016*
*VertNet, 2016*
*iNaturalist, 2016*
*eBird, 2016*
*Calflora, 2016*
*Consortium of California Herbaria, 2016*
**Imagery**
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA
WATER SUPPLY PROJECT, MPWSP

**FIGURE** 5-3
*Suitable Habitat for Yadons Piperia*

**Table 5-2. Area of Mapped Habitat for Federally Listed Plant Species within the BSA and Project Footprint**

| Species | Area of Mapped Habitat in the BSA acres (hectares) | Area of Mapped Habitat in the Project Footprint acres (hectares) |
|---|---|---|
| Monterey spineflower | 258.25 (104.51) | 95.53 (38.66) |
| Menzies' wallflower | 77.36 (31.31) | 25.56 (10.34) |
| Monterey gilia | 223.98 (90.64) | 79.99 (32.37) |
| Yadon's piperia | 63.56 (25.72) | 23.57 (9.54) |
| Ben Lomond wallflower | 0.00 (0.00) | 0.00 (0.00) |

**Not all areas of MaxEnt modeled habitat within the BSA were surveyed. Unsureyed areas are limited to those areas where permission to enter was not granted or areas that were added to the BSA since the most recent surveys. Table 5-3 present the amount of the habitat modeled with MaxEnt that was not surveyed.**

**Table 5-3. Area of MaxEnt Modeled Habitat Not Surveyed within the BSA**

| Species | Area of Modeled, Unsurveyed[Ŧ] Habitat in the BSA acres (hectares) |
|---|---|
| Monterey spineflower | 34.96 (14.15) |
| Menzies' wallflower | 16.29 (6.60) |
| Monterey gilia | 26.68 (10.80) |
| Yadon's piperia | 63.56 (25.72) |
| Ben Lomond wallflower | 0.00 (0.00) |

**However, the amount of known occupied habitat of federally listed plants applies only to Monterey spineflower as those were the plants observed and mapped within the BSA. The amount of known occupied habitat is presented in Table 5-4.**

**Table 5-4. Area of Known Occupied Habitat for Monterey Spineflower within the BSA and Project Footprint**

| Species | Area of Occupied Habitat in the BSA acres (hectares) | Area of Occupied Habitat in the Project Footprint acres (hectares) |
|---|---|---|
| Monterey spineflower | 10.27 (4.16) | 4.60 (1.86) |

Federally listed plants on non-federal lands may be adversely affected by installation of the pipeline alignment, construction of the Proposed Desalination Plant, installation of the Intake Slant Wells, and construction of the Carmel Valley Pump Station. These activities would require clearing, grubbing, and ground disturbance that would cause temporary direct effects on federally listed plants consisting of habitat disturbance and mortality (Table 5-1). Construction activities would also mobilize dust in the Action Area, which could harm federally listed plants. The Proposed Desalination Plant and the Carmel Valley Pump Station would permanently eliminate habitat for federally listed plants (Table 5-1).

Operations and maintenance of the Slant Wells would impact approximately 3.75 acres (1.5 hectares) of habitat. Potential habitat for federally listed plants would be permanenty affected in this area. Table 5-5 presents these impacts.

Table 5-5. Area of Permanent Habitat Impacts from Operation and Maintenance of the Slant Wells

| Species | Area of Permanent Impacts to Potentially Suitable Habitat from Operation and Maintenance of the Slant Wells acres (hectares) | Area of Permanent Impacts to Known Occupied Habitat from Operation and Maintenance of the Slant Wells acres (hectares) |
|---|---|---|
| Monterey spineflower | 0.71 (0.29) | 0.00 (0.00) |
| Menzies' wallflower | 0.43 (0.17) | 0.00 (0.00) |
| Monterey gilia | 0.67 (0.27) | 0.00 (0.00) |
| Yadon's piperia | 0.00 (0.00) | 0.00 (0.00) |
| Ben Lomond wallflower | 0.00 (0.00) | 0.00 (0.00) |

Federally listed plants are present in the Action Area on non-federal lands. The Proposed Action is likely to cause disturbance and mortality through vegetation clearing, grubbing, grading, and trenching along the pipeline alignment, at the Proposed Desalination Plant Site, at the Intake Slant Well sites, and at the Carmel Valley Pump Station. Construction of the Proposed Desalination Plant and the Carmel Valley Pump Station would also permanently eliminate habitat for federally listed plants on non-federal lands. The Avoidance and Minimization Measures described in Section 3 will limit habitat disturbance and mortality to the greatest extent practicable. In addition, temporarily-disturbed habitat will be restored at a 1:1 ratio and permanently-disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for mortality during construction, the Proposed Action *may affect, and is likely to adversely affect* federally listed plants on non-federal lands.

Critical habitat for federally listed plants either has not been designated or does not overlap with the Action Area. Therefore, the Proposed Action would have *no effect* on DCH for federally listed plants.

## 5.5 Smith's blue butterfly

MaxEnt modeling results show that suitable habitat for Smith's blue butterfly is present within the Action Area along the majority of the pipeline alignment south of the Salinas River, at the Intake Slant Well sites, at the Proposed Desalination Plant Site, and the Carmel Valley Pump Station (Figure 5-5). Construction activities in these areas, including vegetation clearing, grubbing, grading, trenching (along the pipeline alignment), and drilling (at the CEMEX Lapis Plant) could cause temporary, direct effects on Smith's blue butterfly through injury or mortality of butterfly adults, larvae, and/or eggs if equipment disturbs or removes host plants (coast buckwheat and seacliff buckwheat) or soil associated with the host plants. Disturbance to or removal of host plants or associated soil may also adversely affect Smith's blue butterflies through temporary habitat loss () and habitat fragmentation, which could limit foraging, movement, and oviposition. Construction activities would produce temporary noise, vibration, and artificial light, which could cause behavioral changes in Smith's blue butterflies such as cessation of foraging or dispersal. Light associated with construction activities could also increase predation on Smith's blue butterflies. Construction and operation of equipment and vehicles would mobilize dust, which could cause injury or mortality to Smith's blue butterfly adults, larvae, or eggs, and could degrade habitat. Since the pipeline ROW would be restored to original conditions after the completion of construction, any disturbance to species habitat would be temporary, and there would be no permanent adverse effects on Smith's blue butterfly habitat resulting from installation of the pipeline alignment. Installation of the Intake Slant Wells, construction of the Proposed Desalination Plant, construction of the ASR wells, and construction of the Carmel Valley Pump Station would permanently adversely affect the species by eliminating existing habitat for Smith's blue butterfly (Table 5-1).

Suitable habitat for Smith's blue butterfly host plants is present, and was mapped, in the Action Area in both the BSA and the project footprint. Table 5-6 presents the amount of mapped habitat for federally listed plants.

**Table 5-6. Area of Mapped Habitat for Smith's blue butterfly host plants in the BSA and Project Footprint**

| Species | Area of Mapped Habitat in the BSA acres (hectares) | Area of Mapped Habitat in the Project Footprint acres (hectares) |
|---|---|---|
| Smith's blue butterfly | 261.71 (105.91) | 97.62 (39.50) |

Not all areas of MaxEnt modeled habitat within the BSA were surveyed. Unsureyed areas are limited to those areas where permission to enter was not granted or areas that were added to the BSA since the most recent surveys. Table 5-7 present the amount of the Smith's blue butterfly host plant habitat modeled with MaxEnt that was not surveyed.

**Table 5-7. Area of MaxEnt Modeled Habitat Not Surveyed within the BSA**

| Species | Area of Modeled, Unsurveyed[‡] Habitat in the BSA acres (hectares) |
|---|---|
| Smith's blue butterfly | 261.71 (105.91) |

However, the amount of known occupied habitat of Smith's blue butterfly host plants applies only to areas where those plants were observed and mapped within the BSA. The amount of known occupied habitat is presented in Table 5-8. Plants were observed at approximately 1,660 plants per acre, which would be approximately 3,400 plants observed to occupy the project footprint and approximately 10,160 observed in the BSA.

**Table 5-8. Area of Known Occupied Habitat for Smith's blue butterfly host plants in the BSA and Project Footprint**

| Species | Area of Occupied Habitat in the BSA acres (hectares) | Area of Occupied Habitat in the Project Footprint acres (hectares) |
|---|---|---|
| Smith's blue butterfly | 6.35 (2.57) | 2.13 (0.86) |

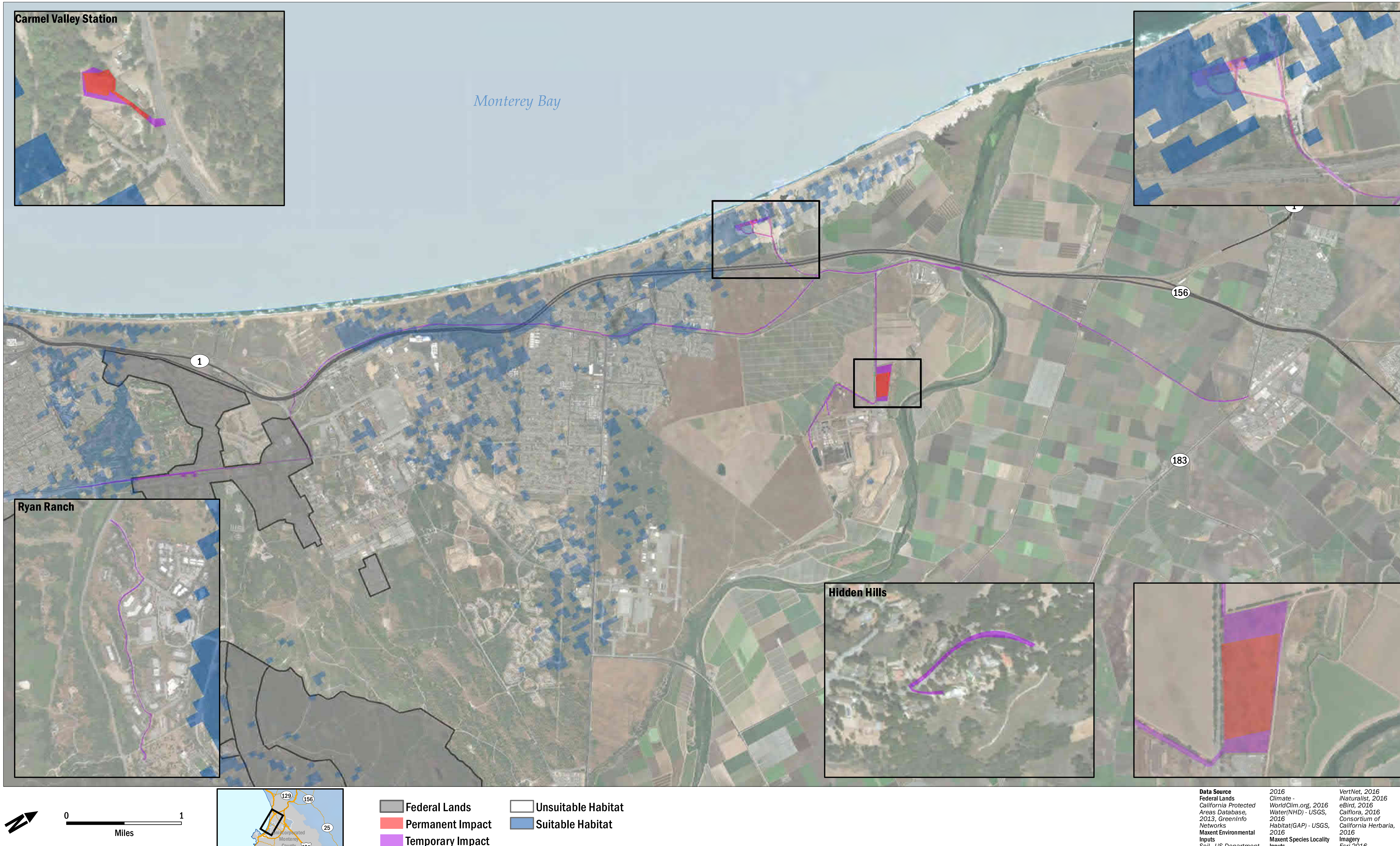
Operations and maintenance of the Slant Wells would impact approximately 3.75 acres (1.5 hectares) of habitat. Habitat for Smith's blue butterfly host plants would be permanenty affected in this area. Table 5-9 presents these impacts.

**Table 5-9. Area of Permanent Habitat Impacts from Operation and Maintenance of the Slant Wells**

| Species | Area of Permanent Habitat Impacts from Operation and Maintenance of the Slant Wells acres (hectares) |
|---|---|
| Smith's blue butterfly | 0.08 (0.03) |

Although The Proposed Action may cause injury or mortality during construction and would permanently eliminate some habitat for the species, the Avoidance and Minimization Measures described in Section 3 will limit habitat disturbance, injury, and mortality to the greatest extent practicable. In addition, temporarily-disturbed habitat will be restored at a 1:1 ratio and permanently-disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for injury or mortality during construction, the Proposed Action *may affect, and is likely to adversely affect* Smith's blue butterfly.

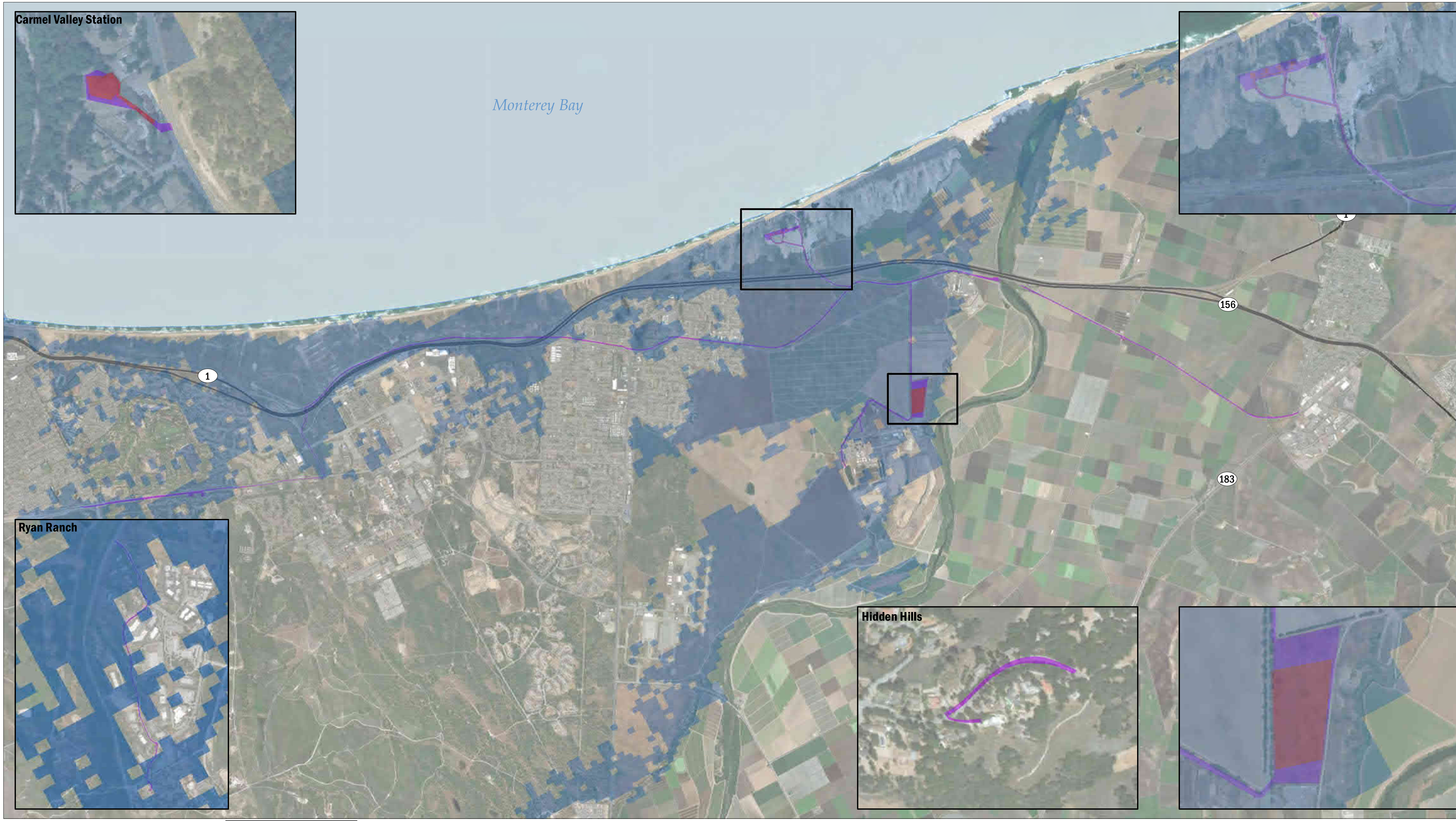
Critical habitat has not been designated for Smith's blue butterfly; therefore, the Proposed Action would have *no effect* on Smith's blue butterfly DCH.



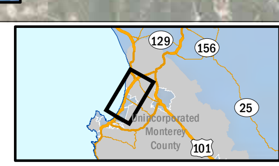

**Data Source**
**Federal Lands**
*California Protected Areas Database, 2013, GreenInfo Networks*
**Maxent Environmental Inputs**
*Soil - US Department of Agriculture (USDA), 2016*
*Climate - WorldClim.org, 2016*
*Water(NHD) - USGS, 2016*
*Habitat(GAP) - USGS, 2016*
**Maxent Species Locality Inputs**
*CNDDB, 2016*
*VertNet, 2016*
*iNaturalist, 2016*
*eBird, 2016*
*Calflora, 2016*
*Consortium of California Herbaria, 2016*
**Imagery**
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA
WATER SUPPLY PROJECT, MPWSP

**FIGURE** 5-4
*Suitable Habitat for Menzie's Wallflower*








Permanent Impact
Temporary Impact
Unsuitable Habitat
Suitable Habitat

**Data Source**
**Maxent Environmental Inputs**
*Soil - US Department of Agriculture (USDA), 2016*
*Climate - WorldClim.org, 2016*
*Water(NHD) - USGS, 2016*
*Habitat(GAP) - USGS, 2016*
**Maxent Species Locality Inputs**
*CNDDB, 2016*
*VertNet, 2016*
*iNaturalist, 2016*
*eBird, 2016*
*Calflora, 2016*
*Consortium of California Herbaria, 2016*
**Imagery**
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA
WATER SUPPLY PROJECT, MPWSP

**FIGURE** 5-5
*Suitable Habitat for Smith's Blue Butterfly*

## 5.6 Tidewater goby

MaxEnt modeling was not performed for tidewater goby as the model typically does not generate accurate results for aquatic species. Based on recent observations and presence of potentially suitable habitat, tidewater goby may occur in the Salinas River or in Tembladero Slough within the Action Area (Table 5-1). At Salinas River, the pipeline would be attached to the existing Monte Road Bridge with the assistance of a barge in the Salinas River. The barge would remain in the river for up to one month, during which time it would be moving frequently and is therefore not expected to cause substantial shading effects on any one portion of the channel. At Tembladero Slough, the pipeline would be installed under the slough using HDD. If equipment or materials fall into the water at these sites, tidewater goby could be injured or killed. Tidewater goby could also be injured or killed if the Proposed Action damages water quality, which could occur as a result of an HDD frac-out at Tembladero Slough, or due to equipment or materials falling into the water, erosion, or a hazardous materials spill at Salinas River or Tembladero Slough. Construction-related noise, vibration, and artificial light could cause temporary behavioral changes in tidewater goby, including dispersal or cessation of foraging, and artificial light could cause increased predation on tidewater goby. The Proposed Action would mobilize dust, which could enter the Salinas River and Tembladero Slough. This increased noise, light and dust mobilization would temporarily degrade habitat for tidewater goby and could result in a temporary direct adverse effect on the species. The Proposed Action would not cause any permanent adverse effects on tidewater goby habitat as all aquatic features are anticipated to be protected to the maximum extent practicable during construction.

There is high potential for tidewater goby to occur in the Salinas River in the Action Area and a low potential for the species to occur in Tembladero Slough in the Action Area. With proper implementation of the Avoidance and Minimization Measures described in Section 3, the likelihood of objects falling into the water during construction and the likelihood of an HDD frac-out and causing adverse impacts to the tidewater goby and/or its habitat would be discountable. Therefore, the Proposed Action *may affect, but is not likely to adversely affect* tidewater goby.

DCH for tidewater goby overlaps with the Action Area in the Salinas River. The Proposed Action may cause adverse impacts on DCH for tidewater goby if equipment or materials fall into the water and degrade water quality. However, with proper implementation of the Avoidance and Minimization Measures described in Section 3, the likelihood of objects falling into the water during construction would be discountable. Therefore, the Proposed Action *may affect, but is not likely to adversely affect* tidewater goby DCH.

## 5.7 California tiger salamander

MaxEnt modeling results show that suitable habitat for California tiger salamander is present along portions of the ASR pipelines, the new Transmission Main, Desalinated Water Pipeline, Source Water Pipeline, Brine Discharge Pipeline, Pipeline to CSIP Pond, and Castroville Pipeline, as well as at the Proposed Desalination Plant Site (Figure 5-6). Vegetation clearing, grubbing, grading, and trenching along the pipeline alignment and vegetation clearing, grubbing, grading, and construction activities at the Proposed Desalination Plant Site could cause injury or mortality to the species if equipment or materials come into direct contact with California tiger salamander adults or juveniles. California tiger salamanders may also be injured or killed if they fall into or are trapped in open trenches; however, this is not anticipated as all open trenches will be equipped with escape ramps. At Tembladero Slough, California tiger salamander adults, juveniles, larvae, and/or egg masses could be injured or killed and habitat could be degraded in the event of an HDD frac-out, or due to equipment or materials falling into the water, erosion, or a hazardous materials spill. Any mortality of individuals resulting from the Proposed Action would constitute a direct adverse effect to the species.

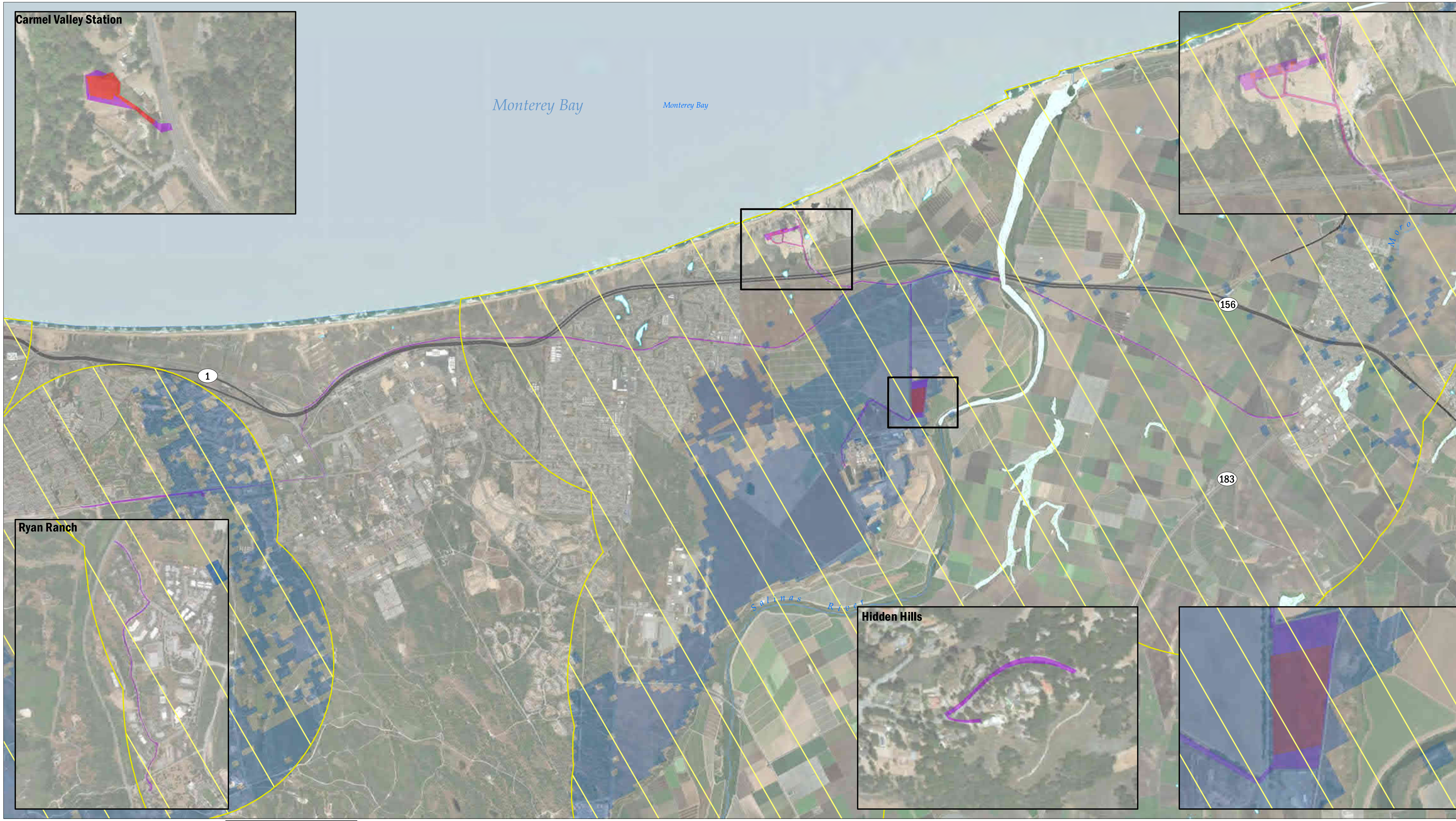
The Proposed Action could also temporarily cause behavioral disturbances and alter habitat for California tiger salamander (Table 5-1). Work along the pipeline alignment and at the Proposed Desalination Plant Site would result in temporary habitat loss and fragmentation, which could impede dispersal. Construction activities would also generate temporary noise, vibration, and artificial light, which could cause behavioral changes in California tiger salamander such as cessation of foraging, retreat into small mammal burrows, or dispersal. Light associated with construction activities could also increase predation on dispersing California tiger salamanders. Construction and operation of equipment and vehicles would mobilize dust, which could degrade California tiger salamander habitat. Since the ROW would be restored to original conditions after the completion of construction, there would be no permanent impacts on California tiger salamander habitat resulting from installation of the pipeline along the pipeline alignment. However, the Proposed Desalination Plant, which would include a desalination building, chemical storage and feed facilities, electrical substation, pump station, post-treatment facility, treated water storage tanks, and administrative offices, would permanently eliminate some suitable upland habitat for California tiger salamander (Table 5-1).

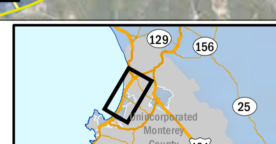
There is high potential for California tiger salamander to occur in the Action Area due to the presence of suitable upland habitat including small mammal burrows. The Proposed Action may cause injury or mortality during construction and would eliminate habitat for the species at the Proposed Desalination Plant Site and the ASR well sites. The Avoidance and Minimization Measures described in Section 3 will limit habitat disturbance, injury, and mortality to the greatest extent practicable. In addition, temporarily-disturbed habitat will be restored at a 1:1 ratio and permanently-disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for injury or mortality during construction, the Proposed Action *may affect, and is likely to adversely affect* California tiger salamander.

DCH for California tiger salamander is not present in the Action Area; therefore the Proposed Action would have *no effect* on California tiger salamander DCH.

## 5.8 California red-legged frog

The Action Area contains suitable breeding and dispersal habitat for California red-legged frog and there is moderate potential for the species to occur along segments of the pipeline alignment, particularly in the portion of the Action Area around Tembladero Slough (new Castroville Pipeline), the Salinas River (new Castroville Pipeline), and the Carmel River (Carmel Valley Pump Station). There is also potential for the species to occur near the Proposed Desalination Plant Site along the banks of the Salinas River and adjacent wetlands, and at the Neponset Road Pond.




0 1
Miles

Permanent Impact
Temporary Impact
Unsuitable Habitat
Suitable Habitat
Dispersal Range

**Data Source**
**Maxent Environmental Inputs**
*Soil - US Department of Agriculture (USDA), 2016*
*Climate - WorldClim.org, 2016*
*Water(NHD) - USGS, 2016*
*Habitat(GAP) - USGS, 2016*
**Maxent Species Locality Inputs**
*CNDDB, 2016*
*VertNet, 2016*
*iNaturalist, 2016*
*eBird, 2016*
*Calflora, 2016*
*Consortium of California Herbaria, 2016*
**Imagery**
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA
WATER SUPPLY PROJECT, MPWSP

**FIGURE** 5-6
*Suitable Habitat for California Tiger Salamander*

The MaxEnt model (Figure 5-7) supports the site assessment and CNDDB data in indicating potential California red-legged frog habitat at the Salinas River, Tembladero Slough, and the Carmel River. At these locations, installation of the pipeline alignment and/or facilities would cause temporary direct impacts on California red-legged frog habitat. Grubbing, grading, and trenching in the Action Area would cause disturbance to upland habitat for California red-legged frog, including small mammal burrows. These actions could also cause California red-legged frog injury or mortality if individuals are present in upland habitat during construction.

At Tembladero Slough, California red-legged frog adults, juveniles, larvae, and/or egg masses could be injured or killed and habitat could be degraded in the event of an HDD frac-out, or due to equipment or materials falling into the water, erosion, or a hazardous materials spill. Since the ROW would be restored to original conditions after the completion of construction, there would be no permanent impacts on California red-legged frog habitat resulting from installation of the pipeline alignment.

Construction of the Proposed Desalination Plant may cause direct effects on dispersing California red-legged frogs and their upland habitat (Table 5-1). The Action Area at the Proposed Desalination Plant does not overlap with the MaxEnt model's assessment of suitable habitat; however, the Salinas River and adjacent wetlands near the Action Area may provide habitat, and dispersing frogs could be affected by the Proposed Action. Similarly, potential California red-legged frog habitat at Neponset Road Pond was not mapped as suitable habitat in the MaxEnt model; habitat would not be affected by the installation of the pipeline alignment. However, field surveys were unable to rule this location out as potential habitat due to limited access. If frogs are present at Neponset Road Pond, individuals dispersing into the Action Area may be adversely affected by construction activities, as associated vegetation clearing, grubbing, and ground disturbance may injure or kill California red-legged frog.

The Carmel Valley Pump Station, which would include three 60 hp pumps and approximately 1,000 linear feet of inlet and outlet piping, would permanently eliminate some suitable upland habitat for California red-legged frog (Table 5-1).

There is moderate potential for California red-legged frog to occur in the Action Area and suitable habitat is present along the pipeline alignment near the Salinas River, north of the Salinas River, and at the Carmel Valley Pump Station. The Proposed Action may cause injury or mortality during construction. The Avoidance and Minimization Measures described in Section 3 will limit habitat disturbance, injury, and mortality to the greatest extent practicable. In addition, temporarily-disturbed habitat will be restored at a 1:1 ratio and permanently-disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for injury or mortality during construction at the Salinas River and Tembladero Slough, the Proposed Action *may affect, and is likely to adversely affect* California red-legged frog.

DCH for California red-legged frog is present in the Action Area at the Carmel Valley Pump Station and the Hidden Hills Interconnection Improvement. Construction of the Carmel Valley Pump Station would include clearing and grading construction and staging areas; excavating; installing pipelines and pipe connections; pouring concrete footings; constructing walls and roofs; and finish work such as paving, landscaping, and fencing.

**Table 5-10. Area of Permanent Impacts to California Red-legged Frog Designated Critical Habitat**

| Species | Area of Permanent Impacts to Designated Critical Habitat acres (hectares) |
|---|---|
| California red-legged frog | 0.58 (0.23) |

Temporarily-disturbed DCH will be restored at a 1:1 ratio, and permanently-disturbed DCH will be mitigated at a 3:1 ratio. Because the facility would permanently eliminate California red-legged frog DCH, the Proposed Action *may affect, and is likely to adversely affect* California red-legged frog DCH.

## 5.9 Western snowy plover

A breeding population of western snowy plover has been documented in the sand dunes at the CEMEX Lapis Plant annually since 2008, and MaxEnt modeling results also show suitable habitat for western snowy plover at the CEMEX Lapis Plant (Figure 5-9). Work in the Action Area at the CEMEX Lapis Plant, which includes drilling six new Intake Slant Wells, could cause injury or mortality if western snowy plover adults or young come into contact with equipment or materials. Construction activities would also cause temporary habitat loss and habitat fragmentation, which could adversely affect western snowy plover foraging, nesting, and dispersal activities (Table 5-1). The Proposed Action would generate temporary noise, vibration, and artificial light, which could cause behavioral changes in western snowy plover such as nest abandonment, cessation of foraging, or dispersal. Light associated with construction activities could also increase predation on western snowy plover adults, juveniles, and eggs. Construction and operation of equipment and vehicles would mobilize dust, which could degrade western snowy plover habitat.

The Proposed Action would also result in the permanent loss of potential western snowy plover nesting habitat due to the installation of features associated with the slant wells, including above ground wellhead(s), an electrical enclosure, and a pump-to-waste basin (Table 5-1). Operations and maintenance of the Slant Wells would impact approximately 3.75 acres (1.5 hectares) of habitat. Habitat for Smith's blue butterfly host plants would be permanenty affected in this area. Table 5-10 presents these impacts.

**Table 5-11. Area of Permanent Habitat Impacts from Operation and Maintenance of the Slant Wells**

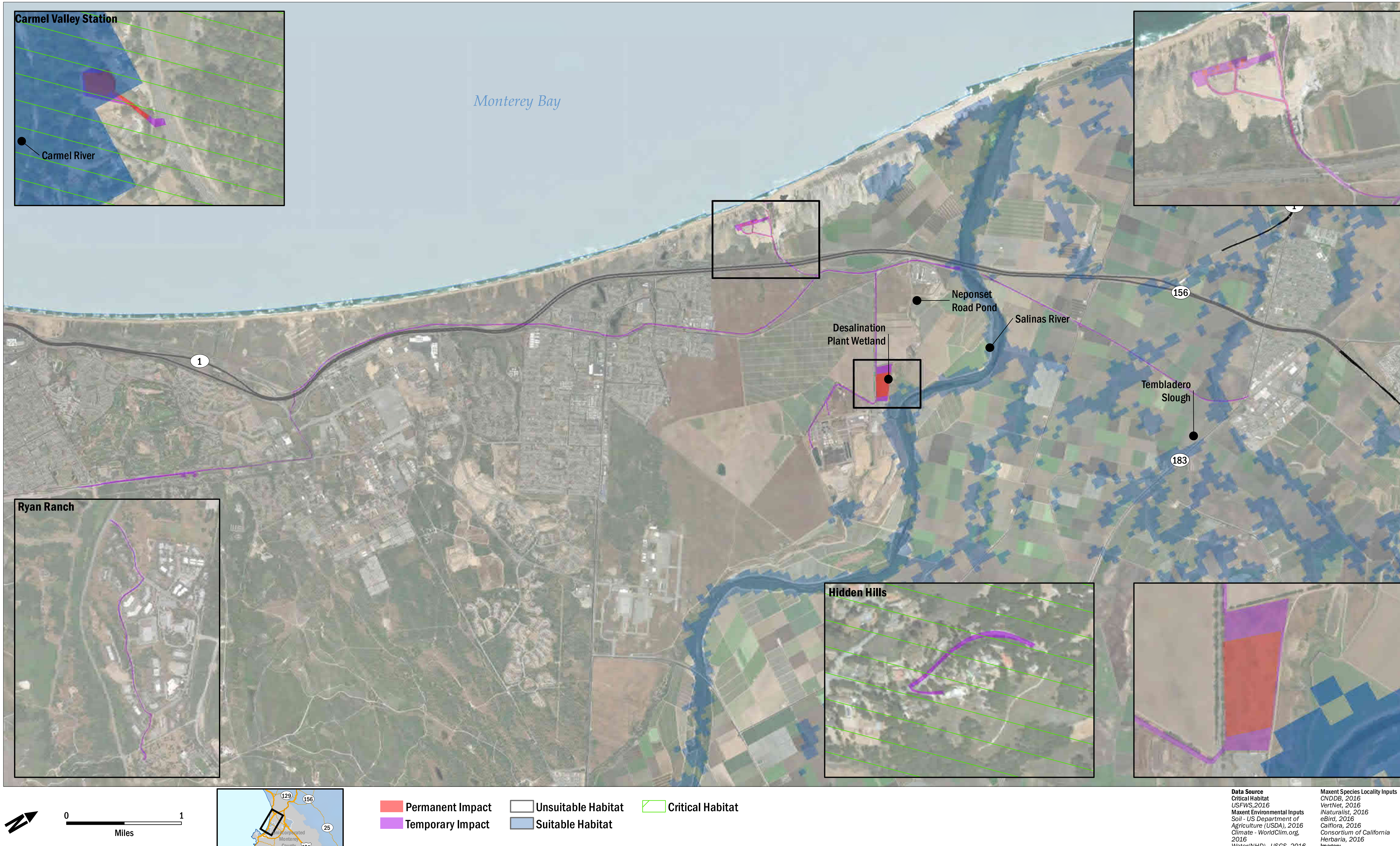
| Species | Area of Permanent Habitat Impacts from Operation and Maintenance of the Slant Wells acres (hectares) |
|---|---|
| Western snowy plover | 1.93 (0.78) |

Point Blue Conservation Science noted a recent loss of beach habitat caused by winter storms at the CEMEX Lapis Plant site that is expected to worsen with climate change. In combination with high

**levels of human disturbance at this site, the long-term effects of habitat loss due to climate change in combination with habitat losses from the Proposed Action will likely have adverse effects on the species by limiting the ability of western snowy plovers to utilize the CEMEX Lapis Plant site.**

**There is high potential for western snowy plover to occur in the Action Area at the CEMEX Lapis Plant. The Proposed Action may cause disturbance, injury, or mortality during construction and would permanently eliminate habitat for the species at the source-water Intake Slant Well sites. The Avoidance and Minimization Measures described in Section 3 will limit habitat disturbance, injury, and mortality to the greatest extent practicable. In addition, temporarily-disturbed habitat will be restored at a 1:1 ratio and permanently-disturbed habitat will be mitigated at a 3:1 ratio. However, due to the potential for injury or mortality during construction, the Proposed Action *may affect, and is likely to adversely affect* western snowy plover.**

**DCH for western snowy plover is not present in the Action Area; therefore, the Proposed Action would have no effect on western snowy plover DCH.**

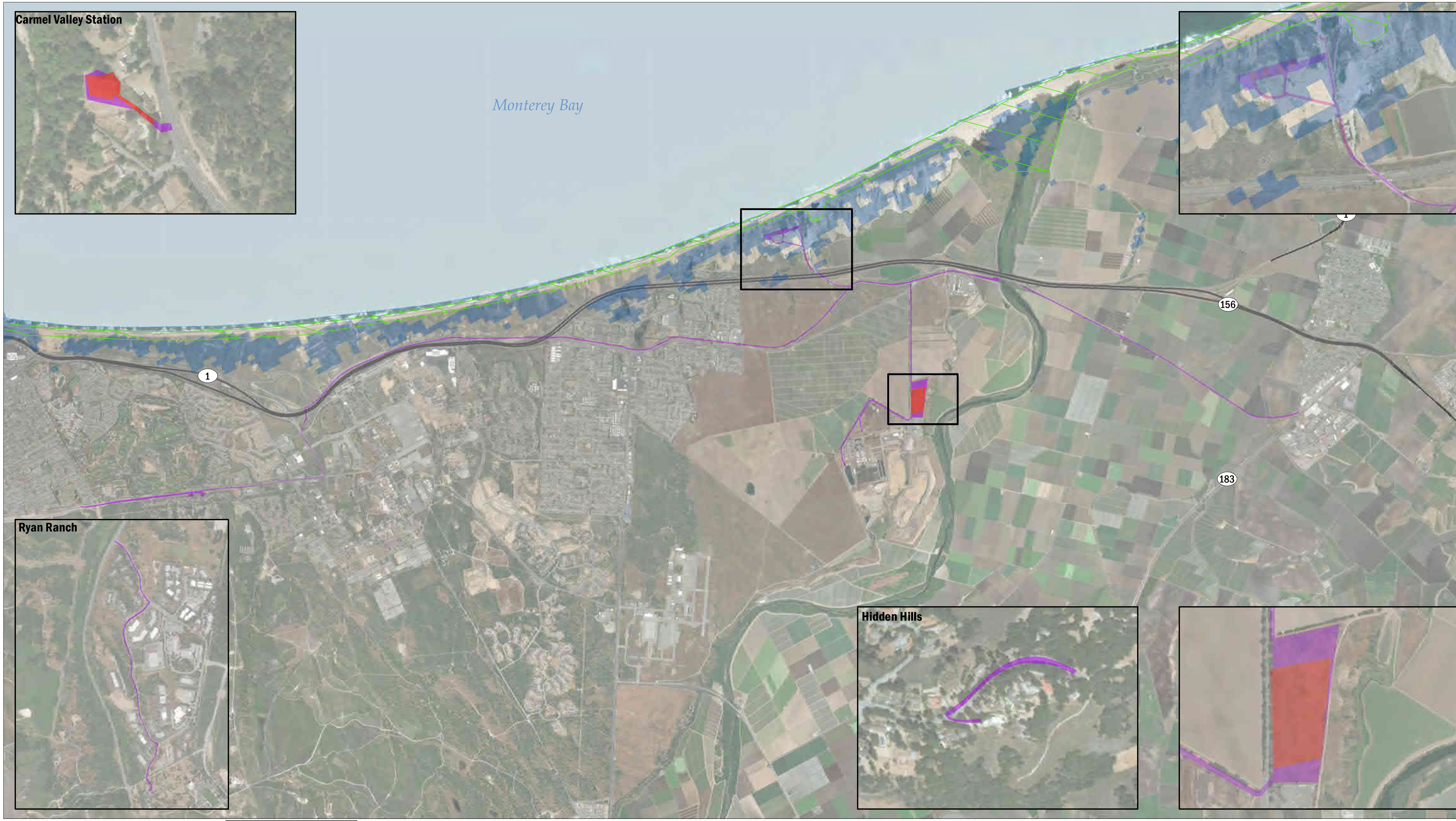



**Data Source**
**Critical Habitat**
*USFWS,2016*
**Maxent Environmental Inputs**
*Soil - US Department of Agriculture (USDA), 2016*
*Climate - WorldClim.org, 2016*
*Water(NHD) - USGS, 2016*
*Habitat(GAP) - USGS, 2016*

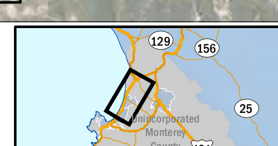
**Maxent Species Locality Inputs**
*CNDDB, 2016*
*VertNet, 2016*
*iNaturalist, 2016*
*eBird, 2016*
*Calflora, 2016*
*Consortium of California Herbaria, 2016*
**Imagery**
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA
WATER SUPPLY PROJECT, MPWSP

**FIGURE** 5-7
*Suitable Habitat for California Red-Legged Frog*








Permanent Impact
Temporary Impact
Unsuitable Habitat
Suitable Habitat
Critical Habitat

**Data Source**
**Critical Habitat**
*USFWS,2016*
**Maxent Environmental Inputs**
*Soil - US Department of Agriculture (USDA), 2016*
*Climate - WorldClim.org, 2016*
*Water(NHD) - USGS, 2016*
*Habitat(GAP) - USGS, 2016*

**Maxent Species Locality Inputs**
*CNDDB, 2016*
*VertNet, 2016*
*iNaturalist, 2016*
*eBird, 2016*
*Calflora, 2016*
*Consortium of California Herbaria, 2016*
**Imagery**
*Esri 2016*

**California American Water**
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*
MONTEREY PENINSULA
WATER SUPPLY PROJECT, MPWSP

**FIGURE** 5-8
*Suitable Habitat for Western Snowy Plover*

## 5.10 Least Bell's vireo

While riparian habitats are present in the Action Area near the Salinas River and the Carmel Valley Pump Station, MaxEnt model results show no suitable breeding habitat for least Bell's vireo is present in the Action Area. The Proposed Action could cause temporary direct effects on migrating and foraging least Bell's vireo, including temporary habitat disturbance, noise and light pollution, and dust mobilization resulting from clearing, grubbing, grading, and trenching. However, due to the low potential for the species to be present in the region and the lack of suitable breeding habitat in the Action Area, these effects are unlikely to harm least Bell's vireo and are therefore discountable.

There is low potential for least Bell's vireo to occur in the Action Area and the MaxEnt modeling showed no suitable habitat in the Action Area. Due to the lack of suitable habitat and low potential for the species to occur in the Action Area, any potential adverse of effects of the Proposed Action would be discountable and therefore the Proposed Action would have *no effect* on least Bell's vireo

DCH for least Bell's vireo is not present in the Action Area; therefore, the Proposed Action would have *no effect* on least Bell's vireo DCH.

## 5.11 Southern sea otter

The Proposed Action is not anticipated to directly affect the southern sea otter due to the absence of construction activities that would alter suitable, occupied habitat in the Action Area. There is potential for southern sea otter to be indirectly adversely affected by the Proposed Action if the brine discharge associated with the Proposed Action alters the benthic community. The Proposed Action would adhere to the 2015 California Ocean Plan (SWRCB 2015) requirement that brine discharge cannot exceed 2 ppt above natural background salinity further than 328 feet (100 meters) from each discharge point. Brine-only discharge, because it would be more dense than the surrounding seawater, would spread out along the seafloor and could have minimal effects on the benthic community. Benthic organisms are not expected to experience chronic or acute adverse effects due to the Proposed Action; studies of purple urchin (*Strongylocentrotus purpuratus*), mysid shrimp (*Americamysis bahia*), and sand dollar (*Dendraster excentricus*) measured no significant changes when salinity increases were within the 2 ppt limit defined by the 2015 California Ocean Plan (Phillips et al. 2012, Weston Solutions 2013). In the long term, changes in salinity may favor some organisms over others and result in community composition changes, although these effects are anticipated to be minimal due to the natural variability in salinity. The Proposed Action may result in a reduction in foraging success for southern sea otters within the Action Area due to long-term changes in benthic community composition; however, due to the relatively small increase in salinity associated with brine discharge and the small area over which salinity would be impacted, these effects are expected to be discountable.

While there is some potential for southern sea otter to occur in the Action Area, individuals are unlikely to spend extended periods of time in the area due to the distance from shore and water depths. The Proposed Action may cause minor changes to the benthic community in the vicinity of the discharge due to elevated ammonia (up to 15 meters from the outfall structure) or salinity (up to 350 meters from the outfall structure). However, such changes are not expected to have adverse effects on sea otter due to the transient nature of the exposure. Therefore, the Proposed Action would have *no effect* on southern sea otter.

Critical habitat has not been designated for the southern sea otter; therefore, the Proposed Action would have *no effect* on southern sea otter.

## 5.12 Birds covered by the MBTA

Components of the Proposed Action with potential to adversely affect birds covered by the MBTA would include installation of the source water Intake Slant Wells and construction of the Proposed Desalination Plant, the pump stations, and the pipeline alignment. These activities would require vegetation clearing, grubbing, grading, and trenching, which would reduce the amount of available nesting habitat and could reduce the abundance of prey within the Action Area. Construction would produce temporary noise and light pollution, which could cause behavioral changes in nesting or foraging. In addition, construction activities could result in nest disturbance that could cause direct loss of birds, nests, or eggs.

## 5.13 Interrelated and Interdependent Effects

Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those having no independent utility apart from the Proposed Action.

There are no interrelated actions to the Proposed Action. There is one interdependent action to the Proposed Action.

Replacement of the WEKO seals in the existing outfall. The existing stainless steel alloy WEKO seals or clamps would be replaced specifically because the increased brine discharge from the MPWSP through the existing outfall could cause corrosion of the stainless steel seals, potentially leading to leaks in the out fall structure in the nearshore are. MRWPCA has determined that MPWSP cannot discharge brine through their outfall without these seals. Therefore, this project is interdependent with the MPWSP. The expected impacts from the interdependent WEKO Seal Replacement project are described below.

Replacement of the old WEKO clamps and installation of new WEKO clamps would be done prior to replacing the beach junction box so that the existing junction box can be used as an accessway for divers. The existing 60-inch-diameter Monterey Regional Water Pollution Control Agency (MRWPCA) outfall pipeline includes a 13,000-foot-long unlined segment on land, starting at the regional wastewater treatment plant, and a 9,880-foot-long unlined segment offshore. An unlined reinforced concrete beach junction box connects the land segment and the offshore segment of the outfall.

Due to storm events in the winter of 2015-2016, the beach junction box and a portion of the existing outfall became exposed on the beach in front of the CEMEX Lapis Plant. Under an emergency Coastal Development Permit from the California Coastal Commission, MRWPCA was allowed to make temporary repairs, but is required to relocate the exposed components. As a separate and independent project, MRWPCA would apply for a separate Coastal Development Permit and would relocate a pre-lined beach junction box inland by 650 to 1,000 feet. That independent project would be completed prior to accepting MPWSP brine discharge into the outfall and would protect the beach junction structure and the portion of the offshore segment of the outfall that was of concern for increased corrosion from brine.

Prior to operation of the MPWSP Desalination Plant, and as part of an agreement with MRWPCA to use the outfall for brine discharge, CalAm will protect the offshore segment of the MRWPCA ocean outfall from corrosion by replacing the existing WEKO seal clamps in the nearshore portion of the ocean outfall with new corrosion-resistant clamps. Construction will occur in late summer/early fall, during the irrigation season, when flows in the outfall would typically be at a minimum. This would also be at the end of the snowy plover nesting season. Construction access will follow along the existing outfall access road. The staging and work area will be created on already disturbed ground at the western end of the access road and consist of no larger than a 50 square foot area for divers and diving equipment. Up to 0.15 acre around the junction structure may be disturbed. Two working shifts per day may be required, and the installation would take approximately 6-8 weeks.

During construction, the contractor will install temporary fencing around the construction site and construction will be prohibited outside of the defined construction, staging, and storage areas. Construction work will not be conducted seaward of the mean high water line. All accessways impacted by construction activities will be restored to their pre-construction condition or better within 3 days of completion of construction. Any beach sand in the area that is impacted by construction will be filtered as necessary to remove construction debris.

WEKO seal clamp replacement activities and the construction area described above could temporarily disturb up to 0.15 acre between the dunes and the beach. That temporary disturbance would include disturbance to 0.12 acres of western snowy plaver Designated Critical Habitat. Installation activities would be completed late in the snowy plover nesting season to minimize any impact. However, construction activities would have the potential to impact terrestrial biological resources in the vicinity of the project site. Therefore, all applicable avoidance and minimization measures presented in the BA or Mitigation Measures outlined in the EIR/EIS would be implemented with this project.

## 5.14 Cumulative Effects

As defined by the ESA, cumulative effects are those effects of future State or private activities, not involving Federal activities, that are reasonably certain to occur in the Action Area (50 CFR 402.02). Future federal actions that are unrelated to the Proposed Action are not considered in this section because they require separate consultation, pursuant to Section 7 of the ESA. There are several proposed projects that may cause cumulative effects within the Action Area (Table 5-12.).

Many of these proposed future projects are in the early stages of planning and it is currently unclear what, if any, impacts they would have on federally listed species and whether some would have a federal nexus and require Section 7 consultation. All of the proposed future projects in Table 5-12. would be reviewed under CEQA and would be required to develop avoidance and minimization measures and disclose significant impacts on federally listed species. If the future projects are expected to cause significant impacts on federally listed species, the project applicant would be required to initiate ESA consultation either under Section 7 with a federal nexus or if take is anticipated under Section 10.

The Proposed Action would have temporary impacts on the portion of the Action Area that overlaps with the proposed future projects resulting from installation of the pipeline alignment. These temporary impacts include vegetation clearing, grubbing, grading, and trenching along the pipeline alignment that would temporarily eliminate habitat for federally listed species and could temporarily disturb federally listed species. Construction activities would also produce temporary noise, vibration, and artificial light, which could cause behavioral changes in federally listed species including dispersal, cessation of foraging, or cessation of reproduction or nesting. Construction activities associated with the proposed future projects that are reasonably certain to occur, and would occur within portions of the Action Area, would likely also result in temporary impacts on federally listed species and/or their habitat. Many of the proposed projects that are reasonably certain to occur within portions of the Action Area would also have potential for long term effects on federally listed species and potential to permanently eliminate habitat. Most of the proposed projects would not overlap with the temporary construction effects associated with the Proposed Action. Instead, the effects of the proposed projects would be separated by time from the effects associated with the Proposed Action.

Due to the possibility of injury, mortality, and disturbance to federally listed species and temporary impacts and permanent alteration of habitat for federally listed species, it is possible that the Proposed Action and proposed projects that are reasonably certain to occur in portions of the Action Area could cause cumulative adverse impacts on federally listed species in the Action Area. However, most of the proposed projects would not overlap in time, and would only overlap within portions of the Proposed Action. All of the proposed projects would be required to implement avoidance and minimization measures (at a minimum through CEQA) that should avoid, minimize and compensate for significant impacts on the federally listed species and their habitat. Thus, the net effect would be a minor incremental cumulative effect on species affected by the Proposed Action.

**Table 5-12. Proposed Projects in the Action Area**

| Project Location | Project Name and Description | Estimated Construction Schedule |
|---|---|---|
| Salinas River near the City of Marina | Salinas Valley Water Project Phase II – The project would allow the Monterey County Water Resources Agency to facilitate further offsets of groundwater pumping by delivering additional surface water to the Pressure and East Side subareas. The project would divert up to 135,000 acre-feet per year (afy) of water from the Salinas River for municipal, industrial, and/or agricultural uses in the Pressure and East Side subareas.<br>The project proposes two new surface water diversion points and appurtenant facilities for capture, conveyance, and delivery of the water. The capture and diversion facilities would consist of either a surface water diversion facility, similar to the Salinas River Diversion Facility, or subsurface collectors, such as radial arm wells. The conveyance facilities would be composed of pipelines and pump stations. The pipeline diameter, length, destination, number and location of turnouts, locations of pump stations, and physical layout of the conveyance facilities have not been determined. The delivery facilities may consist of injection wells for aquifer storage and recovery, percolation ponds, turnouts for direct use of the water, or other options. The construction design and physical location of the delivery facilities would be influenced by the type of facility, the end-users' intended application of the water (agricultural versus urban), and need for water treatment (MCWRA 2014). | Construction anticipated after 2018; Project operation anticipated 2026 |
| Former Fort Ord | Cypress Knolls Senior Residential Project – Senior residential | Unknown |

### Table 5-12. Proposed Projects in the Action Area

| Project Location | Project Name and Description | Estimated Construction Schedule |
|---|---|---|
| Military Base 3rd Avenue / Imjin Parkway | community with active-adult housing, care services, senior community center, and supportive amenities and services on 188 acres (76 hectares) (City of Marina 2013). | |
| Reservation Road between Del Monte Boulevard and Forest Avenue | Marina Downtown Vitalization Specific Plan – Redevelopment plan for Marina's 225-acre (91-hectare) downtown area comprising mixed-use commercial, residential, educational, and civic uses (City of Marina 2011b). | Unknown / Full Buildout Scheduled for 2040 |
| Armstrong Ranch, Marina (Along the northern limits of the city of Marina, on either side of Del Monte Avenue) | Marina Station – Development project comprising 1,360 residential units, approximately 60,000 square feet (5,570 square meters) of retail space, 144,000 square feet (13,400 square meters) of office space, and 652,000 square feet (60,600 square meters) of business park/industrial uses (City of Marina 2011c). | Unknown |
| Former Fort Ord Military base Monterey Road / Coe Avenue | The Seaside Resort – The first phase, completed in 2009, involved upgrades to the Bayonet and Black Horse Golf Courses. The next phase of development features a four-star hotel with approximately 275 hotel rooms, 175 timeshare units, and 125 residential units (City of Seaside 2013). | Stage 1 2017 - 2018 |
| Former Fort Ord Military Base between Highway 1 and 2nd Avenue, and Lightfighter Drive and 1st Street | Main Gate Specific Plan – Mixed-use development project featuring approximately 500,000 square feet (46,500 square meters) of retail and entertainment space, and a 250-room hotel/conference center with spa amenities (PMC 2010). | Unknown |
| Carmel Valley Road | Rancho Cañada Village – Development of 281 mixed-use residential units, including 182 single-family dwellings, 64 townhomes, and 35 condominiums (Monterey County Planning Department 2017). | Unknown |
| Marina Coastal Water District / Salinas Valley Reclamation Plant, Monterey County | Regional Urban Water Augmentation Project Recycled Water Element – Construction of a recycled water distribution system to provide up to 1,500 afy of recycled water to urban users in the Marina Coast Water District service areas, including the former Fort Ord. The water would be recycled at the existing Salinas Valley Reclamation Plant. This project includes the following facilities: a new pipeline connection to the Salinas Valley Reclamation Plant; two pump stations; 40,000 linear feet (12,200 meters) of distribution pipelines; and a 1.5-million-gallon storage tank known as Blackhorse Reservoir (MCWD 2013). | Unknown |

**Table 5-12. Proposed Projects in the Action Area**

| Project Location | Project Name and Description | Estimated Construction Schedule |
|---|---|---|
| Cities of Castroville, Marina, Monterey, Seaside, Sand City, and County of Monterey | Transportation Agency for Monterey County Monterey Peninsula Light Rail Project - Construction of commuter light rail service predominantly, but not exclusively, along the Transportation Agency for Monterey County's (TAMC's) existing Monterey Branch Line right-of-way, from House Plaza in the city of Monterey to Blackie Road in Castroville. This 15.2-mile-long (24.5-kilometer-long) project would involve improvements to existing rail, construction of new rail, and 12 new stops/stations (one in Castroville, five in Marina, three in Seaside and Sand City, and three in the city of Monterey). Approximately 860 new parking spaces would be constructed at these stations. The project would also include a new maintenance facility; this facility would be located at one of three sites under consideration, all of which are near Highway 1 on lands formerly associated with the Fort Ord military base (TAMC 2011). TAMC has placed this project on hold indefinitely until the agency can secure funding for environmental review, design, and construction. | Unknown |
| Fort Ord Dunes State Park (immediately west of the TAMC rail corridor and State Highway 1, west of the former Fort Ord Military Base) | Fort Ord Dunes State Park Campground – Construction and operation of a campground facility and associated infrastructure within Fort Ord Dunes State Park, including 45 RV sites and two host sites, 10 hike/bike sites, and 43 tent sites; parking; restrooms and showers; a multi-purpose building; an outdoor campfire center; interpretation/ viewing areas; renovation of existing bunkers; an entrance station near the 1st Street underpass; modular structures; storage yard and maintenance shop; improved beach access/trails; one plumbed restroom with shower; a 200-foot (60-meter) wildlife/habitat corridor; internal campground trail network, trail improvements, and roadway improvements; and off-site utilities (Denise Duffy & Associates 2013). | Unknown |

afy – acre feet per year
TAMC – Transportation Agency for Monterey County

# 6 Effects Determinations

**Table 6-1 presents a summary of the effects determinations described in Section 5.**

**Table 6-1. Summary of Effects Determinations by Listed Species**

| Listed species/species group | Section 7 Determination | Critical Habitat Determination |
|---|---|---|
| Federally listed plants on federal lands | may affect, and is likely to adversely affect | no effect |
| Federally listed plants on non-federal lands | may affect, and is likely to adversely affect | no effect |
| Smith's blue butterfly | may affect, and is likely to adversely affect | no effect |
| Tidewater goby | may affect, but is not likely to adversely affect | may affect, but is not likely to adversely affect |
| California tiger salamander | may affect, and is likely to adversely affect | no effect |
| California red-legged frog | may affect, and is likely to adversely affect | may affect, and is likely to adversely affect |
| Western snowy plover | may affect, and is likely to adversely affect | no effect |
| Least Bell's vireo | no effect | no effect |
| Southern sea otter | no effect | no effect |

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# Appendix A.
# USFWS Official Species List

# United States Department of the Interior

FISH AND WILDLIFE SERVICE
Ventura Fish and Wildlife Office
2493 PORTOLA ROAD, SUITE B
VENTURA, CA 93003
PHONE: (805)644-1766 FAX: (805)644-3958


Consultation Code: 08EVEN00-2017-SLI-0171 January 18, 2017
Event Code: 08EVEN00-2017-E-00293
Project Name: Monterey Peninsula Water Supply Project

Subject: List of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The enclosed list identifies species listed as threatened and endangered, species proposed for listing as threatened or endangered, designated and proposed critical habitat, and species that are candidates for listing that may occur within the boundary of the area you have indicated using the U.S. Fish and Wildlife Service's (Service) Information Planning and Conservation System (IPaC). The species list fulfills the requirements under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 et seq.). Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the species list should be verified after 90 days. We recommend that verification be completed by visiting the IPaC website at regular intervals during project planning and implementation for updates to species lists following the same process you used to receive the enclosed list. Please include the Consultation Tracking Number in the header of this letter with any correspondence about the species list.

Due to staff shortages and excessive workload, we are unable to provide an official list more specific to your area. Numerous other sources of information are available for you to narrow the list to the habitats and conditions of the site in which you are interested. For example, we recommend conducting a biological site assessment or surveys for plants and animals that could help refine the list.

If a Federal agency is involved in the project, that agency has the responsibility to review its proposed activities and determine whether any listed species may be affected. If the project is a major construction project*, the Federal agency has the responsibility to prepare a biological assessment to make a determination of the effects of the action on the listed species or critical habitat. If the Federal agency determines that a listed species or critical habitat is likely to be adversely affected, it should request, in writing through our office, formal consultation pursuant to section 7 of the Act. Informal consultation may be used to exchange information and resolve conflicts with respect to threatened or endangered species or their critical habitat prior to a written request for formal consultation. During this review process, the Federal agency may engage in planning efforts but may not make any irreversible commitment of resources. Such a commitment could constitute a violation of section 7(d) of the Act.

Federal agencies are required to confer with the Service, pursuant to section 7(a)(4) of the Act, when an agency action is likely to jeopardize the continued existence of any proposed species or result in the destruction or adverse modification of proposed critical habitat (50 CFR 402.10(a)). A request for formal conference must be in writing and should include the same information that would be provided for a request for formal consultation. Conferences can also include discussions between the Service and the Federal agency to identify and resolve potential conflicts between an action and proposed species or proposed critical habitat early in the decision-making process. The Service recommends ways to minimize or avoid adverse effects of the action. These recommendations are advisory because the jeopardy prohibition of section 7(a)(2) of the Act does not apply until the species is listed or the proposed critical habitat is designated. The conference process fulfills the need to inform Federal agencies of possible steps that an agency might take at an early stage to adjust its actions to avoid jeopardizing a proposed species.

When a proposed species or proposed critical habitat may be affected by an action, the lead Federal agency may elect to enter into formal conference with the Service even if the action is not likely to jeopardize or result in the destruction or adverse modification of proposed critical habitat. If the proposed species is listed or the proposed critical habitat is designated after completion of the conference, the Federal agency may ask the Service, in writing, to confirm the conference as a formal consultation. If the Service reviews the proposed action and finds that no significant changes in the action as planned or in the information used during the conference have occurred, the Service will confirm the conference as a formal consultation on the project and no further section 7 consultation will be necessary. Use of the formal conference process in this manner can prevent delays in the event the proposed species is listed or the proposed critical habitat is designated during project development or implementation.

Candidate species are those species presently under review by the Service for consideration for Federal listing. Candidate species should be considered in the planning process because they may become listed or proposed for listing prior to project completion. Preparation of a biological assessment, as described in section 7(c) of the Act, is not required for candidate species. If early evaluation of your project indicates that it is likely to affect a candidate species, you may wish to request technical assistance from this office.

Only listed species receive protection under the Act. However, sensitive species should be considered in the planning process in the event they become listed or proposed for listing prior to project completion. We recommend that you review information in the California Department of Fish and Wildlife's Natural Diversity Data Base. You can contact the California Department of Fish and Wildlife at (916) 324-3812 for information on other sensitive species that may occur in this area.

[*A Biological Assessment is required for construction projects (or other undertakings having similar physical impacts) that are major Federal actions significantly affecting the quality of the human environment as defined in the National Environmental Policy Act (42 U.S.C. 4332(2) (c)). For projects other than major construction activities, the Service suggests that a biological evaluation similar to a Biological Assessment be prepared to determine whether the project may affect listed or proposed species and/or designated or proposed critical habitat. Recommended contents of a Biological Assessment are described at 50 CFR 402.12.]

Attachment

# Official Species List

**Provided by:**

Ventura Fish and Wildlife Office
2493 PORTOLA ROAD, SUITE B
VENTURA, CA 93003
(805) 644-1766

**Consultation Code:** 08EVEN00-2017-SLI-0171
**Event Code:** 08EVEN00-2017-E-00293

**Project Type:** ** OTHER **

**Project Name:** Monterey Peninsula Water Supply Project
**Project Description:** The MPWSP is comprised of the following facilities:
• A seawater intake system, which would have seven subsurface slant wells located at the CEMEX Lapis Plant site. These wells would extend offshore into the submerged lands of MBNMS. A Source Water Pipeline would convey the combined source water from the slant wells to the desalination plant.
• A 6.4 million gallons per day (mgd) desalination plant and attached or auxiliary facilities, including source water receiving tanks; pretreatment, reverse osmosis (RO), and post-treatment systems; chemical feed and storage facilities; brine storage and facilities; and other associated non-process facilities.
• Desalinated water conveyance facilities, including pipelines and treated water storage tanks.
• An expanded aquifer storage and recovery (ASR) system, including two additional injection/extraction wells (ASR-5 and ASR-6 wells) and three parallel pipelines, the ASR Conveyance Pipeline, ASR Pump-to-Waste Pipeline, and ASR Recirculation Pipeline. These expanded pipelines would convey water to and from the new ASR injection/extraction wells and backwash effluent from the wells to an existing settling basin.

**Please Note:** The FWS office may have modified the Project Name and/or Project Description, so it may be different from what was submitted in your previous request. If the Consultation Code matches, the FWS considers this to be the same project. Contact the office in the 'Provided by' section of your previous Official Species list if you have any questions or concerns.

**Project Location Map:**


**Project Coordinates:** The coordinates are too numerous to display here.

**Project Counties:** Monterey, CA

# Endangered Species Act Species List

There are a total of 22 threatened or endangered species on your species list. Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species. Critical habitats listed under the **Has Critical Habitat** column may or may not lie within your project area. See the **Critical habitats within your project area** section further below for critical habitat that lies within your project. Please contact the designated FWS office if you have questions.

| **Amphibians** | **Status** | **Has Critical Habitat** | **Condition(s)** |
|---|---|---|---|
| California red-legged frog *(Rana draytonii)*<br>Population: Wherever found | Threatened | Final designated | |
| California tiger Salamander *(Ambystoma californiense)*<br>Population: U.S.A. (Central CA DPS) | Threatened | Final designated | |
| Santa Cruz Long-Toed salamander *(Ambystoma macrodactylum croceum)*<br>Population: Wherever found | Endangered | | |
| **Birds** | | | |
| California Clapper rail *(Rallus longirostris obsoletus)*<br>Population: Wherever found | Endangered | | |
| California Least tern *(Sterna antillarum browni)*<br>Population: Wherever found | Endangered | | |
| California condor *(Gymnogyps californianus)*<br>Population: U.S.A. only, except where listed | Endangered | Final designated | |

| | | | |
|---|---|---|---|
| as an experimental population | | | |
| Least Bell's vireo *(Vireo bellii pusillus)* Population: Wherever found | Endangered | Final designated | |
| Marbled murrelet *(Brachyramphus marmoratus)* Population: U.S.A. (CA, OR, WA) | Threatened | Final designated | |
| Southwestern Willow flycatcher *(Empidonax traillii extimus)* Population: Wherever found | Endangered | Final designated | |
| western snowy plover *(Charadrius nivosus ssp. nivosus)* Population: Pacific Coast population DPS-U.S.A. (CA, OR, WA), Mexico (within 50 miles of Pacific coast) | Threatened | Final designated | |
| **Crustaceans** | | | |
| Vernal Pool fairy shrimp *(Branchinecta lynchi)* Population: Wherever found | Threatened | Final designated | |
| **Fishes** | | | |
| Tidewater goby *(Eucyclogobius newberryi)* Population: Wherever found | Endangered | Final designated | |
| **Flowering Plants** | | | |
| Clover lupine *(Lupinus tidestromii)* Population: Wherever found | Endangered | | |
| Contra Costa goldfields *(Lasthenia conjugens)* | Endangered | Final designated | |

| | | | |
|---|---|---|---|
| Population: Wherever found | | | |
| Marsh Sandwort *(Arenaria paludicola)*<br>Population: Wherever found | Endangered | | |
| Menzies' wallflower *(Erysimum menziesii)*<br>Population: Wherever found | Endangered | | |
| Monterey gilia *(Gilia tenuiflora ssp. arenaria)*<br>Population: Wherever found | Endangered | | |
| Monterey spineflower *(Chorizanthe pungens var. pungens)*<br>Population: Wherever found | Threatened | Final designated | |
| Santa Cruz tarplant *(Holocarpha macradenia)*<br>Population: Wherever found | Threatened | Final designated | |
| Yadon's piperia *(Piperia yadonii)*<br>Population: Wherever found | Endangered | Final designated | |
| **Insects** | | | |
| Smith's Blue butterfly *(Euphilotes enoptes smithi)*<br>Population: Wherever found | Endangered | | |
| **Mammals** | | | |
| Southern Sea otter *(Enhydra lutris nereis)*<br>Population: Wherever found | Threatened | | |

# Critical habitats that lie within your project area

The following critical habitats lie fully or partially within your project area.

| Amphibians | Critical Habitat Type |
|---|---|
| California red-legged frog *(Rana draytonii)*<br>Population: Wherever found | Final designated |
| **Fishes** | |
| Tidewater goby *(Eucyclogobius newberryi)*<br>Population: Wherever found | Final designated |

# Appendix B.
# Federally Listed Species Potential to Occur Tables

Table B-1. Federally-Listed Plants Evaluated for Potential to Occur

| *Scientific Name* COMMON NAME | Federal Status[1] | State Status[2] | California Rare Plant Rank[3] | Preferred Habitat[4] | Micro Habitat, Elevation | Bloom Period[6] | Potential to Occur Discussion |
|---|---|---|---|---|---|---|---|
| *Arenaria paludicola* MARSH SANDWORT | FE | SE | 1B.1 | Marshes and swamps. | Growing up through dense mats of typha, juncus, scirpus, etc. In freshwater marsh. 33-558 ft. | May - August | None. Marginal habitat is limited within Action Area, but the Action Area falls outside the species' range. The nearest presumed extant population is in San Luis Obispo County. |
| *Astragalus tener* var. *titi* COASTAL DUNES MILK-VETCH | FE | SE | 1B.1 | Coastal bluff scrub, coastal dunes | Moist, sandy depressions of bluffs, prairie, or dunes along and near the pacific ocean; one site on a clay terrace. 3-164 feet | March - May | Low. Appropriate coastal prairie, dune, and terrace habitat occurs throughout the Action Area. Populations occur within 5 miles of the Action Area. |
| *Ceanothus ferrisiae* COYOTE CEANOTHUS | FE | -- | 1B.1 | Chaparral, valley and foothill grassland, coastal scrub. | Serpentine sites in the mt. Hamilton range. 394-1493 ft. | January - May | None. Suitable serpentine habitat not present within Action Area. The nearest record is at least 20 miles from the Action Area. |
| *Chorizanthe pungens* var. *hartwegiana* BEN LOMOND SPINEFLOWER | FE | -- | 1B.1 | Lower montane coniferous forest. | Zayante coarse sands in maritime ponderosa pine sandhills. 394-1542ft. | April - July | None. Suitable habitat not present within Action Area. The nearest record is at least 15 miles from the Action Area. |
| *Chorizanthe pungens* var. *pungens* MONTEREY SPINEFLOWER | FT | -- | 1B.1 | Coastal dunes, chaparral, cismontane woodland, coastal scrub. | Sandy soils in coastal dunes or more inland within chaparral or other habitats. 0-492 ft. | April - June | High/Present. Numerous records of this species were observed and mapped throughout the Action Area. |
| *Chorizanthe robusta* var. *hartwegii* SCOTTS VALLEY SPINEFLOWER | FE | -- | 1B.1 | Meadows, valley and foothill grassland. | In grasslands with mudstone and sandstone outcrops. 755-804 ft. | April - June | None. Although one collection of this plant was made within a 5 mile radius of the Action Area (CCH 2016), it is in a different habitat than and highly disjunct from all other known occurrences. The Monterey record is not included in CNDDB and is presumed to be a misidentification. |

| *Scientific Name* COMMON NAME | Federal Status[1] | State Status[2] | California Rare Plant Rank[3] | Preferred Habitat[4] | Micro Habitat, Elevation | Bloom Period[6] | Potential to Occur Discussion |
|---|---|---|---|---|---|---|---|
| *Chorizanthe robusta* var. *robusta* ROBUST SPINEFLOWER | FE | -- | 1B.1 | Cismontane woodland, coastal dunes, coastal scrub. | Sandy terraces and bluffs or in loose sand. 10-394 ft. | May - June | Low. Suitable habitat is present within Action Area. At least four presumed extant occurrences are found within 5 miles of the Action Area, including one adjacent to it in Fort Ord Dunes State Park. |
| *Erysimum menziesii* MENZIES' WALLFLOWER | FE | SE | 1B.1 | Coastal dunes. | Localized on dunes and coastal strand. 0-115 ft. | March - April | Moderate. Suitable habitat is present within Action Area, and populations were observed near the Action Area at Marina State Beach. |
| *Erysimum teretifolium* BEN LOMOND WALLFLOWER | FE | SE | 1B.1 | Lower montane coniferous forest, chaparral. | Inland marine sands (zayante coarse sand). 394-2001 ft. | January - August | Moderate. Appropriate habitat is present within the Action Area, and populations are reported from Marina State Beach and Fort Ord National Monument, adjacent to the Action Area. Monterey County occurrences are not recognized in The Jepson Manual, 2nd Ed., CNPS Inventory and CNDDB. |
| *Gilia tenuiflora* ssp. *Arenaria* MONTEREY GILIA | FE | ST | 1B.2 | Coastal dunes, coastal scrub, chaparral (maritime), cismontane woodland. | Bare, wind-sheltered areas often near dune summit or in the hind dunes; 2 records from pleistocene inland dunes. 0-148 ft. | April - June | High/Present. Small populations were recorded along the existing pipeline. Appropriate habitat is present within the Action Area, and populations are reported within the terminal basin section of the Fort Ord Reuse Area. |
| *Hesperocyparis abramsiana* var. *abramsiana* SANTA CRUZ CYPRESS | FE | SE | 1B.2 | Chaparral, closed-cone coniferous forest, lower montane coniferous forest. | Restricted to the Santa Cruz mountains, on sandstone & granitic-derived soils; often w/p. Attenuata, redwoods. 919-2625 ft. | NA | None. Very little suitable habitat is present, and the Action Area is well outside of the species' range. |
| *Hesperocyparis goveniana* GOWEN CYPRESS | FT | -- | 1B.2 | Closed-cone coniferous forest, chaparral. | Coastal terraces; usually in sandy soils; sometimes with Monterey pine, bishop pine. 98-984 ft. | NA | Low. Very little suitable habitat is present, but the Action Area is within 2 miles of the species' range. |

| *Scientific Name* COMMON NAME | Federal Status[1] | State Status[2] | California Rare Plant Rank[3] | Preferred Habitat[4] | Micro Habitat, Elevation | Bloom Period[6] | Potential to Occur |
|---|---|---|---|---|---|---|---|
| | | | | | | | Discussion |
| *Holocarpha macradenia* SANTA CRUZ TARPLANT | FT | SE | 1B.1 | Coastal prairie, coastal scrub, valley and foothill grassland. | Light, sandy soil or sandy clay; often with nonnatives. 33-722 ft. | June - October | Low. Suitable sandy soils and habitat are present within Action Area. Records indicate that the species occurs near the Elkhorn Slough, within 7 miles of the Action Area. |
| *Lasthenia conjugens* CONTRA COSTA GOLDFIELDS | FE | -- | 1B.1 | Valley and foothill grassland, vernal pools, alkaline playas, cismontane woodland. | Vernal pools, swales, low depressions, in open grassy areas. 3-1542 ft. | March - June | None. Although populations are reported within a mile of the Action Area, appropriate vernal pool habitat is not present within the Action Area. |
| *Layia carnosa* BEACH LAYIA | FE | SE | 1B.1 | Coastal dunes, coastal scrub. | On sparsely vegetated, semi-stabilized dunes, usually behind foredunes. 0-197 ft. | March – July | Low. Suitable habitat is present throughout the Action Area, and populations are reported within a mile of the Action Area at Monterey State Beach, the town of Monterey, and Pacific Grove. |
| *Lupinus tidestromii* CLOVER LUPINE | FE | SE | 1B.1 | Coastal dunes. | Partially stabilized dunes, immediately near the ocean. 0-328 ft. | April - June | Low. Suitable habitat is present within the Action Area, and populations are reported within 2 miles of the Action Area at Monterey State Beach, Asilomar, and the 17-Mile Drive. |
| *Pentachaeta bellidiflora* WHITE-RAYED PENTACHAETA | FE | SE | 1B.1 | Valley and foothill grassland, cismontane woodland. | Open dry rocky slopes and grassy areas, often on soils derived from serpentine bedrock. 115-2034 ft. | March - May | None. Marginal habitat is present within the Action Area, falls outside of the species' range. The nearest extant record is reported roughly 50 miles north. |
| *Piperia yadonii* YADON'S PIPERIA | FE | -- | 1B.1 | Closed-cone coniferous forest, chaparral, coastal bluff scrub. | On sandstone and sandy soil, but poorly drained and often dry. 33-1673 ft. | May - August | Moderate. Suitable habitat is present within the Action Area. Numerous reports of the species are recorded within a 5 mile radius. |
| *Polygonum hickmanii* SCOTTS VALLEY POLYGONUM | FE | SE | 1B.1 | Valley and foothill grassland. | Purisima sandstone or mudstone with a thin soil layer, vernally moist due to runoff. 689-820 ft. | April - August | None. Suitable habitat is not present within the Action Area. The species is restricted to habitats on the south flanks of the Western Transverse Ranges and the Santa Catalina Island with a maritime influence. |

| *Scientific Name* COMMON NAME | Federal Status[1] | State Status[2] | California Rare Plant Rank[3] | Preferred Habitat[4] | Micro Habitat, Elevation | Bloom Period[6] | Potential to Occur Discussion |
|---|---|---|---|---|---|---|---|
| *Potentilla hickmanii* HICKMAN'S CINQUEFOIL | FE | SE | 1B.1 | Coastal bluff scrub, closed-cone coniferous forest, meadows and seeps, marshes and swamps. | Freshwater marshes, seeps, and small streams in open or forested areas along the coast. 33-492 ft. | April - August | Low. One or two extant populations adjacent to the Action Area, within Monterey and Pacific Grove; marginal habitat is present within the Action Area. Nearby occurrences were not found in the specialized microhabitat listed in the CNDDB. |
| *Trifolium trichocalyx* MONTEREY CLOVER | FE | SE | 1B.1 | Closed-cone coniferous forest. | Poorly drained, low nutrient soil underlain with hardpan; also openings and burned areas. 98-787 ft. | April - June | Low. Marginal habitat is present within the Action Area, which lies within 2 miles of known occurrences. |

[1] Federal Status
FE: Listed as endangered under the Endangered Species Act
FT: Listed as threatened under the Endangered Species Act

[2] State Status
SE: Listed as endangered under the California Endangered Species Act
ST: Listed as threatened under the California Endangered Species Act

[3] California Rare Plant Rank, formerly California Native Plant Society List
1B: Rare, threatened, or endangered in California and elsewhere

[4] General and micro habitat information primarily drawn from CNDDB database: California Natural Diversity Database (CNDDB). 2016 RareFind 5 [Internet]. California Department of Fish and Wildlife [October 25, 2016].

[6] Bloom period data from CNPS and The Jepson Manual.

[7] CCH = Consortium of California Herbaria: Data provided by the participants of the Consortium of California Herbaria (ucjeps.berkeley.edu/consortium/)

*Table B-2. Federally-Listed Animals Evaluated for Potential to Occur*

| *Scientific Name* COMMON NAME | Federal Status[1,2] | State Status[3] | Preferred Habitat | Potential to Occur |
|---|---|---|---|---|
| Invertebrates | | | | |
| *Brachinecta conservation*<br>CONSERVANCY FAIRY SHRIMP | FE | -- | Inhabits large, turbid, clay-bottomed vernal pools often formed by braided alluvium. Also found in winter lakes associated with grasslands. | None. No suitable vernal pool habitat is present within the Action Area. |
| *Branchinecta lynchi*<br>VERNAL POOL FAIRY SHRIMP | FT | -- | Found in vernal pools, particularly small, clear-water sandstone depression pools and grassy swale, earth slump, or basalt-flow depression pools. | None. No suitable vernal pool habitat is present within the Action Area. |
| *Cicindela ohlone*<br>OHLONE TIGER BEETLE | FE | -- | Endemic to Santa Cruz County California. Require clay soils within native grasslands of the rare coastal terrace prairie. | None. The Action Area falls outside the limited range of the Ohlone tiger beetle and no suitable habitat is present. |
| *Desmocerus californicus dimorphus*<br>VALLEY ELDERBERRY LONGHORN BEETLE | FT | -- | Blue elderberry shrubs (*Sambucus mexicana*.) with stem diameters of 2 to 8 inches. Species always found close to host plant. Larvae may remain in stems for up to 2 years. | None. Although the host plant of the Valley elderberry longhorn beetle is present in very small numbers within the Action Area, the Action Area falls outside of the species' range. |
| *Euphilotes enoptes smithi*<br>SMITH'S BLUE BUTTERFLY | FE | -- | Along the coast from Monterey Bay south through Big Sur to near Point Gorda, occurring in scattered populations in association with coastal dune, coastal scrub, chaparral, and grassland habitats. They spend their entire lives in association with buckwheat plants. | High. The Smith's blue butterfly is likely within the Action Area. Numerous records fall adjacent to, within, and appropriate habitat and host plants are also numerous within the Action Area. |
| *Euphydryas editha bayensis*<br>BAY CHECKERSPOT BUTTERFLY | FT | -- | Female lay eggs on a native plantain (*Plantago erecta*). Populations inhabit areas around San Francisco Bay and peninsula and mountains near San Jose. In Santa Clara County, most habitat is owned by a landfill corporation. | None. Although suitable habitat is present within the Action Area, it lies well outside the range of the Bay checkerspot butterfly. |
| *Polyphylla barbata*<br>MOUNT HERMON (=BARBATE) JUNE BEETLE | FE | -- | Sand parkland and sandhills manzanita scrub within chaparral and ponderosa pine forest; most often found in sparsely vegetated areas. Often associated with silver-leaf manzanita (*Arctostaphylos silvicola*). Known only in vicinity of Mt. Hermon. | None. Although suitable habitat is present within the Action Area, it lies well outside the range of the Mount Hermon June beetle. |

| *Scientific Name* COMMON NAME | Federal Status[1,2] | State Status[3] | Preferred Habitat | Potential to Occur |
|---|---|---|---|---|
| *Lepidurus packardi* VERNAL POOL TADPOLE SHRIMP | FE | -- | Endemic to the northern Central Valley though may be found in high local abundance elsewhere. Most commonly located in grass bottomed swales of unplowed grasslands in old alluvial soils underlain by hardpan, or in mud-bottomed pools containing highly turbid water. | None. No suitable vernal pool habitat is present within the Action Area. |
| *Trimerotropis infantilis* ZAYANTE BAND-WINGED GRASSHOPPER | FE | -- | Found in sandy substrate sparsely covered with Lotus and grasses at the base of pines. This species co-occur with Ben Lomond wallflower. | None. The Zayante band-winged grasshopper is endemic to the Zayante Sand Hills in Santa Cruz County, well outside of the Action Area. |
| Fish | | | | |
| *Eucyclogobius newberryi* TIDEWATER GOBY | FE | -- | California's coastal estuaries and enclosed lagoons near the mouths of coastal streams, and can also be found in brackish waters of adjoining marshes and streams. | High/Present. Fifty-eight individuals were captured between the mouth of the Salinas River and Highway 1 in 2014, with many occurrences within the Action Area (Hagar Environmental Science 2015). |
| *Spirinchus thaleichthys* LONGFIN SMELT | FC | ST | Anadromous estuarine species occupying the middle or bottom of water column in salinities between 15-30 ppt. | None. Closest known occurrence to the Action Area is in the San Francisco Estuary. |
| *Hypomesus transpacificus* DELTA SMELT | FT | ST | Euryhaline fish that rear in shallow open waters of the estuary. Mostly found in salinity ranges of 2-7 ppt. Rears in or just above the region of the estuary where freshwater and brackishwater mix. | None. Endemic to the upper San Francisco Estuary, particularly the Delta and Suisun Bay. |
| Amphibians | | | | |
| *Ambystoma californiense* CALIFORNIA TIGER SALAMANDER | FT | ST | Annual grasslands and grassy understory of valley-foothill hardwood habitats (i.e., oak-savannah). Require vernal pools or other seasonal water sources for breeding. Require mammal burrows or other underground refuges. | Moderate. Numerous records are reported within 5 miles of the Action Area, most often on Ford Ord; however, records near Moss Landing, Laguna Seca Raceway, Moro Cojo Slough, the city of Seaside suggest that the species may occur in or near the Action Area. Suitable grassland habitat and mammal burrows are present within the Action Area; suitable breeding habitat is not. |

| *Scientific Name* COMMON NAME | Federal Status[1,2] | State Status[3] | Preferred Habitat | Potential to Occur |
|---|---|---|---|---|
| *Ambystoma macrodactylum croceum* SANTA CRUZ LONG-TOED SALAMANDER | FE | SE | Dense riparian vegetation (willows, thick coastal scrub, oak woodland). Endemic to California. Inhabit limited range around coast of Monterey Bay in southern Santa Cruz County and northern edge of Monterey County. | Low. Suitable habitat occurs within the action area. The Action Area lies within a mile of the southernmost known metapopulation for this species. |
| *Anaxyrus californicus* ARROYO TOAD | FE | SSC | Rivers with exposed sandy banks and stable terraces for burrowing. Also found with mixed riparian vegetation including willows, cottonwoods, and sycamores. Prefers calm, shallow, gravelly pools for breeding. | None. The Action Area lies nearly 40 miles north of its closest known occurrence: Fort Hunter Liggett. |
| *Rana draytonii* (*Rana aurora* draytonii) CALIFORNIA RED-LEGGED FROG | FT | SSC | Pools in marshes; streams; ponds with emergent vegetation, and typically without predatory fish; require adequate hibernacula, such as small mammal burrows or moist leaf litter. | High. Numerous records of California red-legged frog are reported within 5 miles of the Action Area and appropriate upland and breeding habitat occurs. |
| Reptiles | | | | |
| *Gambelia (=Crotaphytus) sila* BLUNT-NOSED LEOPARD LIZARD | FE | -- | Resident of sparsely vegetated alkali and desert scrub habitats, in areas of low topographic relief. Seek cover in mammal burrows, under shrubs or structures such as fence posts; they do not excavate their own burrows. | None. The Action Area falls outside the range of the blunt-nosed leopard lizard. |
| *Thamnophis sirtalis tetrataenia* SAN FRANCISCO GARTER SNAKE | FE | -- | Freshwater marshes and low-gradient streams. Prefers habitat with dense emergent vegetation, deep and shallow pools of water (which persist throughout the seasonal cycle of activity), open areas along water margins, and upland habitat with access to structures suitable for hibernation and escape from flooding. | None. The Action Area falls over 20 miles south of the species' known range. |
| Birds | | | | |
| *Charadrius alexandrinus nivosus* WESTERN SNOWY PLOVER | FT | -- | Occurs year round in California range. Inhabits beaches, dry mud or salt flats, sandy shores of rivers, lakes, and ponds. Nests primarily on coastal beaches. Breeds in loose colonies. | High/Present. Breeding western snowy plovers are known to occur on the Cemex Property. They were observed during surveys conducted by Point Blue, and by AECOM biologists in 2016. |

| *Scientific Name* COMMON NAME | Federal Status[1,2] | State Status[3] | Preferred Habitat | Potential to Occur |
|---|---|---|---|---|
| *Coccyzus americanus occidentalis* WESTERN YELLOW-BILLED CUCKOO | C(T) | SE | Riparian forest along the broad, lower flood-bottoms of larger river systems. Nests in riparian jungles of willow and cottonwood with blackberry, nettles, and wild grape understory. | Low. Although the nearest CNDDB record for this species is 20 miles from the Action Area, numerous eBird records exist nearby, indicating the potential for the species to occur. Suitable habitat is present along the Salinas River. |
| *Rallus obsoletus obsoletus* CALIFORNIA RIDGWAY'S RAIL | FE | SE | Occurs within a range of salt and brackish marshes. They inhabit salt marshes dominated by pickleweed and Pacific cordgrass throughout the south and central Bay. | None. The Action Area falls within the species' historic range, but records of the Ridgway's rail have not been reported since 1980. |
| *Brachyramphus marmoratus* MARBLED MURRELET | FT | SE | Nest in forested habitats—typically old growth—within 50 miles of the coast. Forage near shore. | None. Although appropriate habitat is present adjacent to the Action Area, the Action Area does not cross any old growth forests. The underwater intake/brine discharge are unlikely to occur within the foraging area of this species. |
| *Empidonax traillii extimus* SOUTHWESTERN WILLOW FLYCATCHER | FE | SE | Occurs in riparian woodlands in southern California. | None. Species occurs in southern California, northernmost coastal CNDDB occurrence is in Santa Barbara. |
| *Gymnogyps californianus* CALIFORNIA CONDOR | FE | SE / FP | Nests in caves, crevices, behind rock slabs, or on large ledges on high sandstone cliffs. Forages in grasslands, oak savannahs, and along the coast or large rivers. | Low. No breeding habitat is present within the Action Area, but minimal foraging habitat is present throughout. Records have been reported as nearby as 5 miles south of the Action Area. |
| *Pelecanus occidentalis californicus* CALIFORNIA BROWN PELICAN | FE | Delisted / FP | Estuarine, marine subtidal, and marine pelagic waters along the California coast. Nests on coastal islands lacking ground predators; roost on piers, buoys, and other structures on water bodies near the coast. | Low. No breeding habitat is present within the Action Area, but minimal foraging habitat is present at Tembladero Slough and the Old Salinas River. The species was observed flying overhead throughout the Action Area. |
| *Phoebastria albatrus* SHORT-TAILED ALBATROSS | FE | SSC | Rare California coastal visitor that breeds on islands off of southern Japan. | Low. The intake and brine discharge may occur within suitable ocean habitats. |
| *Sterna antillarum browni* CALIFORNIA LEAST TERN | FE | SE / FP | Migratory in California; breeding colonies are found in southern California along marine and estuarine shores, and in San Francisco Bay; feeds in shallow, estuarine waters or lagoons on small fish. | Low. Minimal breeding and foraging habitat is present in Action Area. Closest breeding colony was a nesting location near the Old Salinas River, but this has been absent since the 1950s. |

| *Scientific Name* COMMON NAME | Federal Status[1,2] | State Status[3] | Preferred Habitat | Potential to Occur |
|---|---|---|---|---|
| *Vireo bellii pusillus* LEAST BELL'S VIREO | FE | SE | Summers within California range. Inhabits structurally diverse dense riparian woodlands/shrubs along water courses or near open water. Nests in shrub or low tree, usually 1 meter above ground near edge of thicket. Obligate riparian species during breeding season. | Moderate. The Action Area lies within the subspecies range, and appropriate habitat is present along the Salinas River. Records occur within 10 miles of the Action Area in Watsonville and at Andrew Molera State Park. |
| Mammals | | | | |
| *Dipodomys ingens* GIANT KANGAROO RAT | FE | -- | Prefers annual grassland on gentle slopes (10 degrees) with friable, sandy-loam soils. Prefers open habitat areas with almost no shrub cover. | None. The Action Area falls well outside of the giant kangaroo rat's range. The nearest populations are over 50 miles south. |
| *Enhydra lutris nereis* SOUTHERN SEA OTTER | FT | -- | Sea otters population is found from Half Moon Bay to Morro Bay. They inhabit shallow coastal areas and prefer places with kelp. | Low/Transitory. The species may be present in the marine portion of the Action Area. There is a low potential for the species to haul out at the Cemex property. |
| *Vulpes macrotis mutica* SAN JOAQUIN KIT FOX | FE | -- | Occurs in the San Joaquin Valley in annual grassland or grassy open stages with scattered shrubby vegetation; requires loose-textured sandy soils for burrowing; requires suitable prey base of small rodents, including kangaroo rats or California ground squirrels. | None. Although appropriate habitat is present adjacent to the Action Area, the Action Area lies outside of the species' range. The nearest records are over 20 miles east. |

Notes:

[1] Federal Status
FE – Endangered
FT – Threatened

[2]No critical habitat occurs within a 10-mile radius of the project footprint.

[3]State Status
SE – Endangered
ST – Threatened
SSC – California Species of Special Concern designated by the California Department of Fish and Game.
FP – Fully Protected species designated by the California Department of Fish and Game.

Citations

Hagar Environmental Science. 2015. Salinas River Lagoon Monitoring Report 2014. Prepared for Monterey County Water Resources Agency. Prepared by Hagar Environmental Science and Monterey County Water Resources Agency. June 22.

# Appendix C.
# Wildlife Observed during Field Surveys

| CWHR Habitat Type/Land Use Type | Common Name | Scientific Name |
|---|---|---|
| **Tree-Dominated Habitats** | | |
| Coastal Oak Woodland | Santa Lucia Mountains slender salamander | *Batrachoseps luciae* |
| | western fence lizard | *Sceloporus occidentalis* |
| | California quail | *Callipepla californica* |
| | mourning dove | *Zenaida macroura* |
| | great horned owl | *Bubo virginianus* |
| | Anna's hummingbird | *Calypte ana* |
| | downy woodpecker | *Picoides pubescens* |
| | Nuttall's woodpecker | *Picoides nuttallii* |
| | northern flicker | *Colaptes auratus* |
| | California scrub-jay | *Aphelocoma californica* |
| | oak titmouse | *Baelophus inornatus* |
| | red-breasted nuthatch | *Sitta canadensis* |
| | white-breasted nuthatch | *Sitta carolinensis* |
| | pygmy nuthatch | *Sitta pygmaea* |
| | ruby-crowned kinglet | *Regalus calendula* |
| | western bluebird | *Sialia mexicana* |
| | yellow-rumped warbler | *Dendroica coronata* |
| | Wilson's warbler | *Wilsonia pusilla* |
| | black-headed grosbeak | *Pheucticus melanocephalus* |
| | California towhee | *Melozone crissalis* |
| | lesser goldfinch | *Spinus psaltria* |
| | northern raccoon | *Procyon lotor* |
| | mule deer | *Odocoileus hemionus* |
| | fox squirrel | *Sciurus niger* |
| | California ground squirrel | *Ammospermophilus beecheyi* |
| | yellow warbler | *Setophaga petechial* |
| Closed-Cone Pine-Cypress | red-tailed hawk | *Buteo jamaicensis* |
| | red-shouldered hawk | *Buteo lineatus* |
| | common raven | *Corvus corax* |
| | American crow | *Corvus brachyrynchos* |
| | mule deer | *Odocoileus hemionus* |
| Eucalyptus | common raven | *Corvus corax* |
| | American crow | *Corvus brachyrynchos* |
| | Anna's hummingbird | *Calypte ana* |
| | red-tailed hawk | *Buteo jamaicensis* |
| | great horned owl | *Bubo virginianus* |
| | European starling | *Sturnus neglecta* |
| Montane Hardwood Forest | California scrub-jay | *Aphelocoma californica* |
| | dark-eyed junco | *Junco hyemalis* |

| CWHR Habitat Type/Land Use Type | Common Name | Scientific Name |
|---|---|---|
| Valley Foothill Riparian | Sierran treefrog | *Pseudacris sierrae* |
| | western pond turtle | *Actinemys [=Clemmys/Emys] marmorata* |
| | double-crested cormorant | *Phalacorcorax auritus* |
| | mourning dove | *Zenaida macroura* |
| | band-tailed pigeon | *Patagioenas fasciata* |
| | great horned owl | *Bubo virginianus* |
| | Nuttall’s woodpecker | *Picoides nuttallii* |
| | black phoebe | *Sayornis nigricans* |
| | northern rough-winged swallow | *Stelgidopteryx serripennis* |
| | bank swallow | *Riparia riparia* |
| | violet-green swallow | *Tachycinecta thalassina* |
| | tree swallow | *Tachycinecta bicolor* |
| | cliff swallow | *Petrochelidon pyrrhonota* |
| | barn swallow | *Hirundo rustica* |
| | ruby-crowned kinglet | *Regalus calendula* |
| | Swainson’s thrush | *Catharus ustulatus* |
| | orange-crowned warbler | *Vermivora celata* |
| | song sparrow | *Melospiza melodia* |
| | red-winged blackbird | *Agelaius phoeniceus* |
| | yellow warbler | *Setophaga petechial* |
| | brush rabbit | *Sylvilagus bachmani* |
| | northern raccoon | *Procyon lotor* |
| ***Shrub-Dominated Habitats*** | | |
| Unknown Shrub Type | white-crowned sparrow | *Zonotrichia leucophrys* |
| Chamise-Redshank Chaparral | western fence lizard | *Sceloporus occidentalis* |
| | tiger whiptail | *Aspidoscelis tigris* |
| | side-blotched lizard | *Uta stansburiana* |
| | western skink | *Plestiodon skiltonius* |
| | southern alligator lizard | *Elgaria multicarinata* |
| | coast horned lizard | *Phrynosoma blainvillii* |
| | gopher snake | *Pituophis catenifer* |
| | northern pacific rattlesnake | *Crotalus oreganus oreganus* |
| | chaparral whipsnake | *Masticophis laterallus* |
| | California quail | *Callipepla californica* |
| | greater roadrunner | *Geococcyx californica* |
| | common poorwill | *Phalaenoptilus nuttallii* |
| | white-throated swift | *Aeronautes saxatilis* |
| | Anna’s hummingbird | *Calypte ana* |
| | rufous hummingbird | *Selasphorus rufus* |
| | northern flicker | *Colaptes auratus* |
| | ash-throated flycatcher | *Myiarchus cinerascens* |

| CWHR Habitat Type/Land Use Type | Common Name | Scientific Name |
|---|---|---|
| | California scrub-jay | *Aphelocoma californica* |
| | bushtit | *Psaltriparus minimus* |
| | Bewick's wren | *Thryomanes bewickii* |
| | wrentit | *Chamaea fasciata* |
| | western bluebird | *Sialia mexicana* |
| | hermit thrush | *Catharus guttatus* |
| | northern mockingbird | *Mimus polyglottos* |
| | California thasher | *Toxistoma redivivum* |
| | orange-crowned warbler | *Vermivora celata* |
| | spotted towhee | *Pipilo maculatus* |
| | California towhee | *Melozone crissalis* |
| | Bell's sparrow | *Artemisiospiza belli* |
| | golden-crowned sparrow | *Zonotrichia atricapilla* |
| | white-crowned sparrow | *Zonotrichia leucophrys* |
| | song sparrow | *Melospiza melodia* |
| | dark-eyed junco | *Junco hyemalis* |
| | house finch | *Carpadocus mexicanus* |
| | lesser goldfinch | *Spinus psaltria* |
| | Lawrence's goldfinch | *Spinus lawrencei* |
| | brush rabbit | *Sylvilagus bachmani* |
| | desert cottontail | *Sylvilagus audubonii* |
| | black-tailed jackrabbit | *Lepus californicus* |
| | California ground squirrel | *Ammospermophilus beecheyi* |
| | Merriam's chipmunk | *Tamias merriami* |
| | kangaroo rat | *Dipodomys sp.* |
| | Monterey dusky-footed woodrat | *Neotoma fuscipes luciana* |
| | coyote | *Canis latrans* |
| | gray fox | *Urocyon cineoargenteus* |
| | bobcat | *Lynx rufus* |
| | mountain lion (sign observed) | *Puma concolor* |
| | mule deer | *Odocoileus hemionus* |
| Coastal Scrub | Smith's blue butterfly (host plants observed) | *Euphilotes enoptes smithi* |
| | coastal green hairstreak | *Callophyrys dumetorum* |
| | Acmon blue | *Icaricia acmon* |
| | gray hairstreak | *Strymon melinus* |
| | dune snail | *Helminthoglypta sp.* |
| | coast gartersnake | *Thamnophis elegans terrestris* |
| | California kingsnake | *Lampropeltis californiae* |
| | southern alligator lizard | *Elgaria multicarinata* |
| | western fence lizard | *Sceloporus occidentalis* |
| | side-blotched lizard | *Uta stansburiana* |

| CWHR Habitat Type/Land Use Type | Common Name | Scientific Name |
|---|---|---|
| | western snowy plover | *Charadrius nivosus* |
| | red-tailed hawk | *Buteo jamaicensis* |
| | sharp-shinned hawk | *Accipiter striatus* |
| | American kestrel | *Falco spaverius* |
| | California quail | *Callipepla californica* |
| | mourning dove | *Zenaida macroura* |
| | Anna's hummingbird | *Calypte ana* |
| | Allen's hummingbird | *Selasphorus alleni* |
| | black phoebe | *Sayornis nigricans* |
| | ash-throated flycatcher | *Myiarchus cinerascens* |
| | western kingbird | *Tyrannus verticalis* |
| | California scrub-jay | *Aphelocoma californica* |
| | common raven | *Corvus corax* |
| | American crow | *Corvus brachyrynchos* |
| | oak titmouse | *Baelophus inornatus* |
| | horned lark | *Eremophila alpestris* |
| | bushtit | *Psaltriparus minimus* |
| | house wren | *Troglodytes aedon* |
| | Bewick's wren | *Thryomanes bewickii* |
| | ruby-crowned kinglet | *Regalus calendula* |
| | western bluebird | *Sialia mexicana* |
| | California thrasher | *Toxostoma redivivum* |
| | orange-crowned warbler | *Vermivora celata* |
| | Townsend's warbler | *Denroica townsendi* |
| | Wilson's warbler | *Wilsonia pusilla* |
| | spotted towhee | *Pipilo maculatus* |
| | California towhee | *Melozone crissalis* |
| | rufous-crowned sparrow | *Aimophila ruficeps* |
| | golden-crowned sparrow | *Zonotrichia atricapilla* |
| | white-crowned sparrow | *Zonotrichia leucophrys* |
| | song sparrow | *Melospiza melodia* |
| | dark-eyed junco | *Junco hyemalis* |
| | lesser goldfinch | *Spinus psaltria* |
| | American goldfinch | *Carduelis tristis* |
| | black-tailed jackrabbit | *Lepus californicus* |
| | desert cottontail | *Sylvilagus audubonii* |
| | brush rabbit | *Sylvilagus bachmani* |
| | California ground squirrel | *Ammospermophilus beecheyi* |
| | California vole | *Microtus californicus* |
| | American badger (burrows observed) | *Taxidea taxus* |
| | mule deer | *Odocoileus hemionus* |

| CWHR Habitat Type/Land Use Type | Common Name | Scientific Name |
|---|---|---|
| Mixed Chaparral | Smith’s blue butterfly (host plants observed) | *Euphilotes enoptes smithi* |
| | western fence lizard | *Sceloporus occidentalis* |
| | tiger whiptail | *Aspidoscelis tigris* |
| | side-blotched lizard | *Uta stansburiana* |
| | western skink | *Plestiodon skiltonius* |
| | southern alligator lizard | *Elgaria multicarinata* |
| | coast horned lizard | *Phrynosoma blainvillii* |
| | gopher snake | *Pituophis catenifer* |
| | northern pacific rattlesnake | *Crotalus oreganus oreganus* |
| | chaparral whipsnake | *Masticophis laterallus* |
| | California quail | *Callipepla californica* |
| | greater roadrunner | *Geococcyx californica* |
| | common poorwill | *Phalaenoptilus nuttallii* |
| | white-throated swift | *Aeronautes saxatilis* |
| | Anna’s hummingbird | *Calypte ana* |
| | rufous hummingbird | *Selasphorus rufus* |
| | northern flicker | *Colaptes auratus* |
| | ash-throated flycatcher | *Myiarchus cinerascens* |
| | California scrub-jay | *Aphelocoma californica* |
| | bushtit | *Psaltriparus minimus* |
| | Bewick’s wren | *Thryomanes bewickii* |
| | wrentit | *Chamaea fasciata* |
| | western bluebird | *Sialia mexicana* |
| | hermit thrush | *Catharus guttatus* |
| | northern mockingbird | *Mimus polyglottos* |
| | California thasher | *Toxistoma redivivum* |
| | orange-crowned warbler | *Vermivora celata* |
| | spotted towhee | *Pipilo maculatus* |
| | California towhee | *Melozone crissalis* |
| | Bell’s sparrow | *Artemisiospiza belli* |
| | gold-crowned sparrow | *Zonotrichia atricapilla* |
| | white-crowned sparrow | *Zonotrichia leucophrys* |
| | song sparrow | *Melospiza melodia* |
| | dark-eyed junco | *Junco hyemalis* |
| | house finch | *Carpadocus mexicanus* |
| | lesser goldfinch | *Spinus psaltria* |
| | Lawrence’s goldfinch | *Spinus lawrencei* |
| | brush rabbit | *Sylvilagus bachmani* |
| | desert cottontail | *Sylvilagus audubonii* |
| | black-tailed jackrabbit | *Lepus californicus* |
| | California ground squirrel | *Ammospermophilus beecheyi* |

| CWHR Habitat Type/Land Use Type | Common Name | Scientific Name |
|---|---|---|
| | Merriam’s chipmunk | *Tamias merriami* |
| | kangaroo rat | *Dipodomys sp.* |
| | Monterey dusky-footed woodrat | *Neotoma fuscipes luciana* |
| | American badger (burrows observed) | *Taxidea taxus* |
| | coyote | *Canis latrans* |
| | gray fox | *Urocyon cineoargenteus* |
| | bobcat | *Lynx rufus* |
| | mountain lion (sign observed) | *Puma concolor* |
| | mule deer | *Odocoileus hemionus* |
| *Herbaceous-Dominated Habitats* | | |
| Annual Grassland | coast gartersnake | *Thamnophis elegans terrestris* |
| | California kingsnake | *Lampropeltis californiae* |
| | western fence lizard | *Sceloporus occidentalis* |
| | red-tailed hawk | *Buteo jamaicensis* |
| | ferruginous hawk | *Buteo regalis* |
| | American kestrel | *Falco spaverius* |
| | killdeer | *Charadrius vociferus* |
| | barn owl | *Tyto alba* |
| | Anna’s hummingbird | *Calypte ana* |
| | Allen’s hummingbird | *Selasphorus alleni* |
| | black phoebe | *Sayornis nigricans* |
| | Say’s phoebe | *Sayornis say* |
| | western kingbird | *Tyrannus verticalis* |
| | common raven | *Corvus corax* |
| | American crow | *Corvus brachyrynchos* |
| | barn swallow | *Hirundo rustica* |
| | savannah sparrow | *Passerculus sandwichensis* |
| | golden-crowned sparrow | *Zonotrichia atricapilla* |
| | horned lark | *Eremophila alpestris* |
| | western meadowlark | *Sturnella neglecta* |
| | brown-headed cowbird | *Moluthrus ater* |
| | red-winged blackbird | *Agelaius phoeniceus* |
| | Brewer’s blackbird | *Euphagus cyanocephalus* |
| | house finch | *Carpadocus mexicanus* |
| | lesser goldfinch | *Spinus psaltria* |
| | Lawrence’s goldfinch | *Spinus lawrencei* |
| | American goldfinch | *Carduelis tristis* |
| | black-tailed jackrabbit | *Lepus californicus* |
| | California ground squirrel | *Ammospermophilus beecheyi* |
| | Botta’s pocket gopher | *Thomomys bottae* |
| | California vole | *Microtus californicus* |

| **CWHR Habitat Type/Land Use Type** | **Common Name** | **Scientific Name** |
|---|---|---|
| | coyote | *Canis latrans* |
| Freshwater Emergent Wetland | signal crayfish | *Pacifastacus leniusculus* |
| | mosquitofish | *Gambusia affinis* |
| | western pond turtle | *Actinemys [=Clemmys/Emys] marmorata* |
| | Sierran treefrog | *Pseudacris sierrae* |
| | American bullfrog | *Lithobates catesbianus* |
| | pied-billed grebe | *Podilymbus podiceps* |
| | American white pelican (non-nesting) | *Pelecanus erythrorhynchos* |
| | double-crested cormorant | *Phalacorcorax auritus* |
| | gulls | *Larus spp.* |
| | great blue heron | *Ardea herodias* |
| | great egret | *Ardea albus* |
| | snowy egret | *Egretta thula* |
| | green heron | *Butoroides virescens* |
| | black-crowned night heron | *Nycticorx nycticorax* |
| | Canada goose | *Branta canadensis* |
| | mallard | *Anas platyrhynchos* |
| | Virginia rail | *Rallus limicola* |
| | sora | *Porzana carolina* |
| | American coot | *Fulica americana* |
| | violet-green swallow | *Tachycinecta thalassina* |
| | cliff swallow | *Petrochelidon pyrrhonota* |
| | barn swallow | *Hirundo rustica* |
| | bank swallow | *Riparia riparia* |
| | red-winged blackbird | *Agelaius phoeniceus* |
| | northern raccoon | *Procyon lotor* |
| Saline Emergent Wetland | American bullfrog | *Lithobates catesbianus* |
| | mosquitofish | *Gambusia affinis* |
| *Aquatic Habitats* | | |
| Lacustrine | signal crayfish | *Pacifastacus leniusculus* |
| | mosquitofish | *Gambusia affinis* |
| | Sierran treefrog | *Pseudacris sierrae* |
| | double-crested cormorant | *Phalacorcorax auritus* |
| | pied-billed grebe | *Podilymbus podiceps* |
| | mallard | *Anas platyrhynchos* |
| | bank swallow | *Riparia riparia* |
| | bats | Unknown species |
| Riverine | signal crayfish | *Pacifastacus leniusculus* |
| | mosquitofish | *Gambusia affinis* |
| | Sierran treefrog | *Pseudacris sierrae* |
| | American bullfrog | *Lithobates catesbianus* |

| CWHR Habitat Type/Land Use Type | Common Name | Scientific Name |
|---|---|---|
| | gadwall | *Anas strepera* |
| | mallard | *Anas platyrhynchos* |
| | white-tailed kite | *Elanus leucurus* |
| | gulls | *Larus* spp. |
| | tree swallow | *Tachycinecta bicolor* |
| | barn swallow | *Hirundo rustica* |
| | bank swallow | *Riparia riparia* |
| | bats | Unknown species |
| Marine | California brown pelican | *Pelecanus occidentalis californianus* |
| | scaups | *Aythya spp.* |
| | surf scoters | *Melanitta perspicilata* |
| | loons | *Gavia spp.* |
| | grebes | *Aechmorphus spp.* |
| | great egret | *Ardea albus* |
| | snowy egret | *Egretta thula* |
| | great blue heron | *Ardea herodias* |
| | whimbrel | *Numenius phaeopus* |
| | gulls | *Larus* spp. |
| | southern sea otther | *Enhydra lutris neries* |
| | California sea lion | *Zalophus californianus* |
| | harbor seal | *Phoca vitulina* |
| | Risso’s dolphin | *Grampus griseus* |
| | gray whale | *Eschrichtius robustus* |
| | humpback whale | *Megaptera novaengliae* |
| *Developed Habitats* | | |
| Irrigated row and field crops | great egret | *Ardea albus* |
| | common raven | *Corvus corax* |
| | American crow | *Corvus brachyrynchos* |
| | Brewer’s blackbird | *Euphagus cyanocephalus* |
| | brown-headed cowbird | *Moluthrus ater* |
| | California ground squirrel | *Ammospermophilus beecheyi* |
| Urban | Cabbage white butterfly | *Pieris rapae* |
| | gray hairstreak | *Strymon melinus* |
| | honey bee | *Apis mellifera* |
| | bumble bee | *Bombus spp.* |
| | Sierran treefrog | *Pseudacris sierrae* |
| | western fence lizard | *Sceloporus occidentalis* |
| | great blue heron | *Ardea herodias* |
| | great egret | *Ardea albus* |
| | snowy egret | *Egretta thula* |
| | black-crowned night heron | *Nycticorx nycticorax* |

| CWHR Habitat Type/Land Use Type | Common Name | Scientific Name |
|---|---|---|
| | Canada goose | *Branta canadensis* |
| | mallard | *Anas platyrhynchos* |
| | turkey vulture | *Cathartes aura* |
| | sharp-shinned hawk | *Accipiter striatus* |
| | Cooper’s hawk | *Accipiter cooperi* |
| | red-shouldered hawk | *Buteo lineatus* |
| | red-tailed hawk | *Buteo jamaicensis* |
| | wild turkey | *Meleagris gallopavo* |
| | killdeer | *Charadrius vociferus* |
| | gulls | *Larus* spp. |
| | black phoebe | *Sayornis nigricans* |
| | Steller’s jay | *Cyancitta stelleri* |
| | California scrub-jay | *Aphelocoma californica* |
| | common raven | *Corvus corax* |
| | American crow | *Corvus brachyrynchos* |
| | nuthatch | *Sitta* sp. |
| | American robin | *Turdus migratorius* |
| | northern mockingbird | *Mimus polyglottos* |
| | yellow-rumped warbler | *Dendroica coronata* |
| | golden-crowned sparrow | *Zonotrichia atricapilla* |
| | white-crowned sparrow | *Zonotrichia leucophrys* |
| | red-winged blackbird | *Agelaius phoeniceus* |
| | Brewer’s blackbird | *Euphagus cyanocephalus* |
| | house finch | *Carpadocus mexicanus* |
| | American goldfinch | *Carduelis tristis* |
| | house sparrow | *Passer domesticus* |
| | striped skunk | *Mephitis mephitis* |
| | northern raccoon | *Procyon lotor* |
| | domestic cat | *Felis catus* |
| | mule deer | *Odocoileus hemionus* |
| *Non-Vegetated Habitats* | | |
| Barren | dragon lubbers | *Draccotettix monstruosus* |
| | dune beetles | *Coelus spp.* |
| | horned lark | *Eremophila alpestris* |
| | savannah sparrow | *Passerculus sandwichensis* |

# Appendix D.
# California Red-Legged Frog Survey Report

# California Red-Legged Frog Survey Summary

# for

# California American Water

# Monterey Peninsula Water Supply Project

January 2017

60489096

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## List of Acronyms

| | |
|---|---|
| afy | acre-feet per year |
| ASR | aquifer storage and recovery |
| BIRP | Begonia Iron Removal Plant |
| BMP | Best Management Practice |
| CAW | California American Water |
| CCC | California Coastal Commission |
| CCSD | Cambria Community Services District |
| CEQA | California Environmental Quality Act |
| cm | centimeters |
| CNDDB | California Natural Diversity Database |
| CPUC | California Public Utilities Commission |

| | |
|---|---|
| CRLF | California red-legged frog |
| CSIP | Castroville Seawater Intrusion Project |
| gpm | gallons per minute |
| hp | horsepower |
| MBMH | Monterey Bay military Housing |
| MBNMS | Monterey Bay National Marine Sanctuary |
| mgd | million gallons per day |
| mg/L | milligrams per Liter |
| MHW | mean high water |
| MNT | Monterey |
| MPP | Monterey Pipeline Project |
| MPWSP | Monterey Peninsula Water Supply Project |
| MRWPCA | Monterey Regional Water Pollution Control Agency |
| NEPA | National Environmental Policy Act |
| NWI | National Wetlands Inventory |
| PCE | Primary Constituent Element |
| PG&E | Pacific Gas & Electric Company |
| ppt | parts per thousand |
| RO | Reverse Osmosis |
| ROW | right-of-way |
| RWQCB | Regional Water Quality Control Board |
| SCADA | Supervisory Control and Data Acquisition |
| SR | State Route |
| SWRCS | State Water Resources Control Board |
| TAMC | Transportation Agency for Monterey County |
| USFWS | U.S. Fish and Wildlife Service |

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# 1 Introduction

The California American Water (CAW) Monterey Pipeline Project (MPP) and Monterey Peninsula Water Supply Project (MPWSP) propose to install pipelines to convey water through communities along Monterey Bay in Monterey County, California. Both projects lie within the historic and current range of the federally threatened California red-legged frog (CRLF, *Rana draytonii*).

To determine the presence or presumed absence of CRLF within the MPP and MPWSP, site assessment and protocol level surveys were conducted for the two projects. The survey results for the MPWSP are presented in this document. Survey summaries for the MPP are presented in a separate report.

This report was prepared in accordance with the CRLF survey protocols outlined in the U.S. Fish and Wildlife Service's (USFWS) *Revised Guidance on Site Assessments and Field Surveys for the California Red-Legged Frog* (USFWS 2005). Protocol level surveys were conducted in the spring and summer of 2016.

## 1.1 Project Area

The MPWSP is located in in the cities of Marina, Seaside, and Castroville, and unincorporated Monterey County. The project area includes locations where pipelines and facilities will be installed, including proposed staging areas and the access routes, and a50-foot (15.24 meter)project buffer on either side of all pipelines and facilities (Figure 1-1). Elevation in the project area ranges from approximately 10 to 300 feet (3 to 91 meters) above mean sea level. Land use includes urban residential development, military properties, undeveloped land managed by California State Parks, and agricultural lands.

## 1.2 Project Description

CAW is under two "Cease and Desist Orders" from the State Water Resources Control Board (SWRCB) to reduce diversion of water from the Carmel River to 3,376 acre-feet per year (afy) (4.16.4 hectare-meters) (SWRCB Order 95-10) and from the Seaside Groundwater Basin to 1,474 afy (181.8 hectare-meters) (SWRCB Order 2009-0060). CAW must replace this reduction in source water with a consistent and reliable water supply in order to maintain existing service to its Monterey District customers. In response, CAW has proposed the MPWSP to the California Public Utilities Commission (CPUC) as its only feasible solution.

The proposed MPWSP will consist of a large-scale infrastructure expansion and installation of a seawater desalination plant, in order to provide CAW with a flexible and cost-effective approach to serve its 40,000 customers and to meet the SWRCB orders in a timely manner. The purpose of the proposed MPWSP is to produce, transfer, and store desalinated water in order to convey it to CAW customers via the existing distribution system. Implementation of the project will also increase use of existing storage capacity in the Seaside Groundwater Basin. The proposed MPWSP will serve the greater Monterey Peninsula.

The proposed project involves pipelines and facilities to be placed within unincorporated areas of Monterey County and in the cities of Castroville, Marina, and Seaside. It consists of several distinct physical components which are described below.

### 1.2.1 Project Components

The MPWSP is comprised of the following facilities:

- A seawater intake system, which would have seven subsurface slant wells located at the CEMEX Lapis Plant site. These wells would extend offshore into the submerged lands of MBNMS. A Source Water Pipeline would convey the combined source water from the slant wells to the desalination plant.
- A 6.4 million gallons per day (mgd) desalination plant and attached or auxiliary facilities, including source water receiving tanks; pretreatment, reverse osmosis (RO), and post-treatment systems; chemical feed and storage facilities; brine storage and facilities; and other associated non-process facilities.
- Desalinated water conveyance facilities, including pipelines and treated water storage tanks.
- An expanded aquifer storage and recovery (ASR) system, including two additional injection/extraction wells (ASR-5 and ASR-6 wells) and three parallel pipelines, the ASR Conveyance Pipeline, ASR Pump-to-Waste Pipeline, and ASR Recirculation Pipeline. These expanded pipelines would convey water to and from the new ASR injection/extraction wells and backwash effluent from the wells to an existing settling basin.

#### *1.2.1.1 Seawater Intake System*

***Subsurface Slant Wells***
The seawater intake system would include seven subsurface slant wells located at the CEMEX Lapis Plant site. These wells would draw seawater from beneath the ocean floor for use as source water for the MPWSP Desalination Plant. The subsurface slant wells would be located in the City of Marina, about 2 miles (3 kilometers) south of the Salinas River, in the retired mining area of the CEMEX sand mining facility (Figure 1-2). The slant wells would be built on the landward side of the dunes, south of the existing CEMEX access road.

***Test Slant Well and Long-Term Aquifer Pump Test***
CAW built a test slant well at the CEMEX Lapis Plant active sand mining area. The test slant well is currently operating as a pilot program to collect data. The environmental effects associated with construction and operation of the test slant well were evaluated in November 2014 under California Environmental Quality Act (CEQA) and National Environmental Policy Act requirements by the City of Marina/California Coastal Commission (CCC) and MBNMS, respectively. The test well is permitted through February 2018; therefore, construction and operation of the test slant well are not evaluated in this document. The data from the pilot program will inform the final design of the subsurface slant wells, the overall seawater intake system, and the MPWSP Desalination Plant treatment system. The test slant well facilities include the test well, a submersible well pump, a wellhead vault, electrical facilities and controls, temporary flow measurement and sampling equipment, monitoring wells, and a temporary pipeline connection to the adjacent Monterey Regional Water Pollution Control Agency (MRWPCA) ocean outfall pipeline for discharges of the test water. The test slant well was drilled at 19 degrees below horizontal and is approximately 720 feet (220 meters) long.

CAW proposes to convert the test slant well into a permanent well after testing is done and operate it as part of the MPWSP seawater intake system. The construction of the additional conveyance and treatment facilities needed to convert the test slant well to a permanent well is evaluated in this document. The conveyance and treatment facilities for the source water produced from the subsurface slant wells are described below.

***Permanent Slant Wells***

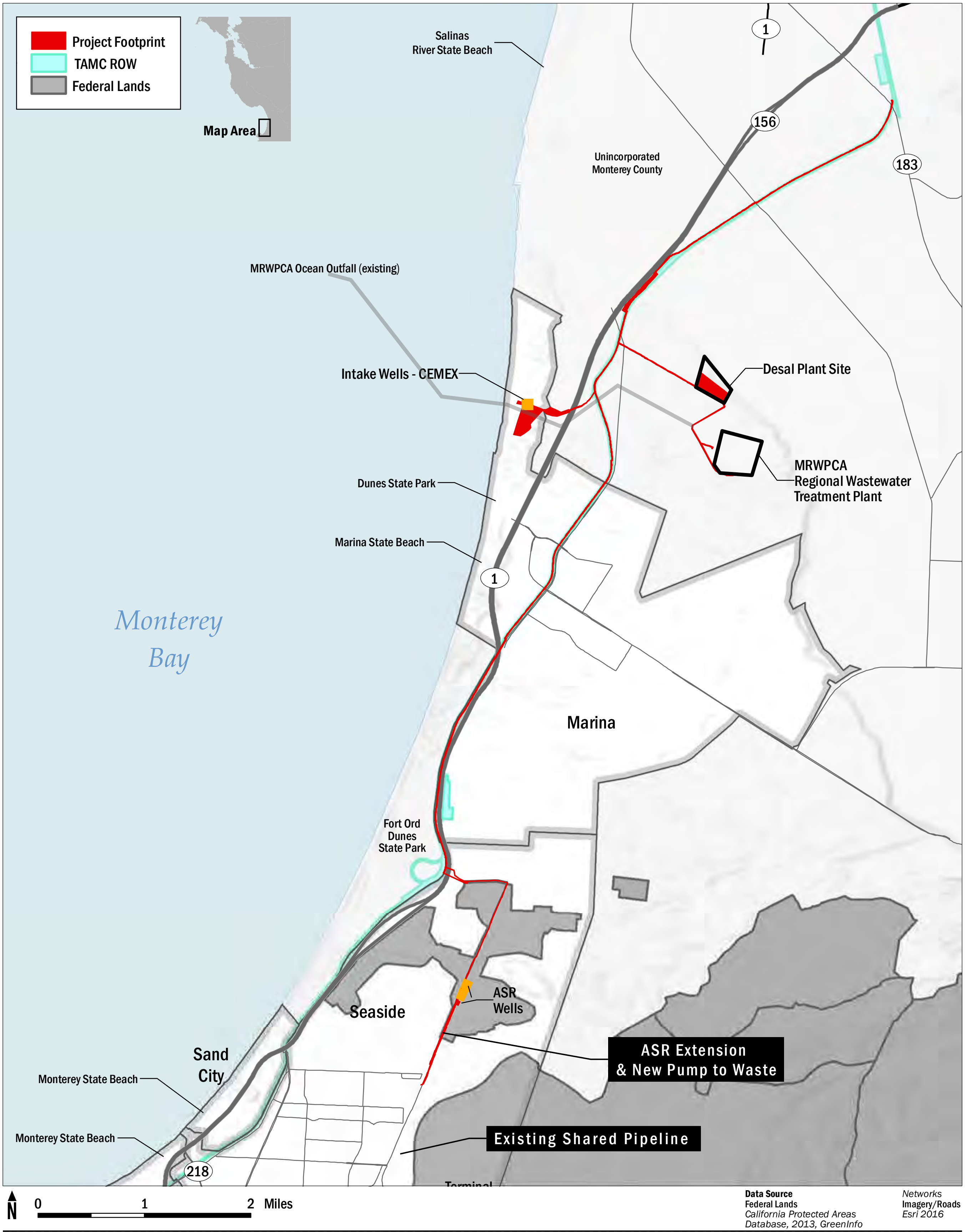
The seven subsurface slant wells (the converted test slant well and six new wells) would be drilled from an onshore location and would extend under the seafloor, within MBNMS, using an 18-inch-diameter (46-centimeter-diameter) steel casing. The completed pump columns and wellheads would be 10 to 12 inches (25 to 31 centimeters) in diameter.

The six new permanent slant wells would be approximately 900 to 1,000 feet (270 to 300 meters) long and drilled at approximately 19 degrees below horizontal, extending offshore 161 to 356 feet (49 to 109 meters) seaward of the mean high water (MHW) line, to a depth of 190 to 210 feet (58 to 64 meters) beneath the seafloor. All construction activities and ground disturbance would occur above mean sea level, landward of the MHW line. However, the well casings would extend seaward and subsurface of the MHW line, below the seafloor within MBNMS.

The seven slant wells would be located at five new wellhead sites and one existing test slant well site located along the back of the dunes. The well sites are numbered sequentially, with Site 1 being the northernmost site and Site 6 the southernmost site. The test slant well site (Site 1) and four new sites (Sites 3 – 6) would each have one slant well, and one site (Sites 2) would have two slant wells (Figure 1-2). Site 2 would be located about 650 feet (198 meters) south of Site 1. Sites 2 through 6 would be drilled over a total distance of about 975 feet (297 meters). Sites 3, 4 and 5 would be spaced approximately 250 feet (76 meters) apart and would have one slant well each; Site 2 would have two wells.

The well sites would include the following aboveground facilities: one wellhead vault per slant well, mechanical piping (meters, valves, and gauges), an electrical control cabinet, and a flush-to-waste basin. The electrical operation controls for the slant wells would be contained in a single-story, 12-foot-long (4-meter-long) by 4-foot-wide (1-meter-wide) fiberglass electrical control cabinet located at each of the five well sites. Each site would also have a flush-to-waste basin for the percolation of turbid water produced during slant well startup and shutdown. The flush-to-waste would be a 12-foot-long (4-meter-long), 8-foot-wide (2-meter-wide), riprap basin. The new permanent slant wells and associated aboveground infrastructure at Sites 2 through 6 would be constructed on a 250- to 370-square-foot (23- to 34-square-meter) concrete pad located above the maximum high tide elevation on the inland side of the dunes (no concrete pad would be built at Site 1). A 750-foot-long (229-meter-long), 42-inch-diameter (1-meter-diameter) buried NSF/ANSI 61[1]-certified pipe would collect the seawater pumped from Sites 2 through 6 and convey it to the proposed buried Source Water Pipeline located at the existing CEMEX access road.

1 National Sanitation Foundation/American National Standards Institute. NSF/ANSI Standard 61 (NSF-61) is a set of national standards that relates to water treatment and establishes stringent requirements for the control of equipment that comes in contact with either potable water or products that support the production of potable water.



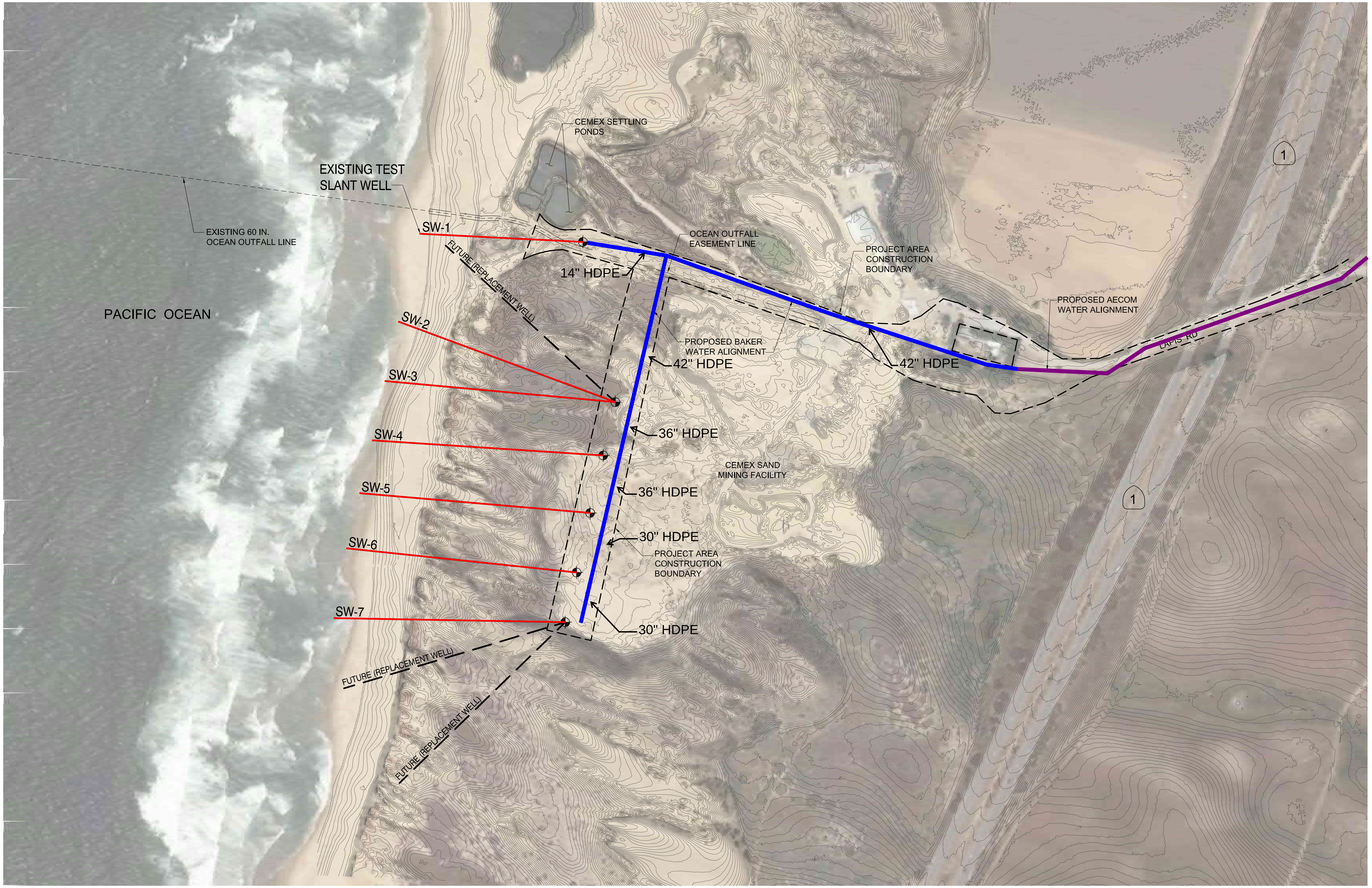

**California American Water**

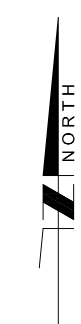
*Transmission Mains and Aquifer Storage & Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 1-1**

*Project Footprint*



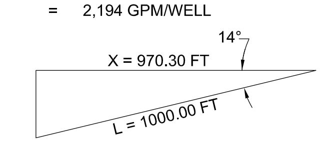




DRAWING NOTES:

1. 6.4 MGD PRODUCT WATER
2. 40.5 % RECOVERY FEED WATER SUPPLY

$\frac{6.4}{0.405}$ = 15.8 MGD

(10,972 GPM) 5 ACTIVE, 2 STDBY
= 2,194 GPM/WELL




PROPOSED SLANT WELLHEAD
SLANT WELL
FUTURE
AECOM ALIGNMENT
BAKER ALIGNMENT
CONSTRUCTION BOUNDARY

0 200 400
APPROXIMATE HORIZONTAL SCALE (FEET)

Michael Baker INTERNATIONAL

BASIS OF DESIGN REPORT SLANT WELL INTAKE PUMPS

# Slant Well Layout - Initial Pipeline Alignment

Figure 1-2

***Source Water Pipeline***

The Source Water Pipeline is an approximately 2.2-mile-long (3.5-kilometer-long), 42-inch-diameter (1-meter-diameter) buried pipeline that would convey water from the well clusters to the MPWSP Desalination Plant at Charles Benson Road. From the slant wells, it would generally follow the CEMEX access road and would run parallel to MRWPCA's existing outfall pipeline for approximately 0.7 mile (1.1 kilometer) (Figure 1-3). The Source Water Pipeline would turn northeast approximately 500 feet (150 meters) east of Highway 1 and follow a dirt path for roughly 1,000 feet (300 meters) to Lapis Road. A jack and bore method would be used to install the pipeline under the existing railroad tracks. The Alignment would continue north about 0.5 mile (0.8 kilometer) within the Transportation Agency for Monterey County (TAMC) right-of-way (ROW) along Lapis Road. The pipeline would turn east across Del Monte Boulevard south of the intersection with Lapis Road and continue east for 0.8 mile (1.3 kilometer) to the MPWSP Desalination Plant site at the east end of Charles Benson Road. This segment of pipeline would parallel the north side of Charles Benson Road, outside of the paved road. The pipeline would be installed east-to-west along the north side of the row of mature Monterey cypress and eucalyptus trees that form a boundary between the agricultural land to the north and Charles Benson Road (Figure 1-3). CAW is negotiating with landowners for an easement for this Alignment.

### *1.2.1.2 MPWSP Desalination Facilities*

The desalination plant is located on approximately 25 acres (11 hectares) of a vacant, 46-acre (19-hectare) parcel of land located along Charles Benson Road in unincorporated Monterey County. The plant would house the seawater desalination infrastructure used to create potable water. The proposed desalination plant would have a 6.4-mgd production capacity (Figure 1-3).

***Pretreatment System***

The pretreatment system would treat source water to remove suspended and dissolved contaminants that could damage the RO system. Pretreated source water would be conveyed and stored in two 300,000-gallon backwash supply and filtered water equalization tanks.

***Reverse Osmosis System***

The RO system would be housed in a process and electrical building, located in the central portion of the MPWSP Desalination Plant site. The building would also contain an ultravoilet disinfection system (if required) and the cleaning system for the RO membranes.

***Post-treatment System***

The desalinated water would pass through a post-treatment system station after leaving the RO system. This is to make the water more compatible with other water supply sources in the CAW system and provide adequate disinfection prior to distribution to customers. Facility operators would treat the water with various chemicals to ensure the water meets drinking water quality requirements and is compatible with native groundwater in the Seaside Groundwater Basin. These chemicals would be stored onsite in accordance with applicable regulatory requirements.

***Multi-purpose Pump Station***

A multi-purpose pump station located near the center of the proposed plant would divert waste effluent produced during the RO process to the brine waste stream and then to be discharged by the existing MRWPCA outfall and diffuser.

***Administrative Building***
An administrative building at the MPWSP Desalination Plant site would house visitor reception, offices, restrooms, locker rooms, break rooms, conference rooms, a control room, a laboratory, equipment storage and maintenance area, and monitoring and control systems for the RO system, post-treatment system, chemical feed systems, and related facilities.

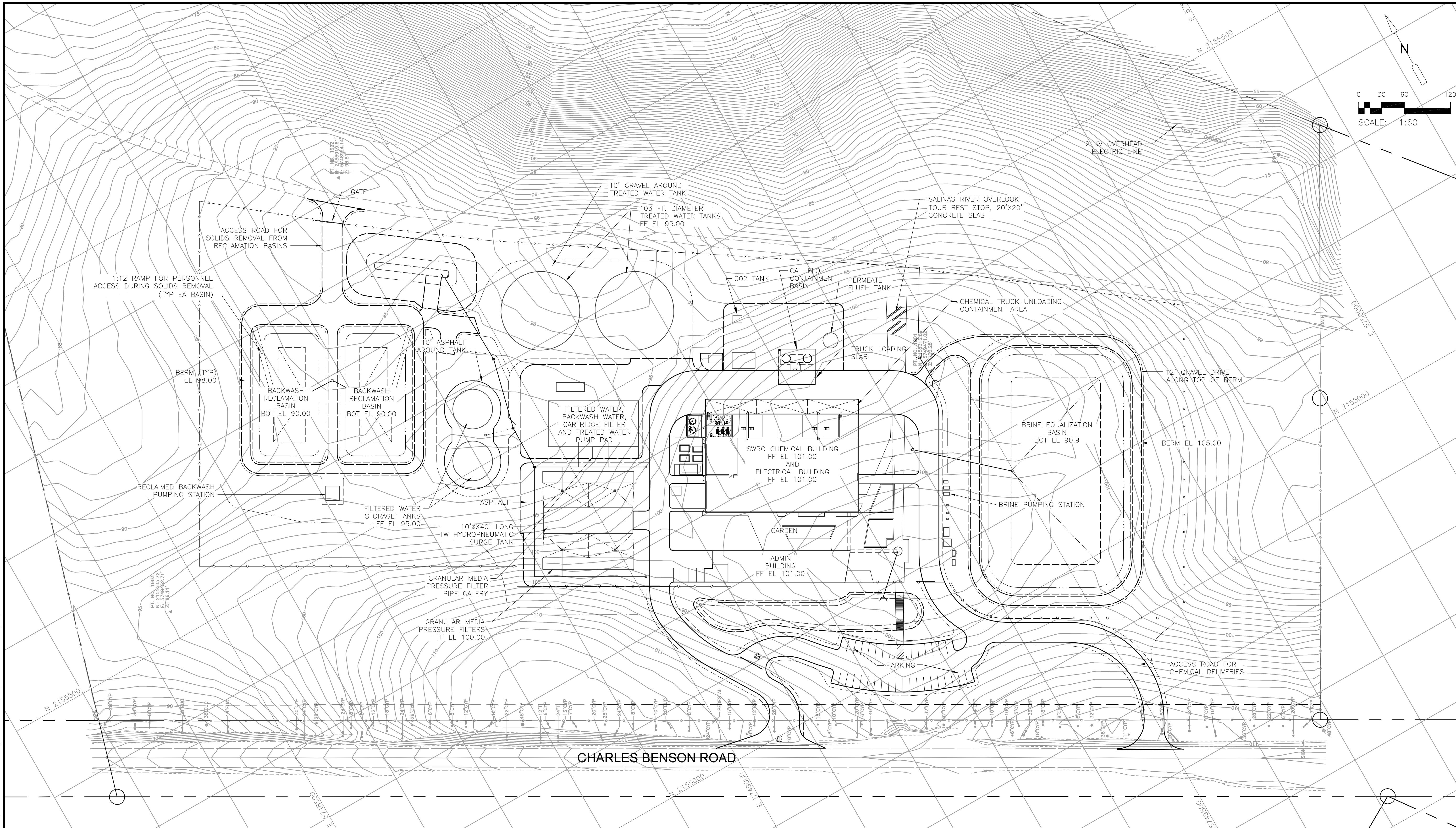
#### *1.2.1.3 Brine Storage and Disposal Facilities*
The brine storage and disposal system would have an uncovered 3-million-gallon brine storage basin with two impermeable liners; two 6 mgd, 40 horsepower (hp) brine discharge pumps; and a brine aeration system to maintain dissolved oxygen concentrations in the brine at 5 milligrams per liter. The RO process would generate approximately 9 mgd of brine, including decanted backwash water. Brine from the RO system would be conveyed through the 3,900-foot-long (1,200-meter-long), 36-inch-diameter (91-centimeter-diameter) Brine Discharge Pipeline to a proposed Brine Mixing Facility at the MRWPCA waste water treatment plant and then connect the mixed waste with the existing MRWPCA ocean outfall that discharges into the waters of MBNMS. When temporary storage is needed, brine would be directed to the brine storage basin where it can be stored for up to 5 hours, then pumped to the Brine Discharge Pipeline.

The existing MRWPCA outfall pipeline is 2.1 miles (3.4 kilometers) long and ends with a 1,100-foot-long (340-meter-long), underwater diffuser that rests on rock ballast. The diffuser ports are approximately 6 inches (15 centimeteres) above the rock ballast and nominally 54 inches (137 centimeters) above the seafloor. For the dilution calculations, the ports are assumed to be 4 feet (1 meters) above the seafloor at approximately 90 to 110 feet (27 to 34 meters) below sea level. The diffuser is equipped with 172 ports (129 open and 43 closed), each 2 inches (5 centimeters) in diameter and spaced 8 feet (2 meters) apart.

#### *1.2.1.4 Desalinated Water Conveyance*
Desalinated product water from the MPWSP Desalination Plant would flow south through a series of proposed pipelines (i.e., the Desalinated Water Pipeline and Transmission Main) to existing CAW water infrastructure, described below. These pipelines would include surface equipment such as valves and blowoffs.

***Treated Water Storage Tanks***
Desalinated, post-treatment product water would flow to two covered, aboveground tanks. Each tank would be approximately 103 feet (31 meters) in diameter and 35 feet (11 meters) tall, constructed of steel or concrete, and provide 1,750,000 gallons of storage, for a total storage volume of 3.5 million gallons.

***Desalinated Water Pumps***
The pumps for the desalinated water would be located at the multi-purpose pump station near the center of the Desalination Plant. Salinas Valley return flow pumps would pump desalinated product water (i.e., Salinas Valley return flows) to the Cambria Community Services District (CCSD) and Castroville Seawater Intrusion Project (CSIP) water distribution systems unless aquifer pump test results at the existing test slant well indicate otherwise. Separate systems would pump desalinated product water to the CAW water system and to the Salinas Valley.






CALIFORNIA AMERICAN WATER

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## LICENSED PROFESSIONAL ENGINEER
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CDM Smith

DRAWN BY G. RODRIGUEZ
PROJECT ENG'R D. BROWN

DATE OCTOBER 2014
PROJECT 154001-0191

# MPWSP DESALINATION INFRASTRUCTURE PROJECT
CIVIL
SITE PLAN

Figure 1-3

| CALIFORNIA AMERICAN WATER CO. | COASTAL DIVISION | USE DIMENSIONS ONLY SCALE AS NOTED |
|---|---|---|
| USE APPROVED DRAWINGS ONLY FOR CONSTRUCTION PURPOSES | 60% SUBMITTAL | 154001-0191-C6 |

1540010191C6.DWG

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### *Desalinated Water Pipeline*

The desalinated water pump station would pump desalinated water through the new Desalinated Water Pipeline and new Transmission Main in the CAW system. The 3.3-mile-long (5.3-kilometer-long), 36-inch-diameter (91-centimeter-diameter) buried new Desalinated Water Pipeline would extend west for approximately 0.8 mile (1.3 kilometer) parallel on the north side of the Charles Benson Road ROW. The Desalinated Water Pipeline would be installed alongside the Source Water Pipeline north of the row of trees separating Charles Benson Road and agricultural land. The Desalinated Water Pipeline would turn north on Del Monte Boulevard for approximately 800 feet (240 meters) to Lapis Road, then continue south within the TAMC ROW along Lapis Road for approximately 1.3 mile (2.1 kilometers) to the southern intersection of Lapis Road and Del Monte Boulevard. From this intersection, the Desalinated Water Pipeline would be built under the Monterey Peninsula Recreational Trail and TAMC ROW using trenchless construction. It would then continue south along the west side of the Monterey Peninsula Recreational Trail and TAMC ROW for approximately 1.4 mile (2.3 kilometers) to Reservation Road (Figure 1-3). The proposed pipeline south of Reservation Road is referred to as the Transmission Main.

### *Transmission Main*

Water would flow from the Desalinated Water Pipeline and enter the 6-mile-long (10-kilometer-long), 36-inch-diameter (91-centimeter-diameter) Transmission Main at Reservation Road; it would then continue south along the west side of the Monterey Peninsula Recreational Trail and TAMC ROW. The Transmission Main would cross east, under the Monterey Peninsula Recreational Trail and TAMC ROW, approximately 750 feet (230 meters) north of Highway 1 using trenchless construction. It would continue south on the west side of Del Monte Boulevard and beneath the Highway 1 overpass for approximately 1,000 feet (300 meters); the pipeline would then turn back into the TAMC ROW. The Transmission Main would cross under Highway 1 approximately 1,000 feet (300 meters) north of the Lightfighter Drive overpass and continue southeast for approximately 1,400 feet (430 meters), making two turns before reaching the south side of Lightfighter Drive, just east of the intersection of Lightfighter Drive and 1st Avenue. The Highway 1 crossing construction would require an entry pit at the Monterey Peninsula Recreational Trail and TAMC ROW, and an exit pit on the opposite side of Highway 1, between the highway and 1st Avenue. The pits would be approximately 150 feet (46 meters) long by 50 feet (15 meters) wide. The Transmission Main would continue east along Lightfighter Drive for approximately 0.4 mile (0.6 kilometer) to General Jim Moore Boulevard. It would then turn south along the east side of General Jim Moore Boulevard to Normandy Road. South of Normandy Road the pipeline would be located along the west side of General Jim Moore Boulevard, ending at the existing Phase I ASR Facilities near General Jim Moore and Coe Avenue (Figure 1-3).

### *Carmel Valley Pump Station*

The Carmel Valley Pump Station site is located at 26530 Rancho San Carlos Road in unincorporated Monterey County, west of the intersection of Carmel Valley Road and Rancho San Carlos Road. The pump station would be connected to existing water mains located between the Forest Lake Reservoir to the west and the Segunda Tank to the east.

These mains are part of the Begonia Iron Removal Plant (BIRP) operation. When operating, BIRP conveys water to both the Forest Lake Reservoir and Segunda Tank through the interconnecting mains. When BIRP is not operating, no water is being conveyed to the Segunda Tank. The Carmel Valley Pump Station would enable water to be conveyed from Forest Lake Reservoir to the Segunda Tank. The Forest Lake Reservoir would be filled by the Desalination Plant using this Pump Station when BIRP is offline. Additionally, the Carmel Valley Pump Station would provide fire water to the Desalination Plant through Crest Tank via Segunda Pump Station and Tank when BIRP is offline.

The proposed pump station facility would consist of three, 60 hp pumps and approximately 1,000 linear feet (300 meters) of inlet and outlet piping. The mechanical equipment would be housed and raised above the 100-year flood elevation in a proposed concrete 756 square-foot (70-square-meter) structure and 18.28-foot (5.57-meter) tall masonry structure building (Figure 1-3).

The Carmel Valley Pump Station would require supply and discharge pipeline connections to an existing Carmel Valley Road main. Three new manual valves would be installed in Camel Valley Road or in the public right-of-way. Additionally, three new actuated valves would be installed in the CAW owned parcel.

***Castroville Pipeline***
The 4.5-mile-long (7.2-kilometer-long), 12-inch-diameter (30-centimeter-diameter) Castroville Pipeline would convey desalinated Salinas Valley return water from the MPWSP Desalination Plant to the CSIP distribution system and the CCSD Well #3. The Castroville Pipeline would branch off from the Desalinated Pipeline approximately 240 feet (70 meters) south of the intersection of Del Monte Boulevard and Lapis Road. The pipeline would follow Lapis Road north, within the TAMC ROW and along Monte Road, and would cross over the Salinas River at Monte Road by being attached to the underside of the Monte Road Bridge.

The pipeline would continue northeast from the Salinas River, along the TAMC ROW and Monte Road, to Nashua Road. A new pipe connection to the CSIP distribution system would be built at the northern end of Monte Road, where it meets Nashua Road. The Castroville Pipeline would continue north along the TAMC ROW, crossing under Tembladero Slough to Highway 183 (Salinas Road). From Highway 183, the pipeline would continue north between Del Monte Avenue and Union Pacific Railroad, turn west across Del Monte Avenue and connect to CCSD Well #3 at the north corner of Del Monte Avenue and Merritt Street (Figure 1-3).

***Pipeline to CSIP Pond***
Water from the Salinas Valley return to be delivered the CSIP pond would flow through a new connection along the Castroville Pipeline at Nashua and Monte roads. A new 1.2-mile-long (1.9-kilometer-long), 12-inch-diameter (30-centimeter-diameter) pipeline would connect to the existing CSIP pond at the southern end of the MRWPCA Regional Wastewater Treatment Plant. From the CSIP pond, water would be delivered to agricultural users in the Salinas Valley through existing infrastructure (Figure 1-3).

***Proposed ASR Facilities***
CAW proposes to expand the existing Seaside Groundwater Basin ASR system to provide additional injection/extraction capacity for both desalinated product water and Carmel River water supplies in order to increase system reliability. The proposed improvements to the ASR system include two additional injection/extraction wells, ASR-5 and ASR-6, and three parallel, 0.9-mile-long (1.4-kilometer-long), ASR pipelines.

***ASR Injection/Extraction Wells (ASR-5 and ASR-6 Wells)***
CAW would build two additional injection/extraction wells (ASR-5 and ASR-6 wells) on two U.S. Army-owned parcels located east of General Jim Moore Boulevard, south of its intersection with Ardennes

Circle, in the Fitch Park Monterey Bay Military Housing (MBMH) area (Figure 1-3). The new injection/extraction wells would be drilled to a depth of approximately 1,000 feet (300 meters) and would be screened in the Santa Margarita sandstone aquifer. Each well would have a permanent 500 hp, multi-stage, vertical turbine pump, Supervisory Control and Data Acquisition (commonly called SCADA)[2] controls for remote operation, and various pipes and valves. Each well pump and electrical control system would be housed in a 900-square-foot (80-square-meter) concrete pump house. A low-voltage, 480-volt, three-phase electrical transformer would be installed at each well site to power the electrical control system. Pacific Gas & Electric Company, the local electrical utility, would own and operate the electrical transformers. Security fencing would encompass an area of approximately 0.4- and 0.5-acre (0.16- and 0.20-hectare) around the ASR-5 and ASR-6 wells, respectively (RBF Consulting 2010).

The existing ASR disinfection system is housed within the chemical/electrical control building at the site of the existing ASR-1 and ASR-2 wells.[3] The existing disinfection system has sufficient capacity to treat ASR product water extracted from all six ASR injection/extraction wells (the four Phase I and Phase II wells and the two new wells). The disinfection system consists of a 5,000-gallon bulk sodium hypochlorite storage tank, chemical metering pumps, and a chlorine residual analyzer. The disinfection system includes double containment for all chemical storage and dispensing equipment, protective vent-fume neutralizers, safety showers for operations personnel, and a forced-air ventilation system.

The ASR-5 and ASR-6 wells would have a combined injection capacity of 2.2 mgd (1,050 gallons per minute [gpm]) and combined extraction capacity of approximately 4.3 mgd (3,000 gpm) (RBF Consulting 2013). They would be connected via four 16-inch (41-centimeter) diameter pipelines from the ASR wells to three parallel pipelines proposed within General Jim Moore Boulevard (see description immediately below). The ASR-5 and ASR-6 wells would operate in conjunction with the ASR-1, ASR-2, ASR-3, and ASR-4 wells. Any of the six ASR injection/extraction wells could be used to inject desalinated product water and Carmel River water supplies.

Maintenance of ASR-5 and ASR-6 wells would involve routine backflushing of the two wells. Backwash effluent, containing elevated levels of sediment and turbidity, would be conveyed through the proposed ASR Pump-to-Waste Pipeline (see description below) to the existing settling basin for the Phase I facilities at the intersection of General Jim Moore Boulevard and Coe Avenue, where it would infiltrate into the ground.

***ASR Pipelines***

Three parallel 0.9-mile-long (1.4-kilometer-long), 16-inch-diameter (41-centimeter-diameter), ASR pipelines, (the ASR Recirculation Pipeline, the ASR Conveyance Pipeline, and the ASR Pump-to-Waste Pipeline), would extend along General Jim Moore Boulevard between the proposed ASR-5 and ASR-6 wells (between Fitch Park MBMH area and the intersection of Coe Avenue and General Jim Moore Boulevard). The ASR Recirculation Pipeline would circulate water to prevent stagnation during times when no injection or extraction takes place. The ASR Conveyance Pipeline would convey water to/from the ASR-5 and ASR-6 wells for injection/extraction to the Phase I ASR facilities. The ASR Pump-to-Waste Pipeline would convey backflush effluent from the ASR-5 and ASR-6 wells to the existing settling basin for the ASR-1 and ASR-2 wells, which is about 2 miles (3 kilometers) south of

2 SCADA is a system for remote monitoring and operations of water supply facilities.

3 The existing ASR-1 and ASR-2 Wells are also known as Santa Margarita Wells #1 and #2 in other sources.

the intersection of General Jim Moore Boulevard and Coe Avenue (Figure 1-3). In addition, a 150-foot-long (46-meter-long), 16-inch-diameter (41-centimeter-diameter) pipeline would connect the Transmission Main to each of the ASR wells. These pipelines would convey desalinated water to ASR 5 and ASR 6 wells for injection.

### 1.2.2 Construction

#### *1.2.2.1 Site Preparation and Construction Staging*

***Site Clearing and Preparation***

Construction workers would clear and prepare the construction work areas in stages, as construction progresses. The contractor would clear and grade the portions of the project area to be worked in before construction starts, removing vegetation and debris, as necessary, to provide a relatively level surface for the movement of construction equipment. The contractor would recontour and restore the construction work areas to their original profile upon completion of construction, and would hydroseed or pave the areas, as appropriate.

***Staging Areas***

Construction equipment and materials would be stored within the construction work areas to the extent feasible. Construction staging for the subsurface slant wells at the CEMEX site, the MPWSP Desalination Plant, and the ASR-5 and ASR-6 wells would be contained within the project area boundary (Figure 1-1). For construction of all other facilities and pipelines, construction workers would use eight strategically located staging areas in the project area vicinity. The proposed staging areas are sited with the intent of avoiding sensitive riparian areas or critical habitat for protected species. The designated staging areas are primarily paved, gravel, or dirt parking lots located in highly disturbed areas, except the sandy lot proposed as the staging area near Seaside Middle School. Table 1 summarizes the staging area locations and current site conditions.

Because all of the staging areas are paved, gravel, or dirt, CAW's contractors would not need to remove vegetation to prepare the staging sites. No gravel would be placed in dirt staging areas. Heavy machinery would not be operated at the staging areas unless it is used to move lighter-duty machinery in and out of the staging area, or to load and unload material onto transportation vehicles for delivery to the construction sites. Only motion-sensored nighttime lighting would be installed at staging areas.

**Table 1 Construction Staging Areas**

| Location | Site Description |
|---|---|
| Monte Road/Neponset Road in unincorporated Monterey County | Paved parking lot (semi-trucks) at Dole Vegetable Processing Plant |
| Beach Road in Marina | Paved parking lot at Walmart |
| Highway 1/1st Street in Marina | Gated paved parking lot |
| 2nd Avenue, between Lightfighter Drive and Divarty Street, in Seaside | Paved parking lot at the Cal State University at Monterey Bay Athletic Fields |
| 2nd Avenue/Lightfighter Drive in Seaside | Paved parking lot |
| West side of General Jim Moore Boulevard, near Gigling Road, in Seaside | Paved parking lot |
| East side of General Jim Moore Boulevard, near Gigling Road, in Seaside | Paved parking lot |
| West side of General Jim Moore Boulevard, near Seaside Middle School, in Seaside | Sandy area |

#### *1.2.2.2 Well Drilling and Development and Related Site Improvements*

***Subsurface Slant Wells***

Well installation would be done in two phases: (1) well drilling and (2) well development. All construction activities for the subsurface slant wells would occur inland of the mean high water line and in previously disturbed areas, landward of the dunes. Surface construction activities would occur outside of MBNMS. Slant well construction would take approximately 10 to 12 months to complete, and could take place anytime throughout the overall 24-month construction duration for the Proposed Action. Construction activities associated with installation of the nine additional subsurface slant wells, including staging, materials storage, and stockpiling, would temporarily disturb approximately 9 acres (3.6 hectares) of land (approximately 1 acre [0.4 hectare] of disturbance per slant well) within the project area boundary. Construction activities would occur 24 hours per day, 7 days per week, with multiple slant wells being built simultaneously. Construction-related trucks and vehicles would access the slant well site via Del Monte Boulevard, Lapis Road, and the existing access roads in the CEMEX active mining area. The construction contractor would use a temporary field office (mobile trailer) in the southern portion of the project area throughout slant well construction activities. The field office and materials receiving and storage would be contained within the 9-acre (3.6-hectare) construction disturbance area.

The proposed slant wells would be built using a dual rotary drilling rig, pipe trailers, portable drilling fluid tanks, Baker tanks (portable holding tanks), haul trucks, flatbed trucks, pumps, and air compressors. The slant wells would be drilled at approximately 19 degrees below horizontal.

Drilling fluids, such as water, bentonite mud, or environmentally inert biodegradable additives, would be used to drill through the first 100 feet (30 meters) of the dry dune sands to prevent the sand from locking up the drill bit inside the conductor casing. The fluid would be recirculated using a mud tank located next to the drill rig. Once the drill bit reaches groundwater, the construction contractor would pump out all of the sand-bentonite mud slurry and put it in a storage container for off-site disposal. The elevation of the groundwater surface would be determined from the existing monitoring wells.

The remaining 900 feet (270 meters) of borehole below the top of the groundwater table would be drilled using water already present in the sand and some potable water. No bentonite mud or other additives would be used to drill this segment of the slant well. The water and sediment mixture generated drilling the lower portion of slant well would be placed in settling tanks, as necessary, to allow sediment to settle out. The volume of water produced during this drilling phase would be small, allowing the construction contractor to dispose of the clarified effluent by percolating it into the ground at the CEMEX active mining area. Drilling spoils generated while drilling the lower portion of slant well would not contain bentonite mud or other additives; they would be spread within the construction disturbance area and would not require offsite disposal. To develop the slant wells, a submersible pump would be lowered several hundred feet into each well and would be pumped for 2 to 6 weeks during slant well completion and initial well testing. The groundwater pumped from the wells during well development would be discharged to the ocean, within the waters of MBNMS, through the test slant well discharge pipe and the existing MRWPCA ocean outfall. The wellheads would include 12-inch-diameter (30-centimeter-diameter) discharge piping (i.e., flow meter, isolation valve, check valve, pump control valve, air valve, and pressure gauge). The discharge piping would be approximately 2 to 3 feet (0.6 to 0.9 meters) above the ground on an estimated 370-square-foot (34-square-meters) concrete pad; some of the mechanical and electrical gear would be covered by a pre-manufactured shelter to protect them from the elements. The discharge piping would then transition underground through a trench and connect to the buried source water pipeline. The wellheads would be accessible at grade level.

***ASR Injection/Extraction Wells***

Construction activities for new ASR injection/extraction wells would include grading, installation and removal of temporary sound walls; well drilling, installation of pipeline connections to the proposed ASR Conveyance Pipelines along General Jim Moore Boulevard, and installation of electrical equipment, pumps, and an access road from General Jim Moore Boulevard. Construction equipment would include drill rigs, water tanks, pipe trucks, flatbed trucks, and several service vehicles. The new ASR injection/extraction wells would be drilled using the reverse rotary drilling method. Bentonite drilling fluids would not be used during well drilling, but non-corrosive, environmentally inert, biodegradable additives may be used to keep the borehole open if necessary. Most construction activities would extend from 7 a.m. to 7 p.m., 5 days per week; however, continuous 24-hour construction would be necessary for approximately 4 weeks, per well, of the initial well drilling until final depth is reached and the borehole is stabilized. Construction of both wells is expected to take 12 months.

Water produced during development of the ASR-5 and ASR-6 wells at the Fitch Park MBMH housing area would be expelled to the existing surface water drainage system or direct to water transport trucks. The well development water would be disposed of in accordance with Central Coast Regional Water Quality Control Board (RWQCB) Resolution No. R3-2008-0010, General Waiver for Specific Types of Discharges (RWQCB 2008). Any waste material generated during construction of the proposed ASR facilities that requires off-site disposal would be transported to an approved landfill facility.

Water would be discarded during pipeline testing or following long periods of pipeline stagnation. During operations, discarded water would be sent via a proposed dedicated pipeline to an existing open receiving pit in use adjacent to the existing Santa Margarita ASR well location. This receiving pit is currently available for use by the project proponent.

### *1.2.2.3 Desalination Plant Construction*

Construction activities would include pouring concrete footings for foundations, tanks, and other support equipment; constructing walls and roofs; cutting, laying, and welding pipelines and pipe connections; assembling and installing major desalination process components; installing piping, pumps, storage tanks, and electrical equipment; testing and commissioning facilities; and finish work such as paving, landscaping, and fencing the perimeter of the site.

Construction workers would access the MPWSP Desalination Plant site by Charles Benson Road and existing access roads. Construction equipment would include excavators, backhoes, graders, pavers, rollers, bulldozers, concrete trucks, flatbed trucks, boom trucks or cranes, forklifts, welding equipment, dump trucks, air compressors, and generators. Pretreatment, RO, and post-treatment facilities would be prefabricated and delivered to the site for installation. Approximately 25 acres (10 hectares) of the 46-acre (19-hectare) site would be disturbed during construction. Construction activities at the desalination plant site are expected to occur over 25 months.

### *1.2.2.4 Pipeline Installation*

Approximately 21 miles (34 kilometers) of pipelines would be installed within the paved roadway, or adjacent to roads and the Monterey Peninsula Recreational Trail. Most pipeline segments would be installed using conventional open-trench technology; however, where it is not feasible or desirable to perform open-cut trenching, trenchless methods would be used.

Typical construction equipment for pipeline installation would include flatbed trucks, backhoes, excavators, pipe cutting and welding equipment, haul trucks for spoils transport, trucks for materials delivery, compaction equipment, Baker tanks, pickup trucks, arch welding machines, generators, air compressors, cranes, drill rigs, and skip loaders. Pipeline segments would typically be delivered and installed in 6- to 40-foot-long (2- to 12-meter-long) sections. Soil removed from trenches and pits would be stockpiled and reused, to the extent feasible, or hauled away for offsite disposal. Topsoil would be stockpiled separately and replaced last. Under typical circumstances, the width of the disturbance corridor for pipeline construction would vary from 50 to 100 feet (15 to 30 meters), depending on the size of the pipe being installed. Multiple pipelines would be built simultaneously. Although most pipeline construction would occur over a 15-month period, pipeline construction could occur any time throughout the entire 24-month construction period. The construction durations for most individual pipelines would be much shorter than 15 months. Pipeline installation would be sequenced to minimize land use disturbance and traffic disruption to the extent possible.

#### *Open-Trench Construction*

The construction sequence for pipeline installed using open-trench methods would typically include:

- Clearing and grading the ground surface along the pipeline Alignments;
- Excavating the trench;
- Preparing and installing pipeline sections;
- Installing vaults, manhole risers, manifolds, and other pipeline components;
- Backfilling the trench with non-expansive fills;
- Restoring preconstruction contours; and
- Revegetating or paving the pipeline Alignments, as appropriate.

A conventional backhoe, excavator, or other mechanized equipment would be used to excavate trenches. The typical trench width would be 6 feet (2 meters); however, vaults, manhole risers, and other pipeline components could require wider excavations. Work crews would install trench boxes or shoring, or would lay back and bench the slopes, to stabilize the pipeline trenches and prevent the walls from collapsing during construction. After excavating the trenches, the contractor would line the trench with pipe bedding; that is, sand or other appropriate material shaped to support the pipeline. Construction workers would then place pipe sections (and pipeline components, where applicable) into the trench, weld the sections together as trenching proceeds, and then backfill the trench. Most pipeline segments would have 8 feet (2.4 meters) of cover. Open-trench construction would generally proceed at a rate of about 150 to 250 feet (46 to 76 meters) per day. Steel plates would be placed over trenches to maintain access to private driveways. Some pipeline installation would require construction in existing roadways and could result in temporary lane closures or detours.

***Trenchless Technologies***

Where it is not feasible or desirable to perform open-cut trenching, workers would use trenchless methods such as jack-and-bore, drill-and-burst, horizontal directional drilling (HDD), or microtunneling. Pipeline segments located within heavily congested underground utility areas or in sensitive habitat areas would likely be installed using HDD or microtunneling. Jack-and-bore methods would likely be used beneath railroad crossings. HDD would likely be used for pipeline segments that cross beneath Highway 1 (new Transmission Main) and beneath drainages (Castroville Pipeline). Trenchless methods of pipeline installation would be required at five identified locations (additional locations may be identified during final pipeline design):

1. Installation of the Source Water Pipeline beneath the TAMC ROW at Lapis Road, just north of the CEMEX access Road

2. Installation of the new Desalinated Water Pipeline beneath the TAMC ROW near the southern intersection of Lapis Road and Del Monte Boulevard

3. Installation of the new Transmission Main beneath the TAMC ROW near Marina Drive, Del Monte Boulevard, and Reindollar Avenue in the City of Marina

4. Installation of the new Transmission Main at Highway 1 and Lightfighter Drive

5. Installation of the Castroville Pipeline under Tembladero Slough

***Jack-and-Bore and Microtunneling Methods***

The jack-and-bore and microtunneling methods entail excavating an entry pit and an egress pit at either end of the pipe segment. A horizontal auger is used to drill a hole, and a hydraulic jack is used to push a casing through the hole to the egress pit. As the boring proceeds, a steel casing is jacked into the hole and pipe is installed in the casing.

***Drill-and-Burst Method***

The drill-and-burst method involves drilling a small pilot hole at the desired depth through a substrate, and then pulling increasingly larger reamers through the pilot hole until the hole reaches the desired diameter.

***Horizontal Directional Drilling***

HDD requires the excavation of a pit on either end of the pipe segment. A surface-launched drilling rig is used to drill a small horizontal boring at the desired depth between the two pits. The boring is filled with drilling fluid and enlarged by a back-reamer to the required diameter. The pipeline is then pulled into position through the boring. Entry and receiving pits range in size depending on the length of the crossing, but typically have dimensions of approximately 50 by 50 feet (15 by 15 meters).

***Pipeline Installation at the Salinas River Crossing***

At the Salinas River crossing, the pipeline would be attached to an existing trellis on the Monte Road Bridge with the assistance of a barge in the Salinas River. The barge would remain in the river for up to one month, during which time it would be moving frequently and is therefore not expected to cause substantial shading effects to any one portion of the channel. Construction of the overwater crossing would require trimming of riparian vegetation so that the undersurface of the bridge could be accessed to attach the new pipeline. There are no trees in this area, so the trimming would be limited to shrubby arroyo willows, blackberry, and coyote bush. Within the riparian area leading up to the overhead portion of the pipeline on each bank, the majority of the trenching would be done within an existing unvegetated access road. Ground disturbance of vegetated areas would be limited to an area on either bank where the pipeline turns from the existing access road and goes to the point where it would be built vertically up from the ground to the undersurface of the bridge.

#### *1.2.2.5 Disinfection of Existing and Newly Installed Pipelines*

Before connecting existing and new pipelines, CAW would drain and disinfect the existing pipeline segments before putting them into service. Similarly, upon completing construction activities, facility operators would disinfect the newly installed pipelines and pipeline connections before bringing the pipelines into service. Effluent produced during the pipeline disinfection process would be discharged to the local stormwater drainage system in accordance with the Central Coast RWQCB *General Waste Discharge Requirements for Discharges with Low Threat to Water Quality* (Order No. R3-2011-0223, NPDES Permit No. CAG993001) (RWQCB 2011).

#### *1.2.2.6 Carmel Valley Pump Station*

The contractors would clear and grade the construction areas prion to the onset of construction activities, including temporary staging areas, as necessary. Construction activities would include the following: clearing, excavation and cutting, laying, and welding of pipelines and pipe connections; pouring concrete footings for foundations, tanks, and other support equipment; constructing walls and roofs; assembling and installing major components; installing piping, pumps, storage tanks, and electrical equipment; testing and commissioning facilities; and finish work such as paving, landscaping, and fencing the perimeter of the site.

Typical construction equipment would include excavators, backhoes, graders, pavers, rollers, bulldozers, concrete trucks, flatbed trucks, boom trucks and/or cranes, forklifts, welding equipment, dump trucks, air compressors, and generators. Access to the site would be provided from Carmel Valley Road. Construction-related Best Management Practices would be implemented to minimize soil erosion, soil loss from construction sites, and prevent stormwater and other pollutants from leaving the construction sites. Construction is estimated to begin in June 2018 and conclude by September 2018. Construction would occur 8 hours per day, 5 days a week over the 4 month construction period.

#### *1.2.2.7 Installation of Powerlines*

New powerlines would be built underground and aboveground between the existing powerlines in the area and the proposed facilities. Installation of overhead powerlines would be done in two phases: (1) installing the poles, and (2) installing and tensioning the powerline. Power poles would be installed approximately 300 feet (90 meters) apart. The poles would be set by digging a hole 10 feet (3 meters) deep, placing the pole in the hole, and backfilling. An area approximately of 50 square feet (4.6 square meters) would be needed at each of the pole locations for laydown and assembly. A limited amount of vegetation may be removed, but grading would not be needed. Construction workers would use standard rubber-tired line trucks to access the Alignment, and to install and tension the new overhead powerlines. The puller/tensioner would be mounted on a utility truck or on a double-axle trailer. Workers may need to trim or remove some vegetation along the Alignment to keep vegetation away from the overhead powerlines.

Installation of the new underground powerlines would require excavation of a trench approximately 1-foot-wide (0.3-meter-wide) by 3-foot-deep (0.9-meter-deep) along their alignments. Construction workers would backfill the trench and restore the ground surface after installation of the underground powerline is completed.

#### *1.2.2.8 Construction Schedule*

Construction is expected to start June 2018 and continue through June 2020 (25 months total).

## 1.3 California Red-legged Frog Natural History

The CRLF is listed as threatened by the USFWS. The species is distributed throughout 28 counties in California, but is most abundant in the San Francisco Bay Area (USFWS 2002). Populations have become isolated in the Sierra Nevada, northern Coast Ranges, and northern Transverse Ranges (USFWS 2002). CRLF predominately inhabits permanent water sources, such as streams, lakes, marshes, natural and manmade ponds, and ephemeral drainages in valley bottoms and foothills up to 4,900 feet (1500 meters) in elevation (Jennings and Hayes 1994, Bulger et al. 2003, Stebbins 2003).

CRLF initiate breeding with the advent of seasonal rains, depositing egg masses containing 2,000 to 5,000 eggs that are attached to vegetation below the surface and hatch after 6 to 14 days (Storer 1925, Jennings and Hayes 1994). Larvae undergo metamorphoses 3.5 to 7 months after hatching, and reach sexual maturity at 2 to 3 years of age (Hayes and Jennings 1988, Jennings and Hayes 1994).

Juvenile and adult CRLF also shelter, forage, and disperse in aquatic habitats that may not be suitable for breeding, such as plunge pools within intermittent creeks, seeps and springs, and quiet water refugia in streams with high flow (75 FR 12816). In a study of CRLF terrestrial activity in the Santa Cruz Mountains, Bulger et al. (2003) categorized terrestrial use as migratory and non-migratory. Non-migratory activity occurred over one to several days and was associated with precipitation events, while migratory movements were characterized as the movement between aquatic sites and were most often associated with breeding activities. Suitable upland habitat types for both migratory and non-migratory CRLF include grassland, woodland, forest, wetland, or riparian areas adjacent to aquatic habitat in which frogs find shelter, forage, and avoid predators (75 FR 12816). CRLF are most associated with upland habitat characterized by with dense vegetative cover (e.g., California blackberry [*Rubus ursinus*], poison oak [*Toxicodendron diversilobum*], and coyote brush [*Baccharis pilularis*]), and other structural features like rocks and boulders, organic debris and damp leaf litter, and small mammal burrows.

Migratory upland habitat can also include more altered habitat types, like agricultural fields, which may contain refugia and moisture that enables traveling short distances. However, frogs typically cannot migrate through urban or commercial development, presumably due to the lack of surface moisture and hotter ambient temperatures, which make them prone to desiccation in addition to vehicle strikes, urban predators such as cats and dogs, and a lack of natural refugia. Davidson et al. (2001) demonstrated a strong correlation between declines in CRLF and the amount of surrounding urban land use.

Non-migrating CRLF typically stay within 200 feet (60 meters) of aquatic habitat, while migrating frogs may move up to (1 mile (1.6 kilometers) from aquatic habitat (75 FR 12816, Bulger et al. 2003), though most movements are local and limited to a couple hundred meters (Rathbun et al 1993, Fellers and Kleeman 2007; Bulger et al. 2003). Metapopulation dynamics describe species that have multiple breeding sites within one continuous area. Each of these breeding sites is connected by suitable dispersal habitat and may be occupied at different times, with local extinctions and recolonizations occurring regularly. CRLF appear to conform to this population model, and their habitat is further defined as:. "aquatic and upland areas where suitable breeding and nonbreeding habitat is interspersed throughout the landscape and is interconnected by unfragmented dispersal habitat (75 FR 12816)."

CRLF have been impacted by the increased urbanization and fragmentation of their habitats. The species is adversely affected by the isolation of breeding ponds and by the presence of roads (D'Amore et al. 2009). Evidence shows that movement between breeding sites is necessary to maintain successful reproduction (D'Amore et al. 2010) in CRLF. In studies of pond-breeding amphibians, researchers have found that site or pond isolation caused by urban development is positively correlated with genetic divergence (Marsh and Trenham 2001) which can lead to a reduction in genetic diversity (population bottlenecks) and fitness (Hitchings and Beebee 1998). These studies indicate that even if suitable aquatic and upland habitats are available to CRLF, population persistence is unlikely if connectivity to other breeding habitats is not.

Other threats to CRLF include the presence of non-native predators and competitors. American bullfrogs (*Lithobates catesbeianus*) and introduced fish can compete with CRLF for food, cover, and other resources when such resources are limited. Direct predation of CRLF by introduced species may be an even greater threat than competition (Cook and Currylow 2014; Adams et al. 2003). The negative effect of non-native fish on red-legged frogs has been well documented where they co-occur. In one study, researchers studied six ponds with exotic fish that were little used by adult red-legged frogs and where almost no successful reproduction had taken place. Following fish eradication, frog reproduction rebounded, with hundreds of juvenile frogs observed in a single pond (Alvarez et al. 2002). CRLF, unlike bullfrogs, likely evolved in systems relatively free of fish (Adams et al. 2003), and their tadpoles are highly susceptible to predation. Bullfrog tadpoles are unpalatable to fish (Kruse and Francis 1977), but are consumed readily by predatory macroinvertebrates such as dragonfly nymphs (Adams et al. 2003). There is evidence that non-native fish may facilitate bullfrog reproduction, as they consume dragonfly nymphs and other predatory macroinvertebrates, reducing predation pressure on bullfrog larvae (Adams et al. 2003).

The combination of non-native fish and bullfrog predation pressure has multiple consequences for CRLF tadpoles. The tadpoles are not only prey for bullfrogs, but can also become the prey of predatory fish because, when they seek deeper water to try to evade bullfrog predation, they can then be consumed by predatory fish. This interaction has been shown to have substantial effect on CRLF tadpole survival to metamorphosis (Kiesecker and Blaustein 1998). These synergistic effects of bullfrogs and non-native predatory fish likely confer an advantage on bullfrogs over native frogs when predatory fish are present.

Introduced crayfish, such as the red swamp crayfish (*Procambarus clarkii*) and signal crayfish (*Pacifastacus leniusculus*), are implicated as another potential predator of the CRLF at all life stages (USFWS 2002). Crayfish have been documented to prey on amphibian (newt) eggs and larvae in a lab environment (Gamradt and Kats 1996). As habitat generalists, they likely prey on CRLF eggs and larvae as well. Introduced crayfish, in tandem with predatory game fish and bullfrogs, are associated with the decline of the CRLF and the decline of other native amphibians in California ecosystems (Riley et al. 2005).

# 2 Methods

## 2.1 Desktop Analysis

AECOM biologists established a 1 mile (1.6 kilometer) [4] radius around the MPWSP to generate a study area. The 1 mile (1.6-kilometer) radius is representative of typical CRLF migratory movement distances based on radiotelemetry studies (75 FR 12816, Bulger et al. 2003, USFWS 2005). To locate aquatic features within the study area, AECOM biologists conducted a desktop analysis by querying online databases. Although the majority of these aquatic features do not coincide with MPWSP, there is potential for them to be a source of CRLF that may enter the project area.

Within the study area, GIS analysists queried:

1. All aquatic features identified by the USFWS National Wetlands Inventory (NWI) Wetlands Mapper (USFWS 2016). Each aquatic feature identified during the desktop was further reviewed for CRLF habitat suitability using aerial photography interpretation. Biologists reviewed aerial photographs and conducted ground-truthing surveys to confirm the presence of an aquatic feature and potentially suitable upland habitat.

2. The California Natural Diversity Database (CNDDB) (CDFW 2016) to identify whether the study area occurs within the historic and current range of the CRLF and/or within the species' critical habitat.

3. CRLF occurrences, compiled through a review of the following databases:
    a. CNDDB (CDFW 2016);
    b. AmphibiaWeb (2016);
    c. HerpNet2 (2016)

These data were then compiled and reviewed prior to site assessment surveys.

## 2.2 Site Assessment Surveys

Site assessment surveys were conducted in March, April, and May 2016. During these surveys, each aquatic feature was evaluated for the presence of primary constituent elements (PCE's) and other habitat features outlined by the USFWS (75 FR 12816). PCE's are physical or biological features essential to the conservation of a species and are used to designate critical habitat. Here, they are used to outline the habitat features that are necessary for CRLF. The site assessment surveys for CRLF were based on the PCE's and other habitat features known to be important to the species:

4 The 1-mile (1.6 kilometer) radius is a general guideline recommended by the U.S. Fish and Wildlife Service and is subject to change on a case-by-case basis, as determined through consultation with the Service.

1. Aquatic Breeding Habitat. Standing bodies of fresh water including natural and manmade (e.g., stock) ponds, slow-moving streams or pools within streams, and other ephemeral or permanent water bodies that typically become inundated during winter rains and:
    a. hold water for a minimum of 20 weeks in all but the driest of years;
    b. water must be available during the breeding season, generally from November through April;
    c. standing or slow-moving water at least 2.3 feet (0.7 meters) deep (Hayes and Jennings 1988);
    d. with salinities less than 4.5 parts per thousand (ppt), CRLF embryos are killed by salinities greater than 6 ppt and adults avoid salinities greater than 6.5 ppt (Jennings and Hayes 1990);
    e. and with emergent vegetation such as cattails (*Typha* spp.), bulrushes (*Schoenoplectus* spp.), or overhanging willows (*Salix* spp.) (75 FR 12816, Hayes and Jennings 1988).
2. Aquatic Non-Breeding Habitat. Freshwater pond and stream habitats, as described above, that may not hold water long enough for the species to complete its aquatic life cycle, but which provide for shelter, foraging, predator avoidance, and aquatic dispersal of juvenile and adult CRLF. Other wetland habitats considered to meet these criteria include, but are not limited to: plunge pools within intermittent creeks, seeps, quiet water refugia within streams during high water flows, and springs of sufficient flow to withstand short-term dry periods.
3. Upland Habitat. Upland areas adjacent to or surrounding breeding habitat up to a distance of 1 mile (1.6 kilometers) in most cases (i.e., depending on surrounding landscape and dispersal barriers) including various vegetation types such as grassland, woodland, forest, wetland, or riparian areas that provide shelter, forage, and predator avoidance for the CRLF. Upland features are also essential in that they are needed to maintain the hydrologic, geographic, topographic, ecological, and edaphic features that support and surround the aquatic, wetland, or riparian habitat.

    These upland features contribute to: (1) filling of aquatic, wetland, or riparian habitats; (2) maintaining suitable periods of pool inundation for larval frogs and their food sources; and (3) providing nonbreeding, feeding, and sheltering habitat for juvenile and adult frogs (e.g., shelter, shade, moisture, cooler temperatures, a prey base, foraging opportunities, and areas for predator avoidance). Upland habitat should include structural features such as boulders, rocks and organic debris (e.g., downed trees, logs), small mammal burrows, or moist leaf litter.
4. Dispersal Habitat. Accessible upland or riparian habitat within and between occupied or previously occupied sites that is located within 1 mile (1.6 kilometers) of each other, and that support movement between such sites. Dispersal habitat includes various natural habitats, and altered habitats such as agricultural fields, that do not contain barriers (e.g., heavily traveled roads without bridges or culverts) to dispersal. Dispersal habitat does not include moderate- to high-density urban or industrial developments with large expanses of asphalt or concrete, nor does it include large lakes or reservoirs over 50 acres (20 hectares) in size, or

other areas that do not contain those features identified in PCE 1, 2, or 3 as essential to the conservation of the species.

In addition to the primarily physical characteristics of CRLF habitat described in the PCE's, biologists also assessed the biotic features of each aquatic feature, taking data on general vegetation composition and also any wildlife species observed. Biologists recorded observations of non-native predators, including signal crayfish, mosquito fish (*Gambusia affinis*), and American bullfrogs; and native northern raccoons (*Pyrocon lotor*) and black-crowned night herons (*Nycticorax nycticorax*).

Other native species were noted as well, in particular, Sierran treefrogs (*Pseudacris sierra*), were recorded whenever present since they require some of the same habitat attributes CRLF use. While the Sierran treefrog can survive in a variety of habitats, preferred breeding habitat includes temporary pools with emergent vegetation, similar to CRLF (Morey 2014). This species prefers moist refuges, and will often inhabit wetlands, although they are not restricted to wetland habitats (Morey 2014). However, tadpoles require standing water for the duration of their aquatic development, lasting between one to three months (Morey 2014). Sierran treefrogs also seek cover in burrows, clumps of vegetation, and rotting logs, similar to CRLF (Morey 2014). Although useful in indicating suitable habitat, Sierran treefrogs were not used as a direct proxy for CRLF presence because they are much more of a generalist, requiring a hydroperiod (duration of ponded water) of only about three months. There is also evidence that they are slightly more tolerant of salinity, they have been documented in salinity levels up to 7.2 ppt in the field and can tolerate up to 9.5 ppt in the lab (Hopkins and Brodie 2015).

During the surveys, as required by the USFWS (2005), a "CRLF Habitat Site Assessment Data Sheet" was completed for each aquatic feature identified within the study area. These datasheets are provided in Appendix A and photographs of the surveyed aquatic features and surrounding habitats are provided in Appendix B.

If an aquatic feature was determined to have suitable aquatic breeding and non-breeding habitat, in addition to either upland or dispersal habitat, it was subject to protocol level surveys.

## 2.3 Protocol Level Surveys

Protocol level surveys followed the guidelines outlined in the USFWS's *Revised Guidance on Site Assessments and Field Surveys for the California Red-legged Frog* (USFWS 2005). Based on these guidelines, both breeding and non-breeding surveys took place. At each suitable aquatic feature, biologists conducted a total of two daytime and four nighttime breeding surveys in addition to one daytime and one nighttime nonbreeding survey.

Nighttime surveys were conducted no earlier than one hour after sunset and completed no later than one hour before sunrise. Typically, nighttime surveys were conducted between 9:00 PM and 2:00 AM. Daytime surveys were conducted no earlier than one hour after sunrise and completed no later than one hour before sunset. Typically, daytime surveys were conducted between 7:30 AM and 4:30 PM.

A minimum of two wildlife biologists conducted each survey. At every aquatic feature, surveyors noted all wildlife species, paying special attention to species which may predate CRLF. In addition to wildlife observations, surveyors recorded any natural or man-made barriers to dispersal and indicators of poor habitat quality, such as high levels of urbanization and compromised water quality.

To survey for CRLF, visual-encounter surveys were conducted. Surveyors used binoculars with 8x42 magnification to search banks and shorelines for frogs. During daytime surveys, biologists scanned the banks of aquatic features and where the edge of open water meets emergent vegetation. During nighttime surveys, biologists walked along the shoreline of each aquatic feature holding headlamps or flashlights (rated at approximately 250 lumens) up to eye level and scanning for CRLF and CRLF eye-shine. Weather and visibility conditions were constantly monitored through the duration of each site visit to make sure that conditions were suitable for protocol level CRLF surveys.

# 3 Results.

A review of the results of the desktop analyses, site assessment surveys, and protocol level surveys are provided below. The results are discussed in more detail by aquatic feature in Section 3.4.

## 3.1 Desktop Analysis

The results of the desktop analysis indicate that:

1. According to the USFWS NWI Wetlands Mapper (USFWS 2016), there are 14 aquatic features in the vicinity of the project area (Figure 3-1). These features are within 1-mi (1.6 kilometers) (the dispersal range of CRLF) of the Northern Alignment of the MPWSP.
2. The Carmel River lies inside designated critical habitat unit MNT(Monterey)-2 for CRLF (75 FR 12816; CNDDB 2016). All other aquatic features located within the study are lie outside of designated critical habitat.
3. CRLF occurrences have been reported within 1 mile (1.6 kilometers) of the Salinas River, Tembladero Slough and Carmel River. CRLF occurrence dates at Salinas River were recorded in 2001, 2007, and 2009; at Tembladero Slough in 2001 and 2007; and at Carmel River in 2003. Table 3 lists the 14 aquatic features within 1 mile (1.6 kilometers) of the MPWSP, including the distance and direction of each aquatic feature to its nearest CRLF occurrence for each site.

One of the 14 sites were evaluated using data gathered from the desktop analysis. Eucalyptus Road pond is an artificial, lined, retention basin and was eliminated as potential habitat using the aerial photos. Biologists were not able to survey Legion Way pond and Highway 1 wetland due to fences and restricted access. These two sites were reviewed from aerial photos. All three sites are further discussed in Section 3.4.

## 3.2 Site Assessment Surveys

Site assessment surveys were conducted at 11 of the 14 aquatic features identified during the desktop analysis. Site assessment survey dates are presented in Table 2. Based on the site assessments, seven aquatic features were discounted as having no suitable breeding habitat for CRLF. Five sites (three of which have known, historic CRLF occurrences) have potentially suitable breeding, non-breeding and upland habitat; therefore, CRLF presence was assumed. The two remaining aquatic features were determined to have potentially suitable habitat for breeding CRLF. Protocol-level surveys were conducted at these two sites. A summary of the aquatic features and determinations are shown in Table 3. Results of the site assessment surveys are addressed in more detail in Section 3.4.

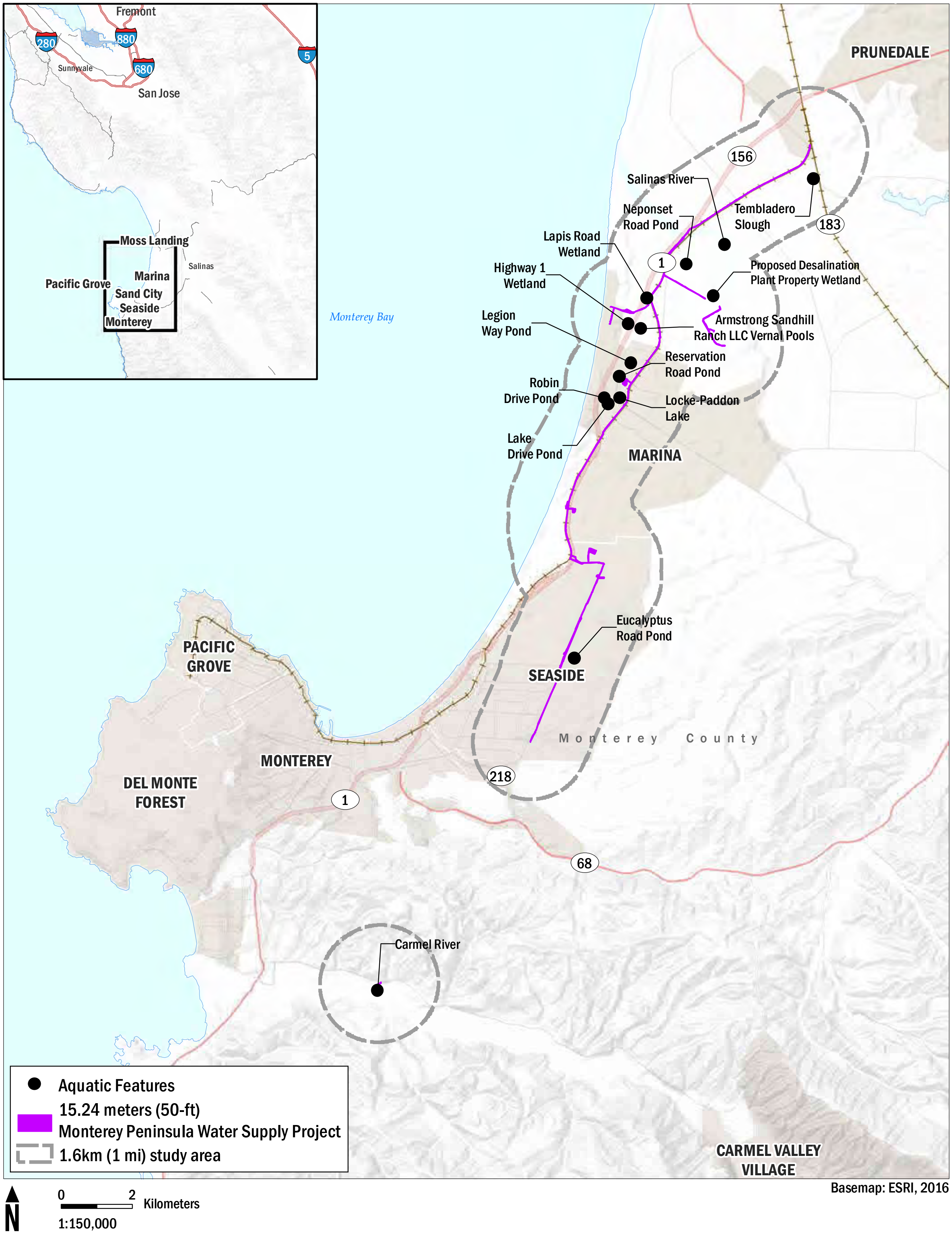


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**FIGURE 3-1**

*Project Vicinity*

**Table 2. Aquatic Features Site Assessment**

| Aquatic Feature | Site Assessment Dates | Site Assessment | Site Surveyed? |
|---|---|---|---|
| Eucalyptus Road pond | Not Available (N/A) | Sufficient habitat PCEs not present | Eliminated due to lack of habitat |
| Robin Drive pond | April 28, 2016 | Sufficient habitat PCEs not present | Eliminated due to lack of habitat |
| Lake Drive pond | April 28, 2016 | Sufficient habitat PCEs not present | Eliminated due to lack of habitat |
| Locke-Paddon Lake | March 14, 2016 | Suitable habitat present | Protocol-level surveys conducted |
| Reservation Road pond | May 23, 2016 | Suitable habitat present | Protocol-level surveys conducted |
| Legion Way pond | N/A | Sufficient habitat PCEs not present | Eliminated due to lack of habitat |
| Armstrong Sandhill Ranch LLC vernal pools | May 23, 2016 | Sufficient habitat PCEs not present | Eliminated due to lack of habitat |
| Highway 1 wetland | N/A | Sufficient habitat PCEs not present | Eliminated due to lack of habitat |
| Lapis Road wetland | May 23, 2016 | Sufficient habitat PCEs not present | Eliminated due to lack of habitat |
| Neponset Road pond | May 23, 2016 | Suitable habitat present | Assuming presence of CRLF |
| Desalination Plant | April 25, 2016 | Suitable habitat present | Assuming presence of CRLF |
| Salinas River | April 25, 2016 | Suitable habitat present | Assuming presence of CRLF |
| Tembladero Slough | April 25, 2016 | Suitable habitat present | Assuming presence of CRLF |
| Carmel River | May 23, 2016 | Suitable habitat present | Assumed presence of CRLF |

**Table 3. Aquatic features within 1 mile (1.6 kilometers) of the MPWSP**

| Feature | Feature Type1 | Municipality | Nearest Critical Habitat | Nearest CRLF Occurrence |
|---|---|---|---|---|
| Eucalyptus Road pond | Retention basin | Marina | 4.3 miles (6.8 kilometers) SW | 4.3 miles (6.8 kilometers) SW |
| Robin Drive pond | Tidal Marsh | Marina | 8.8 miles (14.2 kilometers) SW | 3.3 miles (5.3 kilometers) NE |
| Lake Drive pond | Pond/lacustrine | Marina | 8.7 miles (14 kilometers) SW | 3.3. miles (5.3 kilometers) NE |
| Locke-Paddon Lake | Lake/lacustrine | Marina | 8.8 miles (14.2 kilometers) SW | 3 miles (4.8 kilometers) NE |
| Reservation Road pond | Pond/lacustrine | Marina | 8.8 miles (14.2 kilometers) NE | 3 miles (4.7 kilometers) NE |
| Legion Way pond | Pond/lacustrine | Marina | 14.7miles (8.5 kilometers W | 2.7 miles (4.3 kilometers) NE |
| Armstrong Sandhill Ranch LLC vernal pools | Vernal Pool | Unincorporated Monterey County | 7.9 miles )12.7 kilometers) NE | 2.3 miles (3.7 kilometers) E |
| Highway 1 wetland | Wetland/palustrine | Unincorporated Monterey County | 7.9 miles (12.7 kilometers) NE | 2.6 miles (4.2 kilometers) E |
| Lapis Road wetland | Wetland/palustrine | Unincorporated Monterey County | 11.9 miles (7.4 kilometers) NE | 2.4 miles (3.8 kilometers) N |
| Neponset Road pond | Pond/lacustrine | Unincorporated Monterey County | 6.5 miles (10.5 kilometers) NE | 1.7 miles (2.7 kilometers) N |
| Desalination Plant Wetland | Wetland/palustrine | Unincorporated Monterey County | 6.9 miles (11.2 kilometers) NE | 1.1 miles (1.77 kilometers) SE |
| Salinas River | Stream/riverine | Unincorporated Monterey County | 5.8 miles (9.4 kilometers) NE | 0.4 miles (0.7 kilometers) SE |
| Tembladero Slough | Stream/riverine | Unincorporated Monterey County | 4.2 miles (6.7 kilometers) NE | 0 miles (0 kilometers) |
| Carmel River | Stream/riverine | Unincorporated Monterey County | In critical habitat | 0.01 miles (0.2 kilometers W |

[1] Feature types are based on Wetland Type in NWI (USFWS 2016).

## 3.3 Protocol Level Survey

Biologists conducted protocol-level surveys at Locke-Paddon and Reservation Road pond. Protocol level breeding surveys were conducted in the months of May and June. Two non-breeding season surveys were conducted in September 2016 (Table 4). Protocol level surveys were negative; no CRLF were found at either of the two sites.

**Table 4. Surveys Conducted**

| | Aquatic Feature | |
|---|---|---|
| Survey Type | Locke-Paddon | Reservation Road pond |
| Habitat assessment | March 24, 2016 | May 23, 2016 |
| Breeding Day Survey 1 | May 23, 2016 | May 23, 2016 |
| Breeding Day Survey 2 | June 15, 2016 | June 15, 2016 |
| Breeding Night Survey 1 | May 23, 2016 | May 31, 2016 |
| Breeding Night Survey 2 | May 31, 2016 | June 15, 2016 |
| Breeding Night Survey 3 | June 15, 2016 | June 24, 2016 |
| Breeding Night Survey 4 | June 24, 2016 | June 27, 2016 |
| Non-Breeding Day Survey 1 | September 20, 2016 | September 20, 2016 |
| Non-Breeding Night Survey 1 | September 21, 2016 | September 21, 2016 |

## 3.4 Survey Results by Aquatic Feature

This section provides a site-by-site discussion of the desktop analysis and survey results. The habitat of each site is described, followed by a brief summary of results. From the data collected, AECOM biologists then made a determination whether the aquatic feature is likely to support CRLF that could reasonably disperse through the MPWSP.

### 3.4.1 Eucalyptus Road Pond

**Habitat**

Eucalyptus Road pond is located in Seaside, immediately east of General Jim Moore Boulevard and the Seaside Middle School. Eucalyptus Road pond is part of the CAW Seaside Groundwater Basin ASR. Water is injected and extracted into the Eucalyptus Road pond between the months of December and May for use during dry periods (CAW customer service representative, personal communication, November 2, 2016). Eucalyptus Road pond is surrounded by scrub and woodland habitats, growing on sandy soils in maritime chaparrals, dominated by woolly-leaf manzanita (*Arctostaphylos tomentosa*) and the rare sandmat manzanita (*Arctostaphylos pumila*). This pond is a retention basin that lacks a natural bank and has no vegetation. A habitat map for Eucalyptus Road pond can be viewed in Appendix D.

**Proximity to the MPWSP**

Eucalyptus Road pond is approximately 0.18 miles (0.3 kilometers) from the MPWSP where it follows General Jim Moore Boulevard in Seaside.

### Previous Occurrences
No previous occurrences for CRLF are documented within 1 mile (1.6 kilometers) of Eucalyptus Road pond (Figure 3-2).

### Species Observed
Eucalyptus Road pond was not accessible, so this site was surveyed using desktop analysis and aerial imagery.

### Suitability for CRLF
Based on the PCE requirements outlined in Section 2.2, Eucalyptus Road pond does not have suitable habitat for CRLF. A description of the factors used to eliminate it from the need for protocol level surveys is below.

**(1) Aquatic Breeding Habitat.**

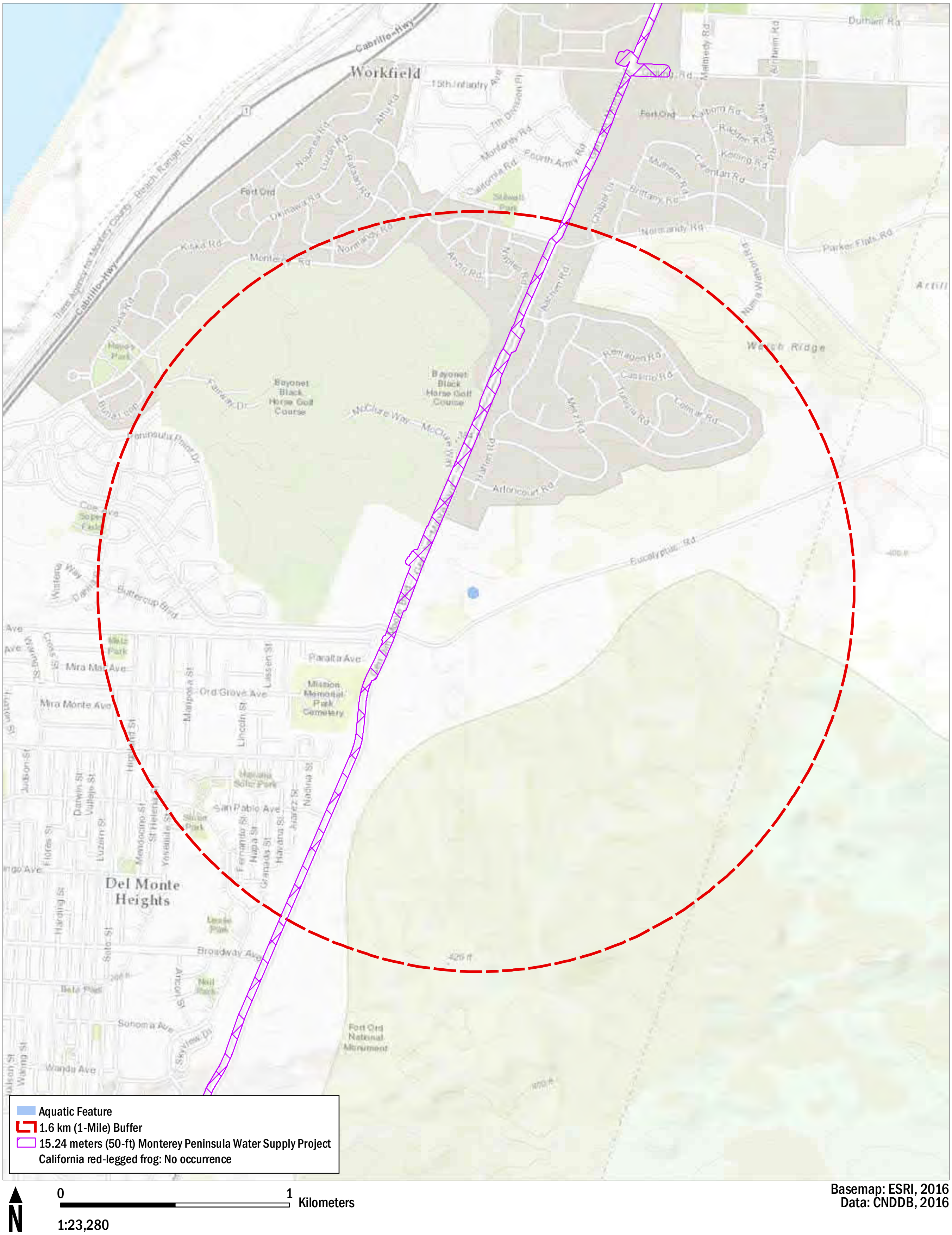
CAW injects Eucalyptus Road pond with water to store for use during the dry season between the months of December to May; therefore Eucalyptus Road pond does hold water for more than 20 weeks during the breeding season. The pond is highly-modified man-made, cement, retention basin that is used for irrigation. It has no emergent vegetation, no natural banks or shore, and is maintained regularly by CAW staff. This retention basin does not provide suitable CRLF breeding habitat.

**(2) Aquatic Non-Breeding Habitat.**

Eucalyptus Road pond does not contain suitable aquatic non-breeding habitat. All though it does not dry, it is a small, man-made basin with no banks or shoreline, and contains no backwaters. The pond does not contain vegetation that could provide refugia, shelter, foraging opportunities, or predator avoidance for juveniles, or adult CRLF.

**(3) Upland Habitat.**

Upland habitat surrounding Eucalyptus Road pond is marginally suitable beyond the modified edge of the retention basin. The habitat includes oak woodland and maritime chaparral communities occurring on stabilized dunes. Burrows are scarce within these loose soils, but some occur. Very little foraging habitat would be available to juvenile or metamorph frogs, as there is no moist bank or shoreline that would host a productive food source. Little moisture would be retained on these exposed, sandy soils surrounding the pond. Organic debris and rocks are present, but scarce.




Basemap: ESRI, 2016
Data: CNDDB, 2016

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**FIGURE 3-2**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Eucalyptus Road Pond*

**(4) Dispersal Habitat.**

There are no major barriers preventing movement into the marginally suitable upland habitat surrounding Eucalyptus Road pond. To the east, frogs could potentially disperse into miles of undisturbed oak woodland and maritime chaparral. To the west, frogs would only need to cross one barrier, General Jim Moore Boulevard, before reaching the Bayonet and Black Horse golf courses which could facilitate dispersal into strips of upland open space along their western edge. However, this dispersal habitat does not connect to other potential CRLF sites within 1 mile (1.6 kilometer) of Eucalyptus Road pond. Even if this site held a CRLF population, it would be isolated and unlikely to persist.

**Conclusion**

Lack of suitable aquatic breeding, aquatic non-breeding, and dispersal habitat to other CRLF sites preclude Eucalyptus Road pond from further surveys. It is highly unlikely that CRLF would disperse from Eucalyptus Road pond to any portion of the MPWSP.

### 3.4.2 Robin Drive Pond

**Habitat**

Robin Drive pond is surrounded on the north, east and south by urban development in Marina. The landscape around the housing is highly modified and is composed of lawns and landscape plantings, and limits the dispersal of CRLF. To the west is Highway 1 and the Marina dunes, which are dune habitat dominated by silver dune lupine (*Lupinus chamissonis*), coastal sagewort (*Artemisia pycnocephala*), mock heather (*Ericameria ericoides*), ice plant (*Carpobrotus edulis*), and other dune vegetation. The upland habitat immediately surrounding the pond is primarily composed of ice plant mat, coyote brush, and patches of Monterey cypress (*Hesperocyparis macrocarpa*).

Wetland vegetation is principally composed of saline emergent wetland dominated by marsh jaumea (*Jaumea carnosa*), pickleweed (*Salicornia pacifica*), and rushes (*Juncus* spp.). Some California bulrush (*Schoenoplectus californicus*) and cattail are also present on the pond margins. The presence of pickleweed suggests that the pond is saline. A habitat map for Robin Drive pond can be viewed in Appendix D.

**Proximity to the MPWSP**

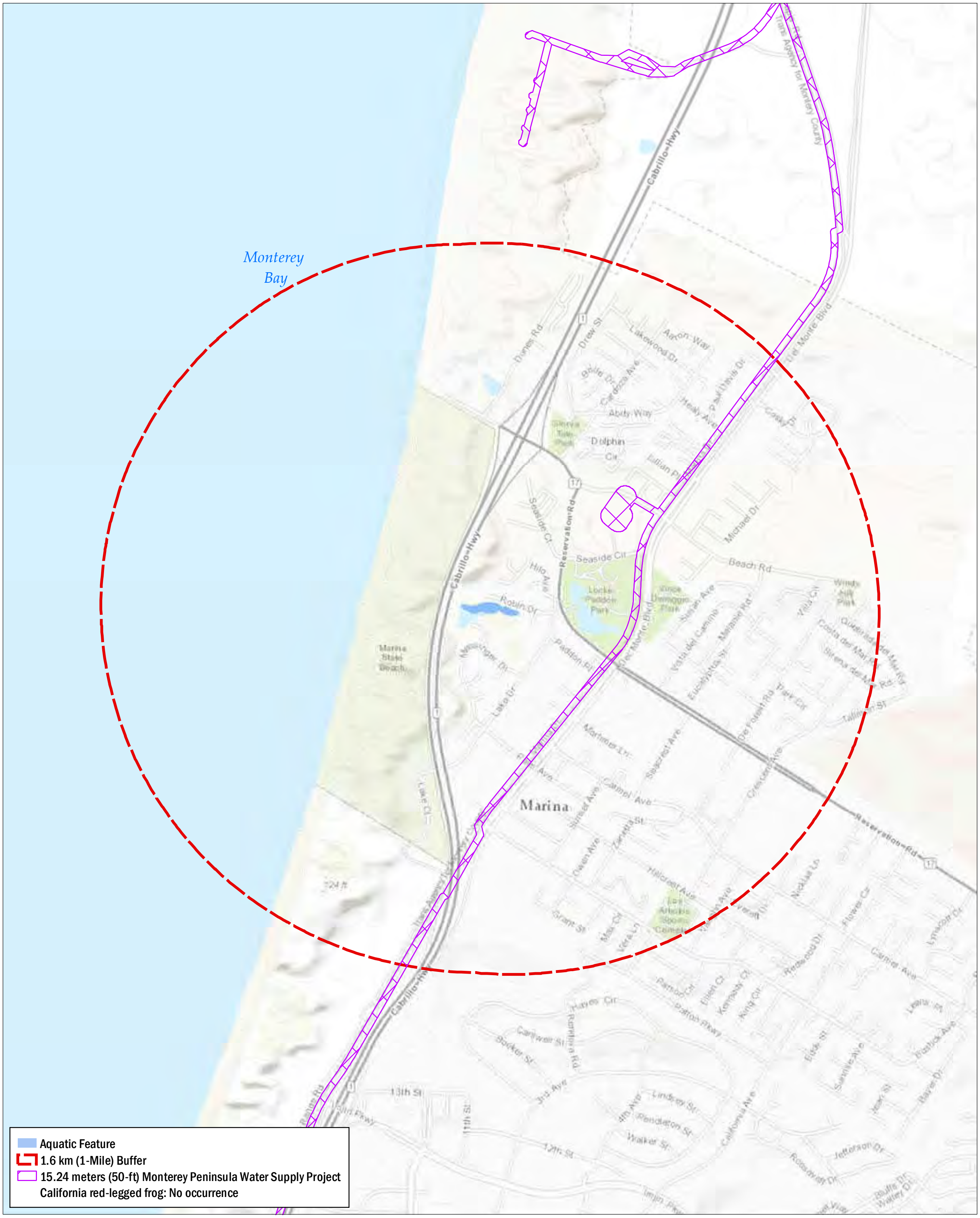
The Robin Drive pond is approximately 0.3 miles (0.5 kilometers) northwest of the MPWSP where it follows old railroad tracks adjacent to Del Monte Boulevard through Marina.

**Previous Occurrences**

No previous occurrences for CRLF are documented within a 1 mile (1.6 kilometers) radius of Robin Drive pond (Figure 3-3).

**Species Observed**

During a site assessment survey conducted at Robin Drive pond on April 28, 2016, native bird species such as herons and egrets, which prey upon CRLF, were observed.

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Basemap: ESRI, 2016
Data: CNDDB, 2016

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**FIGURE 3-3**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Robin Drive Pond*

### Suitability for CRLF

Based on the PCE requirements outlined in Section 2.2, Robin Drive pond does not have the potential to sustain a population of CRLF. A description of the factors used to eliminate it from the need for further surveys is below.

**(1) Aquatic Breeding Habitat.**

Based on the PCE requirements, aquatic breeding habitat is suitable, potentially holding water for more than 20 weeks in some years. In 2014, Robin Drive pond appeared to be dry for all but the wettest two months based on observations during 2014 botanical surveys for the MPWSP. During the 2016 surveys, Robin Drive pond contained water until April. In some years, the pond may hold water for a suitable hydroperiod. However, the majority of the native vegetation growing at Robin Drive pond is pickleweed and marsh jaumea. Pickleweed is typically a dominant species growing in salinities of 10 ppt (Josselyn 1983) to 90 ppt (Lewis 2000). Marsh jaumea is reported to grow best at a salinity of 9 ppt, and tolerate up to 39 ppt (Hutchinson 1988). Though the water was not tested, the dominance of these species suggest that the salinity within Robin Drive pond is, at minimum, 9 or 10 ppt, which exceeds the 6.5 ppt salinity tolerance of the CRLF described by Jennings and Hayes (1990) and the 4.5 ppt used by the PCE's to identify aquatic breeding habitat.

**(2) Aquatic Non-Breeding Habitat.**

If water salinity does not exceed 6.5 ppt, the size and extent of the Robin Drive pond could provide aquatic non-breeding habitat for CRLF. Vegetation within the pond could potentially provide shelter, foraging, and predator avoidance. However, due to the likelihood that salinity is greater than 6.5 ppt, aquatic non-breeding habitat is unlikely to be present.

**(3) Upland Habitat.**

Upland areas adjacent to or surrounding Robin Drive pond include marginal upland habitat. Dune vegetation is present along a strip west of the wetland, stretching 0.25 miles (0.4 kilometers) to the north and 0.75 miles (1.2 kilometers) to the south, paralleling Highway 1. Although this strip does not contain grassland, woodland, forest, wetland, or riparian areas, dune habitats are frequently used by CRLF in Point Reyes, California (Kleeman et al. 2016) and may also provide the necessary shelter, forage, and predator avoidance to support a population of CRLF near Monterey Bay. To the east and south, the majority of upland features include sidewalks, housing, and roads.

**(4) Dispersal Habitat.**

There is suitable dispersal habitat between Robin Drive pond and Lake Drive pond. Lake Drive pond is not highly suitable CRLF habitat (see Section 3.5). Locke Paddon and other aquatic features are within dispersal distance, but frogs traveling between Robin Drive pond and these features would need to cross residential housing and roads.

### Conclusion

Robin Drive pond is unlikely to support CRLF; there is good evidence that salinity is too high for CRLF tolerance, and there are major barriers to dispersal from the pond to other aquatic habitats. Protocol level surveys were not conducted. The pond is not expected to support CRLF that could disperse to any portion of the MPWSP.

### 3.4.3 Lake Drive Pond

**Habitat**
The Lake Drive pond is adjacent to the Robin Drive pond to the south but separated by a fence. The upland habitat is composed of coyote brush, mock heather (*Ericameria ericoides*), and ice plant on degraded dunes. East, south and west of the pond are urban developments composed of roads, houses, lawns, and landscape plantings. The upland habitat immediately surrounding the pond is primarily comprised of ice plant, coyote brush, and patches of Monterey cypress. However, only California bulrush and cattail could be confirmed to be present from the only on-foot vantage point. A habitat map for Lake Drive pond can be viewed in Appendix D.

**Proximity to the MPWSP**
The Lake Drive pond is approximately 0.22 miles (0.35 kilometers) northwest of the MPWSP where it follows old railroad tracks adjacent to Del Monte Boulevard through Marina.

**Previous Occurrences**
No previous occurrences for CRLF are documented within 1 mile (1.6 kilometers) of Lake Drive pond (Figure 3-4).

**Species Observed**
Site assessment surveys were conducted on April 28, 2016 and September 20, 2016. During the April survey, a heron was observed flying overhead at the Lake Drive pond.

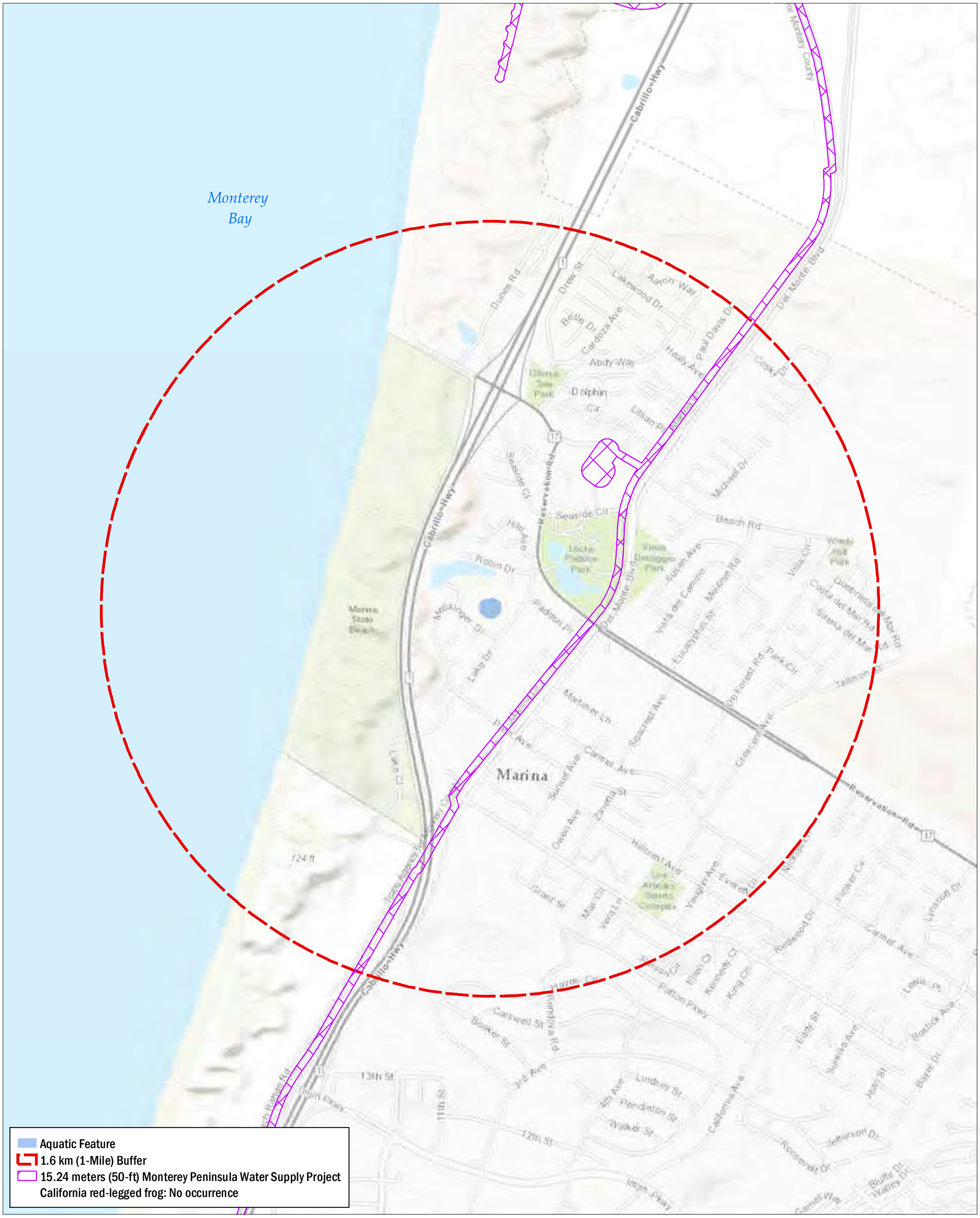
**Suitability for CRLF**
Based on the PCE requirements outlined in Section 2.2, it is very unlikely that Lake Drive pond would provide habitat for CRLF. A description of the factors used to eliminate it from further protocol level surveys is below.

**(1) Aquatic Breeding Habitat.**

Based on the PCE requirements, Lake Drive pond has the potential to have suitable aquatic breeding habitat. It was observed to hold water for more than 20 weeks, retaining standing water into April. Ample vegetation is present within the pond. Although access constraints inhibited surveyors from testing the salinity of the water, the pond likely does not share the same saline qualities as adjacent Robin Drive pond. The only vegetation readily identifiable from the one on-foot vantage point included California bulrush and cattail, the latter not identified to species. Both narrowleaf cattail (*Typha angustifolia*) and broadleaf cattail (*Typha latifolia*) occur in the vicinity of the MPWSP. The former can tolerate salinities of 15-30 ppt, but broadleaf cattail tolerates less than 1 ppt (Crites et al. 2014) and California bulrush tolerates salinities of 0-5 ppt (Neill 2007). Therefore, it may be assumed that Lake Drive pond falls within the salinity tolerance of CRLF.

**(2) Aquatic Non-Breeding Habitat.**

Lake Drive pond could provide potential aquatic non-breeding habitat for CRLF. The pond's vegetated banks could provide shelter, foraging, and predator avoidance for CRLF juveniles and adults.

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Basemap: ESRI, 2016
Data: CNDDB, 2016

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**FIGURE 3-4**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Lake Drive Pond*

**(3) Upland Habitat.**

Upland areas adjacent to or surrounding Lake Drive pond are limited and enclosed by fences. However, there is some dune habitat and ice plant mats, landscaped trees, and ruderal habitats that could provide shelter. No burrows were observed from the distance that the pond was surveyed, but they could be present.

**(4) Dispersal Habitat.**

The only dispersal habitat connecting to another aquatic site is between Lake Drive pond and Robin Drive pond, consisting of dune habitats. Other aquatic features, such as Locke Paddon, are within the dispersal distance, but frogs moving from Lake Drive pond to other sites would need to cross roads and residential areas. There is no woodland, riparian, or grassland areas to facilitate dispersal to the MPWSP and no accessible upland or riparian habitat connecting Lake Drive pond to other potentially suitable habitats.

**Conclusion**

Lake Drive pond does have a potentially suitable hydroperiod and salinity may be within CRLF tolerances. However, upland habitat may be limited and there are major barriers to dispersal. Based on the questionable suitability for CRLF habitat at the neighboring Robin Drive pond; lack of dispersal habitat to other aquatic features, such as Locke Paddon; and the high level of urbanization in the area; it is unlikely that CRLF use Lake Drive pond as habitat, though it cannot be ruled out. No protocol level surveys were conducted at this feature due to lack of access. It is highly unlikely that Lake Drive Pond would provide a source of CRLF to any portion of the MPWSP.

### 3.4.4 Locke-Paddon Park

**Habitat**

Locke-Paddon Park is a large freshwater reservoir contiguous with an urban greenbelt within the city of Marina. The undeveloped habitats surrounding Locke-Paddon Lake consist of natural or naturalized freshwater emergent wetland vegetation, valley-foothill riparian, coastal scrub, and ruderal habitats. Areas which are clearly planted include an oak restoration area, Monterey Cypress, coastal dune scrub species within planting islands, and urban park landscaping.

Aquatic habitats associated with Locke-Paddon Lake include open water, native willow thickets, and California bulrush marsh. Native willow thickets occur principally along the southern and western edge of the lake. Mugwort (*Artemisia douglasiana*), California blackberry, Pacific silverweed (*Potentilla anserina*), stinging nettle (*Urtica dioica*), hedgenettle (*Stachys* spp.), ferns, and other riparian species form a dense, often nearly-impenetrable understory. California bulrush dominates the shallow areas of Locke–Paddon Lake, forming a thick, monotypic fringe around the lake, that in later months of the year, nearly equals the area of open water. Due to the thick vegetation, biologists were unable to survey much of the interface between the open water and the edge of emergent vegetation, where frogs are often observed. However, there were some areas which could be accessed by boardwalks or openings in vegetation; biologists surveyed from these vantage points during the site assessment and all protocol level surveys. A habitat map for Locke-Paddon can be viewed in Appendix D.

### Proximity to the MPWSP

The MPWSP intersects the southern end of Locke-Paddon Lake, where the project follows old railroad tracks adjacent to Del Monte Boulevard through Marina. The MPWSP overlaps the wetland edge and upland habitats on the southeastern margin of the lake, including arroyo willow (*Salix lasiolepis*) thickets and ice plant mats, for 100 feet (30.5 meters). Potential dispersal or upland habitats associated with Locke-Paddon intersect with the MPWSP along the eastern edge of Locke-Paddon Park.

### Previous Occurrences

No previous occurrences for CRLF are documented within 1 mile (1.6 kilometers) of Locke-Paddon (Figure 3-5).

### Species Observed

During the site assessment survey conducted at Locke-Paddon Lake on March 14, 2016 many bird species were observed, including rock pigeons (*Columba livia*), gulls (*Larus* spp.), mallards (*Anas platyrhynchos*), American crows (*Corvus brachyrhynchos*), red-winged blackbirds (*Agelaius phoeniceus*), and song sparrows (*Melospiza melodia*). There were also abundant Sierran treefrogs observed during some of the protocol level surveys which were conducted on April 25, May 24, May 31, June 15, June 24, September 19, and September 21 of 2016. During the protocol level surveys there were also non-native predators observed, including mosquito fish, signal crayfish, and fish; biologists also observed a couple native predators; a raccoon and a Virginia Opossum (*Didelphis virginiana*).

### Suitability for CRLF

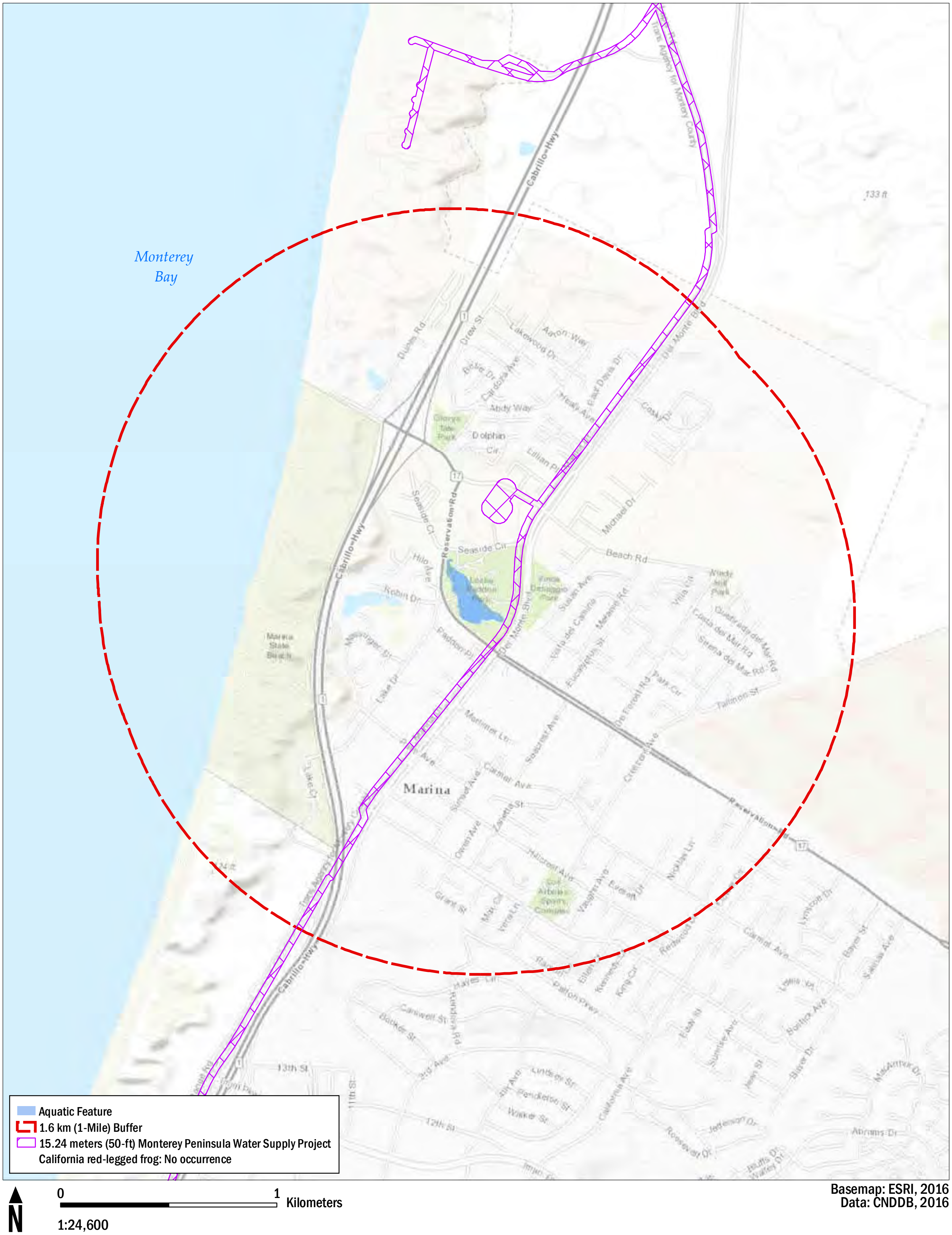
Based on the PCE requirements outlined in Section 2.2, Locke-Paddon was found to have PCE's suitable for sustaining a population of CRLF, with the exception of dispersal habitat allowing movement between CRLF sites.

#### (1) Aquatic Breeding Habitat.

Based on the PCE requirements, aquatic breeding habitat is suitable, holding water for more than 20 weeks. Locke-Paddon is a permanent water source, and emergent vegetation growing in it appears to be healthy and native. No salinity readings were taken from the pond, but the presence of Sierran treefrogs demonstrates that it supports a breeding population of native amphibians. However, the presence of predators including mosquito fish, crayfish, and non-native fish pose a threat to egg masses, tadpoles, and juvenile frogs.

#### (2) Aquatic Non-Breeding Habitat.

The size and extent of Locke-Paddon could provide aquatic non-breeding habitat for CRLF. Marsh vegetation, culverts, and shaded banks within Locke-Paddon could provide shelter, foraging, predator avoidance, and aquatic dispersal for juveniles, and non-breeding adults. However, aquatic predators could affect the survival of a CRLF population here.




Basemap: ESRI, 2016
Data: CNDDB, 2016

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**FIGURE 3-5**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Locke-Paddon Lake*

**(3) Upland Habitat.**

Upland habitat surrounds the park, but is most suitable along the north side of Locke-Paddon Lake. There are numerous gopher burrows for aestivation; furthermore, the drying shoreline leaves extensive patches of moist soil beneath a canopy of living and dead bulrush, in which CRLF could easily aestivate.

**(4) Dispersal Habitat.**

Locke Paddon is very isolated within a densely populated urban area. There are no dispersal corridors from this site to potential CRLF habitat within 1 mile (1.6 kilometers), though other aquatic features are present within the dispersal distance. There are major barriers to dispersal in the form of busy streets, such as Reservation Road and Del Monte Boulevard, and housing developments.

#### Conclusion

Although suitable aquatic breeding and non-breeding, and limited upland habitat exist for CRLF at Locke-Paddon, there are urban barriers to dispersal preventing connection of this site to another potential CRLF site. The presence of non-native fish, crayfish, and the degraded conditions due to extensive urbanization would make a persistent CRLF population at Locke-Paddon Park doubtful. Additionally, no CRLF were observed during protocol-level surveys. Therefore, it is unlikely that Locke-Paddon park supports CRLF that could be affected by construction on the MPWSP.

### 3.4.5 Reservation Road Pond

#### Habitat

Reservation Road pond is surrounded by Reservation Road to the southwest, Beach Road to the south, and a suburban development to the north, which is separated by a strip of Monterey cypress plantings up on a vertical retention wall. These areas are heavily trafficked and act as a dispersal barrier to CRLF. The upland habitat surrounding the pond is highly disturbed and dominated by ice plant and forbs such as sweetclover (*Melilotus albus*) and non-native annual grasses. Scattered native shrubs, such as coyote brush and Christmas berry (*Heteromeles arbutifolia*), also occur in the upland habitat. The immediate pond margin is primarily composed of a ring of valley-foothill riparian dominated by willow thickets. Within the pond, stands of California bulrush compose freshwater emergent wetland. Pickleweed and salt grass (*Distichlis spicata*) also occur on the pond margin, indicating some salinity. A sign on the bank warns visitors not to make contact with the water due to high bacteria count. A habitat map for Reservation Road pond can be viewed in Appendix D.

#### Proximity to the MPWSP

The Reservation Road pond is approximately 0.1 miles (0.17 kilometers) west of the MPWSP where there is a proposed staging area in a Walmart parking lot west of Del Monte Boulevard.

#### Previous Occurrences

No previous occurrences for CRLF are documented within 1 mile (1.6 kilometers) of Reservation Road pond (Figure 3-6).

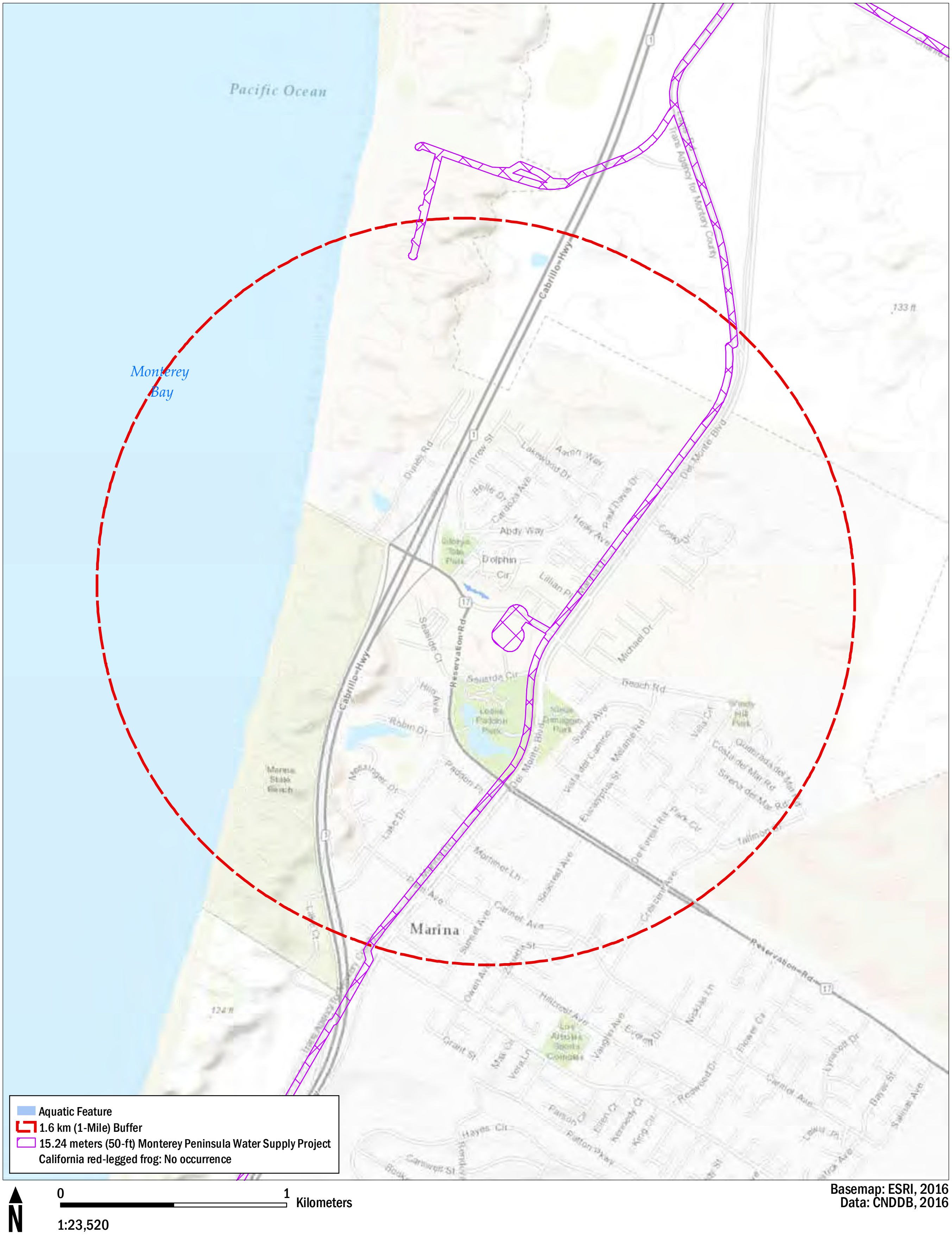


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**FIGURE 3-6**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Reservation Road Pond*

### Species Observed

A site assessment was done on May 23, 2016 and no species were observed. Protocol level surveys were conducted at Reservation Road pond on May 23, May 31, June 15, June 24, June 27, September 19, and September 21of 2016. During these surveys, it was observed that signal crayfish and mosquito fish were very abundant, occurring at least 0.5-1 per square meter (per 10.8 square feet). Sierran treefrogs were observed at Reservation Road pond.

### Suitability for CRLF

Based on the PCE requirements outlined in Section 2.2, Reservation Road pond was found to have suitable breeding, aquatic non-breeding, and upland habitat for CRLF, but is missing the necessary dispersal habitat connecting to another potential CRLF site.

#### (1) Aquatic Breeding Habitat.

Reservation Road pond is small but contains water year-round. Based on the PCE requirements this pond has a suitable hydroperiod, holding water for more than 20 weeks. Reservation Road pond is a permanent water source and emergent vegetation growing in it appears to be healthy and native. Pickleweed and saltgrass grow on the margins of the pond, indicating water salinity of levels that may be above CRLF tolerance (approximately 6.5 ppt). Pickleweed is typically a dominant species growing in salinities of 10 ppt (Josselyn 1983) to 90 ppt (Lewis 2000). Sierran treefrogs persist, though there is evidence that their salinity tolerances are more broad; they can tolerate up to 9.5 ppt in the lab (Hopkins and Brodie 2015). Competition with non-native signal crayfish and mosquito fish may make it difficult for CRLF to successfully breed.

#### (2) Aquatic Non-Breeding Habitat.

CRLF juveniles and adults would be able to disperse into shallower water or vegetated areas after breeding. In spite of the presence of refugia, such as dense vegetation, the abundance of predators including signal crayfish and mosquito fish could keep CRLF from persisting here. If this water is saline, this would also make it unlikely as aquatic non-breeding habitat for CRLF.

#### (3) Upland Habitat.

Upland habitat is marginal at Reservation Road pond, limited to a ruderal or landscaped perimeter no wider than the pond itself on either side. To the north, residential housing and a retention wall encroaches and to the south are Reservation and Beach roads. The narrow upland habitat does contain numerous rodent burrows, rocks, cement blocks, and deep leaf litter in an oak and willow understory where CRLF could aestivate.

#### (4) Dispersal Habitat.

There is no accessible upland or riparian habitat linking Reservation Road pond to previously occupied CRLF sites within 1 mile (1.6 kilometers). There is a small segment of suitable upland habitat adjacent to Reservation Road pond, but it does not connect to other potential CRLF sites. There are other aquatic features within the dispersal distance, but urban barriers to dispersal include major roads such as Reservation Road, residential areas, and the retention wall on the north bank of the pond.

### Conclusion

Although potentially suitable aquatic breeding and non-breeding habitat, as well as marginal upland habitat exist for CRLF at Reservation Road pond, there is no dispersal habitat connecting to other potential CRLF sites. The abundance of signal crayfish and mosquitofish, the presence of pickleweed indicating a potentially saline environment, the limited dispersal habitat, and the restrictive urban surroundings make the presence of CRLF doubtful. Additionally, no CRLF were observed during protocol level surveys. It is unlikely that Reservation Road pond provides a source population for CRLF that could be affected by construction on this project.

## 3.4.6 Legion Way Pond

### Habitat

Legion Way pond is located at the northern end of the City of Marina near the end of Legion Way. It is bounded by urban development on all sides. This is a highly modified landscape composed of roads, buildings, and landscaped vegetation. A vacant lot exists adjacent to Legion Way pond. The pond margin is edged with California bulrush marsh, while the coyote brush scrub and willow dominate the adjacent upland habitat. Several coast live oaks (*Quercus agrifolia*) and Monterey cypresses are scattered throughout. A habitat map for Legion Way pond can be viewed in Appendix D.

### Proximity to the MPWSP

The Legion Way pond is approximately 0.19 miles (0.3 kilometers) west of the MPWSP where it follows Del Monte Boulevard in Marina.

### Previous Occurrences

No previous occurrences for CRLF are documented within 1 mile (1.6 kilometers) of Legion Way pond (Figure 3-7).

### Species Observed

Legion Way pond was not accessible, so this site was surveyed using desktop analysis and aerial imagery.

### Suitability for CRLF

Based on the PCE requirements outlined in Section 2.2, Legion Way pond likely does not have suitable habitat for CRLF. Protocol level surveys were not conducted due to restricted access.

**(1) Aquatic Breeding Habitat.**

Access to this site was limited due to private property and a visual assessment was limited by thick vegetation surrounding the pond. Therefore it is unknown whether or not the pond contained water during site assessment. It is undetermined whether or not Legion Way pond would provide suitable aquatic breeding habitat for CRLF.

**(2) Aquatic Non-Breeding Habitat.**

If water conditions are favorable, Legion Way pond could provide aquatic non-breeding habitat for juvenile and adult CRLF.

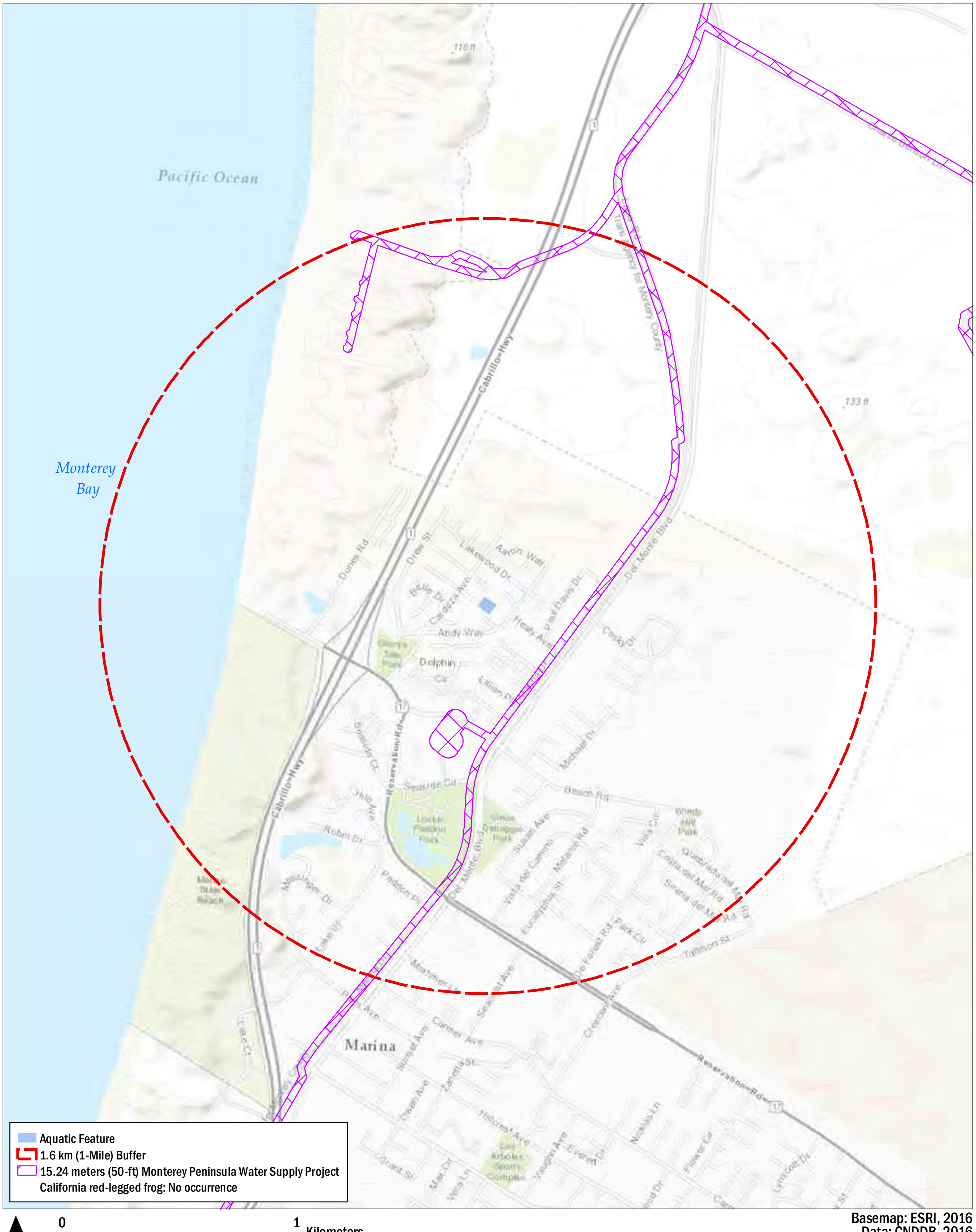


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**FIGURE 3-7**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Legion Way Pond*

**(3) Upland Habitat.**

Upland areas adjacent to or surrounding Legion Way pond is limited but there is a small margin of scrub and woodland that could provide shelter, forage, and predator avoidance for CRLF. A narrow vegetated band surrounds the pond, and a grassy vacant lot to the northeast of Legion Way pond could serve as marginally suitable upland habitat, and potentially provide structural features that CRLF use for cover and foraging.

**(4) Dispersal Habitat.**

There is limited dispersal habitat existing at Legion Way pond, providing a narrow and indirect route to a site southwest of the pond, which could serve as another potential CRLF site. Apart from this, there is no dispersal habitat connecting to potential CRLF sites, and there are many urban barriers consisting of parking lots and residential housing.

#### Conclusion

Due to limited access, biologists were unable to collect enough data to eliminate Legion Way pond as CRLF habitat. From aerial assessments alone, it appears that there is an aquatic feature with limited upland habitat and potential dispersal to one other aquatic feature. Despite this, it is unlikely that Legion Way pond supports CRLF, the pond is surrounded by homes and asphalt roads: frogs would be threatened by low water quality, predation by dogs and cats, and isolation and inbreeding. Any frogs dispersing to the MPWSP would be susceptible to vehicle strikes and desiccation on exposed sidewalks and roads.

### 3.4.7 Armstrong Sandhill Ranch LLC Vernal Pools

#### Habitat

Armstrong Sandhill Ranch LLC vernal pools are located within a grazed pasture north of the City of Marina, between Highway 1 and Lapis Road. The pasture is California annual grassland habitat that is kept short due to grazing. Vegetation communities surrounding the pasture include coyote brush scrub, ice plant mats, mock heather scrub, and other dune and coastal scrub vegetation. There is a high density of California ground squirrel (*Otospermophilus beechevi*) burrows in this area. A habitat map for Armstrong Sandhill Ranch LLC vernal pools can be viewed in Appendix D.

#### Previous Occurrences

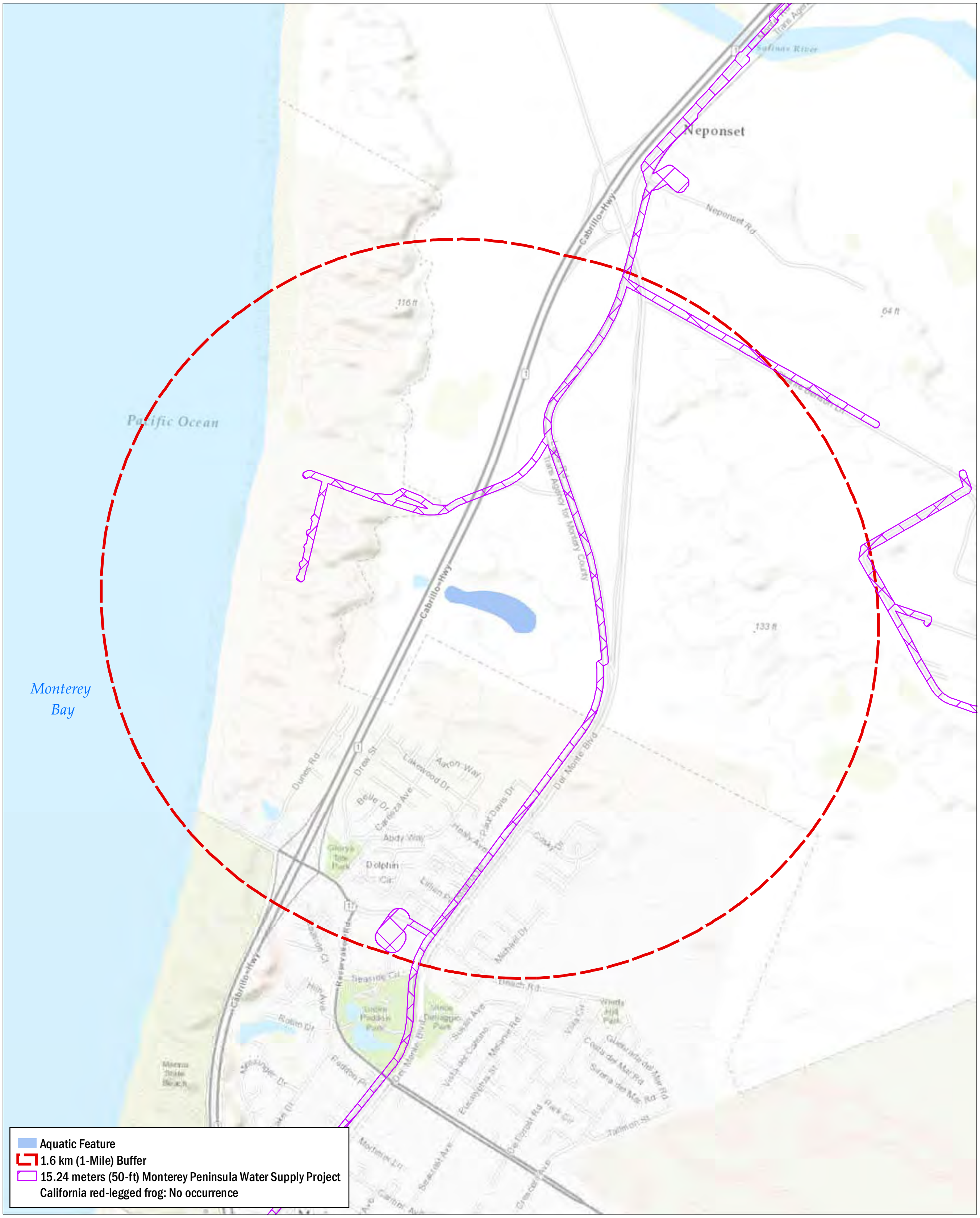
No previous occurrences for CRLF are documented within 1 mile (1.6 kilometers) of Armstrong Sandhill Ranch LLC vernal pools (Figure 3-8).

#### Proximity to the MPWSP

The Armstrong Sandhill Ranch LLC vernal pools are approximately 0.03 miles (0.5 kilometers) west of the MPWSP where they follow Lapis Road north of Marina.

#### Species Observed

A site assessment survey of Armstrong Sandhill Ranch LLC vernal pools was conducted from public roads, due to lack of access, on May 23, 2016. Red-tailed hawks (*Buteo jamaicensis*), golden eagle (*Aquila chrysaetos*), western meadowlark (*Sturnella neglecta*), burrowing owls (*Athene cunicularia*), and American crows were observed. No potential aquatic predators were seen from a distance but coyotes (*Canis latrans*) were observed.

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Basemap: ESRI, 2016
Data: CNDDB, 2016

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**FIGURE 3-8**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Armstrong Sandhill Ranch LLC Vernal Pools*

### Suitability for CRLF

Based on the PCE requirements outlined in Section 2.2, Armstrong Sandhill Ranch LLC vernal pools do not have suitable habitat for CRLF. A description of the factors used to eliminate it from the need for further surveys is below.

**(1) Aquatic Breeding Habitat.**

Based on the PCE requirements, aquatic breeding habitat is not suitable at Armstrong Sandhill Ranch LLC vernal pools. When this site was surveyed in May, there was a few feet of water in the shallow vernal pool. This could indicate that the pool could hold water for 20 weeks of the year; however the water depth must be at least 2.3 feet (0.7 meters) to provide sufficient breeding habitat, which is unlikely at this site. Therefore it is unlikely that Armstrong Sandhill Ranch LLC vernal pools could provide suitable aquatic breeding habitat for CRLF.

**(2) Aquatic Non-Breeding Habitat.**

Armstrong Sandhill Ranch LLC vernal pools contained a small amount of water when surveyed, and exhibited some hydrologic complexity in that there are a series of depressions, likely indicating a small network of ephemeral pools which could potentially provide refugia to juveniles, and non-breeding CRLF adults.

**(3) Upland Habitat.**

Potential upland habitat at Armstrong Sandhill Ranch LLC vernal pools consists of grazed grasslands, with patches of coyote brush scrub, ice plant mat and other grassland vegetation. Large colonies of ground squirrels, and hundreds of burrows, were observed surrounding the vernal pools, indicating a surplus of aestivation areas.

**(4) Dispersal Habitat.**

There is suitable upland habitat adjacent to Armstrong Sandhill Ranch LLC vernal pools; therefore, CRLF could disperse into surrounding stabilized dunes covered by grasslands and scrub. However, this habitat does not connect to previously occupied CRLF sites within 1 mile (1.6 kilometers) of the Armstrong Sandhill Ranch LLC vernal pools.

### Conclusion

Aquatic breeding habitat for CRLF likely does not exist due to the lack of depth of the Armstrong Sandhill Ranch LLC vernal pools. Additionally there is no dispersal habitat which connects to other potential CRLF sites. The lack of aquatic breeding and dispersal habitat precludes the need to conduct protocol level surveys for CRLF at the Armstrong Sandhill Ranch LLC vernal pools. It is highly unlikely that the Armstrong Sandhill Ranch LLC vernal pools would provide a source of CRLF to any portion of the MPWSP.

## 3.4.8 Highway 1 Wetland

### Habitat

This feature is a depression located immediately east of Highway 1, south of the entrance road to the CEMEX plant. It is mapped as a freshwater emergent wetland in the NWI. It is bordered to the west and north by the Marina dunes, Highway 1, and the CEMEX plant. To the east, it is bordered by grazed

California annual grassland and to the south by suburban Marina. The depression is dominated by coyote brush, ice plant, mock heather, and other dune vegetation. This area was not observed to have any standing water or wetland characteristics during the 2016 surveys. A habitat map for Highway 1 wetland can be viewed in Appendix D.

**Proximity to the MPWSP**

This feature is approximately 0.5 mi (0.8 kilometers) west of the MPWSP where it follows Lapis Road north of Marina.

**Previous Occurrences**

No previous occurrences for CRLF are documented within 1 mile (1.6 kilometers) of the Highway 1 wetland (Figure 3-9).

**Species Observed**

During the site assessment on March 16, 2016, there were no species observed.

**Suitability for CRLF**

Based on the PCE requirements outlined in Section 2.2, Highway 1 wetland does not have suitable breeding habitat for CRLF. A description of the factors used to eliminate it from the need for protocol level surveys is below.

**(1) Aquatic Breeding Habitat.**

Based on the PCE requirements, it is unlikely that this site would serve as suitable aquatic breeding habitat. The wetland did not have any water during the March 2016 survey; therefore it probably does not hold water for 20 weeks of the year.

**(2) Aquatic Non-Breeding Habitat.**

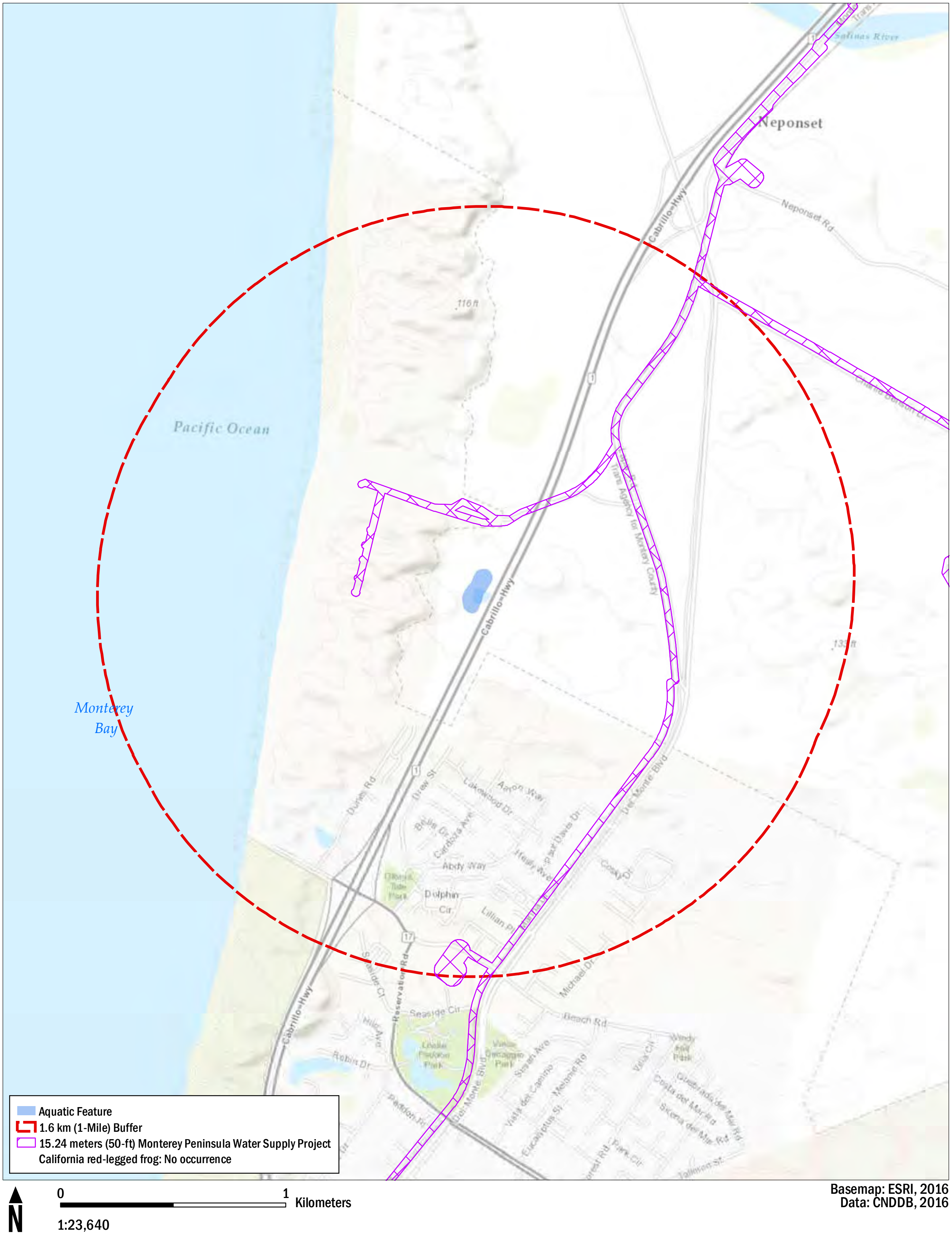
Highway 1 wetland was dry when surveyed in March 2016, however if this site contains water for part of the year, it could serve as aquatic non-breeding habitat and provide shelter, foraging habitat, predator avoidance, and aquatic dispersal for juvenile and adult CRLF.

**(3) Upland Habitat.**

Potential upland habitat at the Highway 1 wetland consists of sandy dunes and dune vegetation. CRLF may be able to use the coyote brush scrub, ice plant mat, mock heather scrub, and other dune vegetation for aestivation.

**(4) Dispersal Habitat.**

Despite suitable dispersal habitat adjacent to the Highway 1 wetland, there is no connectivity to other CRLF sites within a 1 mile (1.6 kilometers) radius. Dispersal to the Armstrong Sandhill Ranch LLC vernal pools is possible, across four lanes of traffic on Highway 1.




Basemap: ESRI, 2016
Data: CNDDB, 2016

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**FIGURE 3-9**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Highway 1 Wetland*

### Conclusion

It is unlikely that aquatic breeding habitat exists for CRLF at the Highway 1 wetland. There is also no dispersal habitat connecting to another potential CRLF site. The lack of aquatic breeding and dispersal habitat precludes the need to conduct protocol-level surveys for CRLF at Highway 1 wetland. It is highly unlikely that CRLF would disperse from Highway 1 wetland to any portion of the MPWSP.

## 3.4.9 Lapis Road Wetland

### Habitat

Lapis Road wetland is a small depression located between Lapis Road and Highway 1, north of the City of Marina, in Monterey County. It is surrounded by disturbed dune vegetation and agricultural fields on all sides. Although mapped as a water feature by USFWS NWI Wetlands Mapper (USFWS 2016 ) surveys conducted in 2016 found it to be completely dry, and it does not appear to be a wetland or have CRLF breeding habitat. During the May 2016 survey, the site was under active construction and it has been recently cleared of vegetation by heavy equipment. Dominant vegetation surrounding the areas outside of the site included mock heather scrub and ice plant mats. A habitat map for Lapis Road wetland can be viewed in Appendix D.

### Proximity to the MPWSP

The Lapis Road wetland is approximately 0.06 miles (0.1 kilometers) west of the MPWSP where it follows Lapis Road north of Marina.

### Previous Occurrences

No previous occurrences for CRLF are documented within 1 mile (1.6 kilometers) of Lapis Road wetland (Figure 3-10).

### Species Observed

Site assessment surveys of Lapis Road wetland were conducted on May 23, 2016. During these surveys no species were observed, likely because this site was under construction.

### Suitability for CRLF

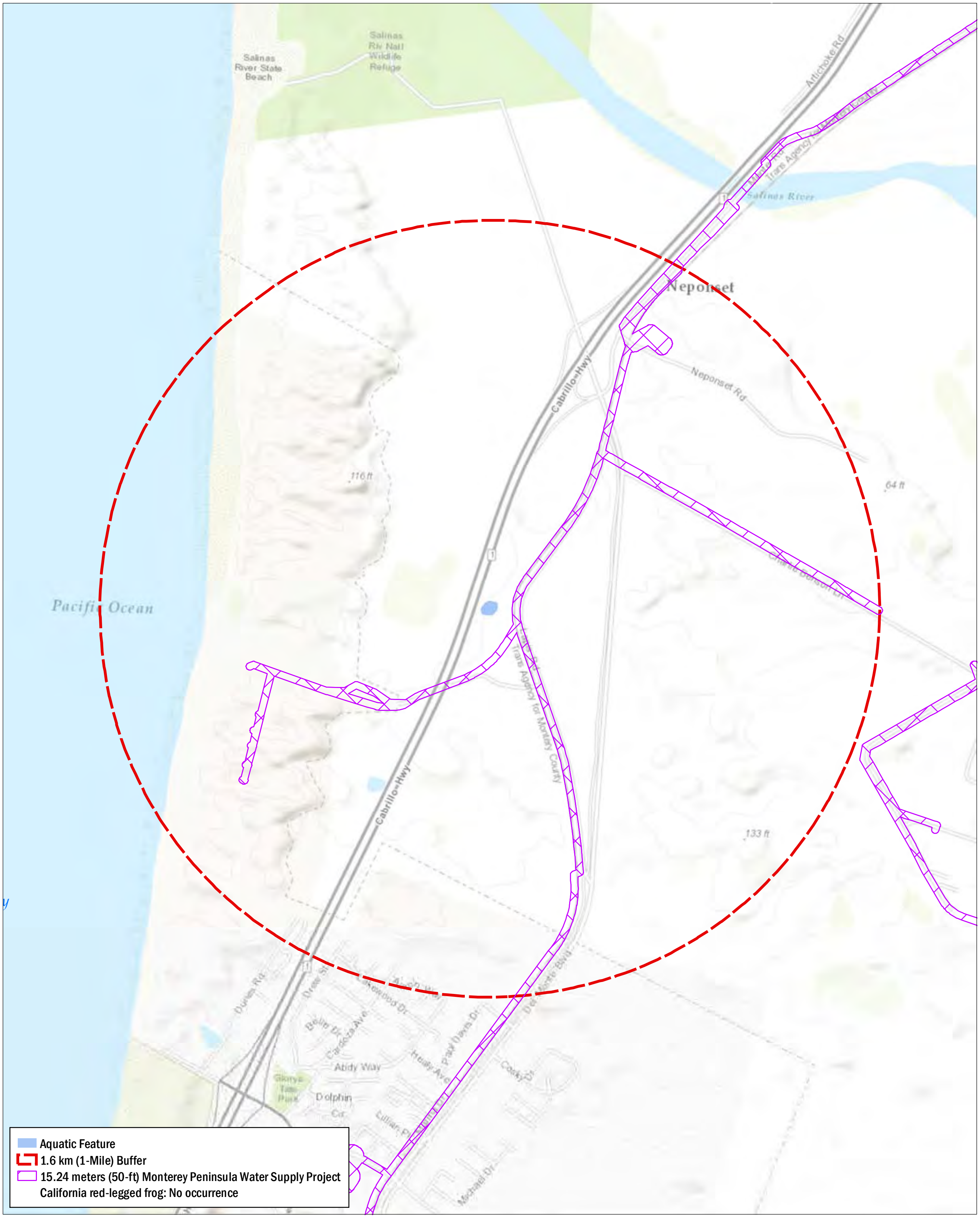
Based on the PCE requirements outlined in Section 2.2, Lapis Road wetland does not have suitable habitat for CRLF. A description of the factors used to eliminate it from the need for protocol level surveys is below.

#### (1) Aquatic Breeding Habitat.

There is no aquatic breeding habitat at Lapis Road wetland. The wetland was completed dry by May and under active construction for a separate project when surveyed.

#### (2) Aquatic Non-Breeding Habitat.

Lapis Road wetland contains no aquatic non-breeding habitat for juvenile or adult CRLF. The site was dry and under construction when surveyed in May, and vegetative cover was removed.

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Basemap: ESRI, 2016
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**FIGURE 3-10**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Lapis Road Wetland*

**(3) Upland Habitat.**

Potential upland habitat at Lapis Road wetland consists of sandy dunes and dune vegetation. CRLF may be able to aestivate in coyote brush scrub, ice plant mat, mock heather scrub, and other dune vegetation. However much of the vegetation was removed during construction.

**(4) Dispersal Habitat.**

There is some suitable dune vegetation upland habitat adjacent to Lapis Road wetland into which CRLF could disperse, but this dispersal habitat does not connect to previously occupied sites, or potential CRLF sites within 1 mile (1.6 kilometers) of Lapis Road wetland. Additionally, urban barriers to dispersal include Highway 1 to the west and Lapis Road to the east.

#### Conclusion

No aquatic breeding or non-breeding habitat exists for CRLF at Lapis Road wetland. There is marginally suitable upland habitat, but no dispersal habitat connecting to potential CRLF sites. The lack of aquatic habitat and dispersal habitat precludes the need to conduct protocol level surveys for CRLF at Lapis Road wetland. It is highly unlikely that the Lapis Road wetland would provide a source of CRLF to any portion of the MPWSP.

### 3.4.10 Neponset Road Pond

#### Habitat

This pond is located along Neponset road, east of the Dole plant in rural Monterey County, between Marina and Castroville. It is surrounded by agricultural land, pasture, and disturbed dune vegetation on all sides. It appears to have standing water year round, and dominant wetland vegetation includes stands of willows and California bulrush. Upland vegetation is dominated by coyote brush, mock heather, ice plant, and non-native annual grasses. A habitat map for Neponset Road pond can be viewed in Appendix D.

#### Proximity to the MPWSP

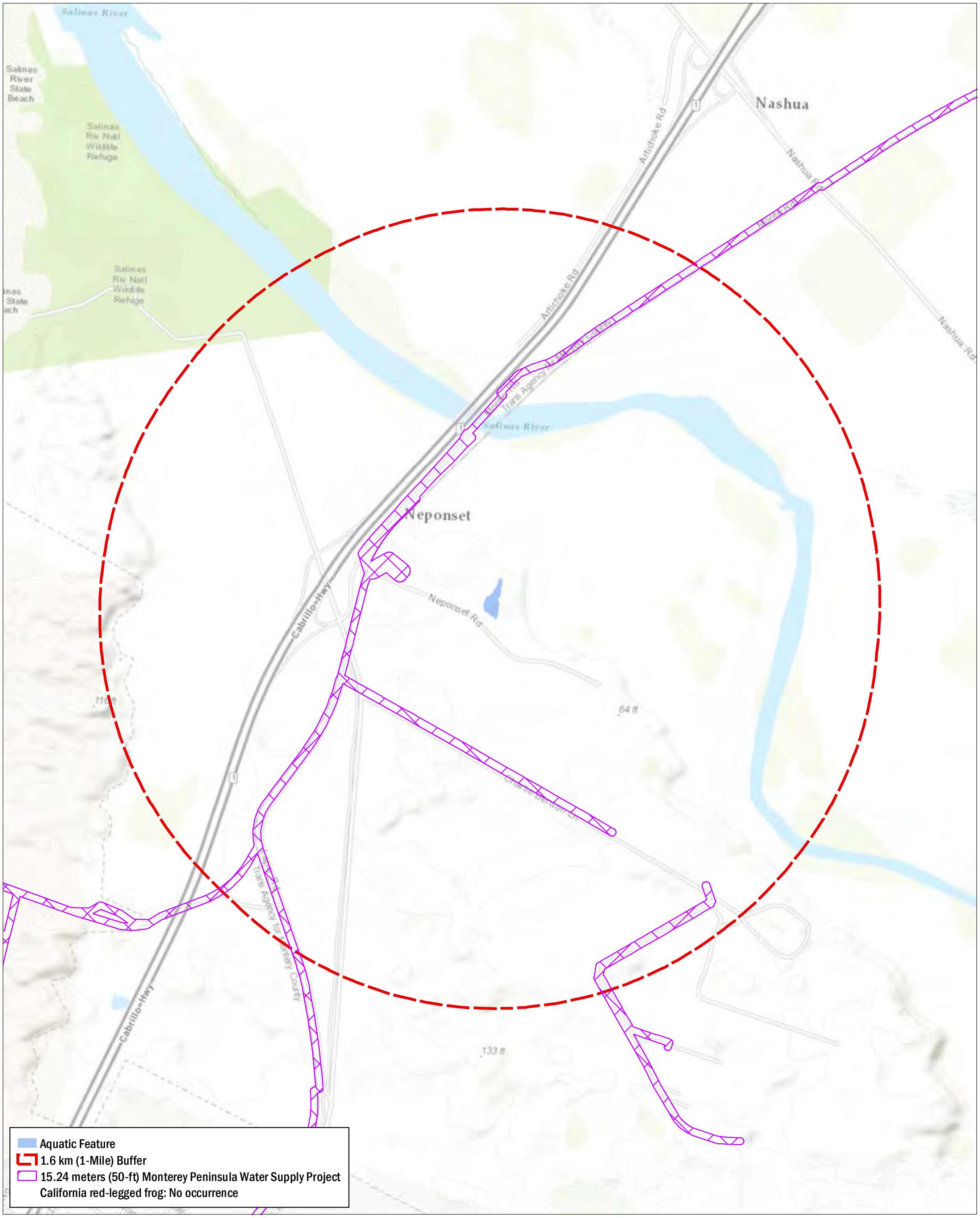
Neponset Road pond is approximately 0.37 miles (0.6 kilometers) north of the spur of the MPWSP that follows Charles Benson Road to the proposed desalination plant site. The wetland is approximately 0.3 miles (0.5 kilometers) east of the main portion of the MPWSP which continues north to Castroville along Monte Road.

#### Previous Occurrences

No occurrences of CRLF are documented within 1 mile (1.6 kilometers) of Neponset Road pond (Figure 3-11).

#### Species Observed

During the site assessment of Neponset Road pond on May 23, 2016, there were no species observed. The site assessment was conducted from an adjacent road due site access restrictions.

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Basemap: ESRI, 2016
Data: CNDDB, 2016

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MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 3-11**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Neponset Road Pond*

**Suitability for CRLF**

Based on the PCE requirements outlined in Section 2.2, Neponset Road pond was found to have potentially suitable habitat for CRLF.

**(1) Aquatic Breeding Habitat.**

Based on the PCE requirements, aquatic breeding habitat is suitable, holding water of adequate depth for more than 20 weeks. Neponset Road pond is a permanent water source, and there is emergent vegetation growing in it that appears to be healthy and native.

**(2) Aquatic Non-Breeding Habitat.**

Neponset Road pond connects to smaller canals and agricultural ditches that CRLF could use for shelter, foraging, predator avoidance and aquatic dispersal of juvenile and adult CRLF.

**(3) Upland Habitat.**

Upland habitat is present surrounding Neponset Road pond. Dense herbaceous and wetland vegetation is found around the edge of the Neponset Road pond and could provide moist refugia for CRLF. Upland habitat beyond the area immediately around the pond are agricultural fields, coyote brush scrub, and ruderal vegetation. Ground squirrels were observed within the ruderal vegetation during surveys, and burrows that could be used for CRLF aestivation were observed to be present.

**(4) Dispersal Habitat.**

Both upland and riparian habitat surrounding Neponset Road pond connect to presumed extant sites within 1 mile (1.6 kilometers). The Salinas River, which is, at its closest 1 mile (1.6 kilometers) north of Neponset Road pond is believed to have populations of CRLF. Dispersal to the Salinas River could be facilitated via a network of agricultural canals and moist agricultural fields. Coyote brush scrub and ruderal areas to the west and south of Neposet Road pond may provide moisture and shelter, as well.

**Conclusion**

Suitable aquatic breeding, non-breeding, dispersal, and upland habitat exist at Neponset Road pond. Biologists could not access Neponset Road pond for protocol level surveys. Appropriate dispersal habitat connects Neponset Road pond to the Salinas River. We assume presence of CRLF at the Neponset Road pond. CRLF could potentially disperse from the Salinas River into Neponset Road pond, and from there enter into the MPSWP.

### 3.4.11 Proposed Desalination Plant Property Wetland.

**Habitat**

The proposed desalination plant site is a large undeveloped property owned by CAW, and consists of a former agricultural terrace overlooking the floodplain of the Salinas River. It lies between the agricultural fields bordering the river to the north and Charles Benson Road, on the southwestern boundary. Evidence of this site's former use is present in the longitudinal furrows stretching across the site, indicating having been tilled. The Last Chance Mercantile and Monterey Regional Waste Water District occur immediately to the east. The site is separated by a gravel road. South of the road, dense ruderal habitat exists. This southern half of the site is vegetated with ruderal vegetation which is likely too thick to permit easy dispersal by CRLF, or to permit ground squirrel burrows. The plant species are mostly comprised of ripgut brome (*Bromus diandrus*), upland mustard (*Brassica nigra*), and wild radish (*Raphanus sativus*), growing in nearly impenetrable densities. The proposed desalination plant itself occurs within this habitat. North of the gravel road, the upland habitat consists of a sloped grassy hillside dominated by California annual grassland. Here, short-cropped brome fescue (*Festuca bromoides*), dense patches of pink cudweed (*Pseudognaphalium rammossissimum*), and Canada horseweed (*Erigeron canadensis*) dominate. Yellow bush lupine scrub, containing yellow bush-lupine (*Lupinus arboreus*) and coyote brush are also abundant.

On the northern edge of the proposed desalination plant site property is a deep agricultural canal covered in duckweed (*Lemna minor*), bordered by a narrow strip of freshwater emergent wetland vegetation roughly 40 feet (12.2 meters) wide (proposed desalination plant wetland). Here, water parsley marsh (*Oenanthe sarmentosa*), smartweed (*Persicaria lapathifolia*) and cocklebur (*Xanthium* sp.) patches, and California blackberry are most abundant. North of the canal, agricultural fields separate the proposed desalination plant site from the Salinas River. A habitat map for the proposed desalination plant site can be viewed in Appendix D.

**Proximity to the MPWSP**

Part of the upland habitat within the proposed desalination plant site will be developed for the MPWSP. MPWSP's proposed desalination plant is expected to be built on the upland terrace of the site. MPWSP pipelines will convey water to and from the desalination plant along Charles Benson Road.

**Previous Occurrences**

No previous occurrences of CRLF are documented within 1 mile (1.6 kilometers) of the proposed desalination plant (Figure 3-12).

**Species Observed**

During site assessment surveys conducted at the proposed desalination plant site on April 25, 2016, biologists observed bird species such as red-tailed hawks, great horned owls (*Bubo virginianus*), finch species (*Fringillidae* sp.) and swallow species (*Hirundo* sp.).

**Suitability for CRLF**

Based on the PCE requirements outlined in Section 2.2, the canal located north of the proposed desalination plant site contains habitat suitable for CRLF.

**(1) Aquatic Breeding Habitat.**

The canal was full into April, indicating that it likely holds water more than more than 20 weeks and potentially year-round. Vegetation growing in it appeared to be healthy and native. Because it is an agricultural canal, there is potential for contaminants, including pesticide and herbicide runoff, as well as high nitrates from adjacent row crops. The water was not tested, but pesticides were observed to be sprayed onto nearby agriculture fields.

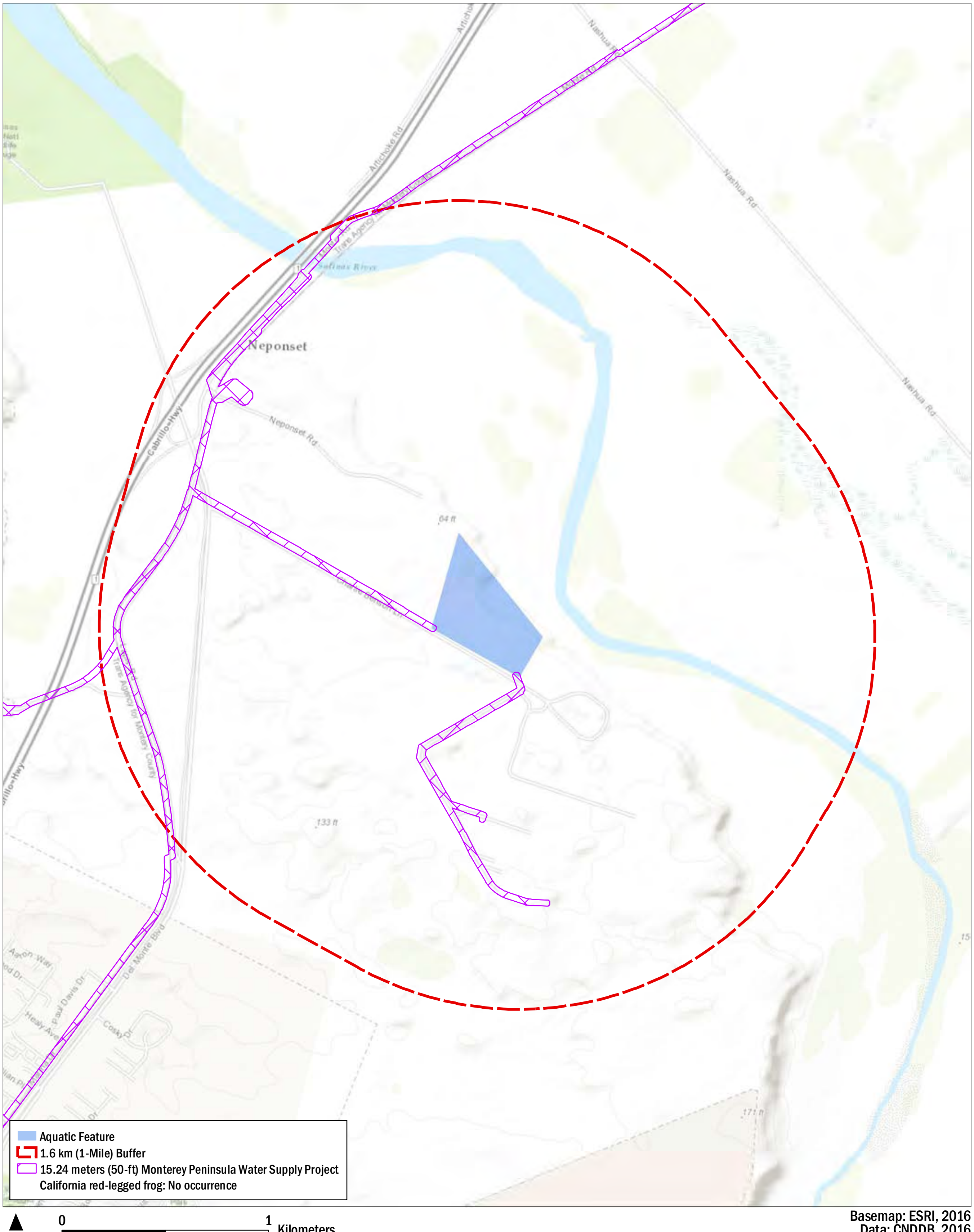


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**FIGURE 3-12**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Proposed Desalination Plant Property Wetland*

**(2) Aquatic Non-Breeding Habitat.**

The canal north of the proposed desalination plant site has some complexity in habitat structure. Sections of it are covered by vegetation, and narrow from 20 feet (6.1 meters) down to just 3 feet (0.9 meters) across. Parts of the canal could provide shelter, foraging, predator avoidance, and aquatic dispersal habitat to juvenile and adult CRLF.

**(3) Upland Habitat.**

Suitable upland habitat within the proposed desalination plant site is limited to areas north of the gravel road, above the Salinas River floodplain, where vegetation is suitable. The ruderal areas south of the gravel road contain vegetation that is likely too dry, spiny, and dense for CRLF to traverse, in addition to containing no burrows. However, the grasslands, yellow bush lupine scrub, and coyote brush scrub between the north side of the road and the canal contain short, sparse grasses that CRLF could travel across to reach the handful of ground squirrel burrows. The blackberry bushes and wetland vegetation that borders the canal likely retain moisture suitable for aestivation.

Only a handful of ground squirrel burrows were observed within the proposed desalination plant site, and these were north of the road. This is likely because the adjacent landowners actively trap, shoot, and poison California ground squirrels. Traps and poison bait stations can be found along the eastern boundary of the proposed desalination plant site, and during one survey, a hunter was seen firing shots into the proposed desalination plant site. He was later confirmed to be eradicating California ground squirrels. Aestivation could, therefore, occur within the few burrows present; or, it could take place under the dense blackberry brambles bordering the canal.

**(4) Dispersal Habitat.**

The canal north of the proposed desalination plant connects to the Salinas River, and therefore, to presumed extant records of CRLF within 1 mile (1..6 kilometers) of the proposed desalination plant. The canal appears to drain into a riparian floodplain that stretches roughly 400 feet (120 meters) to the Salinas River. Additionally, CRLF could reach the Salinas River or riparian habitat along the banks of the Salinas River by crossing agricultural fields in as short of distances as 180 feet (55 meters). Dispersal from the canal into upland habitat just north of the proposed desalination plant would be facilitated by dense wetland vegetation and moist, shaded areas beneath California blackberry brambles.

### Conclusion

Suitable aquatic breeding and nonbreeding, upland, and dispersal habitat exists north of the proposed desalination plant site. Given that there are records of CRLF at the Salinas River and appropriate dispersal habitat exists between the desalination plant and Salinas River, presence of CRLF can be assumed within the canal north of the proposed desalination plant. Therefore, presence will also be assumed within suitable upland habitat between the dirt road and the canal, but not within the ruderal area where the desalination plant is proposed to be built.

### 3.4.12 Salinas River

**Habitat**

The Salinas River intersects the MPWSP north of the proposed desalination plant site. Unlike the proposed desalination plant, only a pipeline crosses the Salinas River, so potential temporary impacts are only 50 feet (15.2 meters) wide at the crossing, which is at Monte Road Bridge. The pipeline is intended to be attached to the Monte Road bridge where it crosses the Salinas River. The Salinas River is roughly 356 feet (111 meters) across at this point. Salinity closest to the MPWSP is 1.36 ppt (CAMP 2016). The river surface at the time of the survey, had patches of algae and mosquito fern (*Azolla filiculoides*). Valley-foothill Riparian habitats include dense stands of arroyo willows, box-elders (*Acer negundo*), California blackberry, and shining willow (*Salix lasiandra*). Freshwater emergent wetland is comprised of perennial pepper weed (*Lepidium latifolium*), Pacific silverweed , California bulrush, and water parsley. These vegetation types occur in more or less natural states, and the southern bank of the river is heavily vegetated for 70 feet (21.3 meters) south of the crossing, where it meets ruderal habitats and agricultural fields. On the north bank, the riparian zone stretches for about 300 feet (90 meters) north before hitting coyote brush scrub and a small community of homes. Downstream of the MPWSP crossing of the Salinas River, riparian vegetation continues west along the banks of the river and for over a half mile, including where it parallels the proposed desalination plant. Upstream of it, riparian vegetation follows the contours of the river for nearly 165 miles (266 kilometers). From the mouth of the river, at the Pacific Ocean, throughout the entire Salinas Valley, agricultural fields subtend the riparian zone. Adjacent to the MPWSP crossing, agricultural fields are found both north and south of it.

Highway 1 crosses the river parallel MPWSP alignment, 80 feet (24.4 meters) west of Monte Road. A habitat map for the Salinas River can be viewed in Appendix D.

**Proximity to the MPWSP**

The MPWSP crosses the Salinas River on the Monte Road Bridge and is therefore unlikely to affect any breeding habitat associated with the river itself. However, dispersal and upland habitat may be present anywhere within a mile (1.6 kilometers) radius of the Salinas River, potentially intersecting with the proposed desalination plant (described above) in addition to other sections of the pipeline.

**Previous Occurrences**

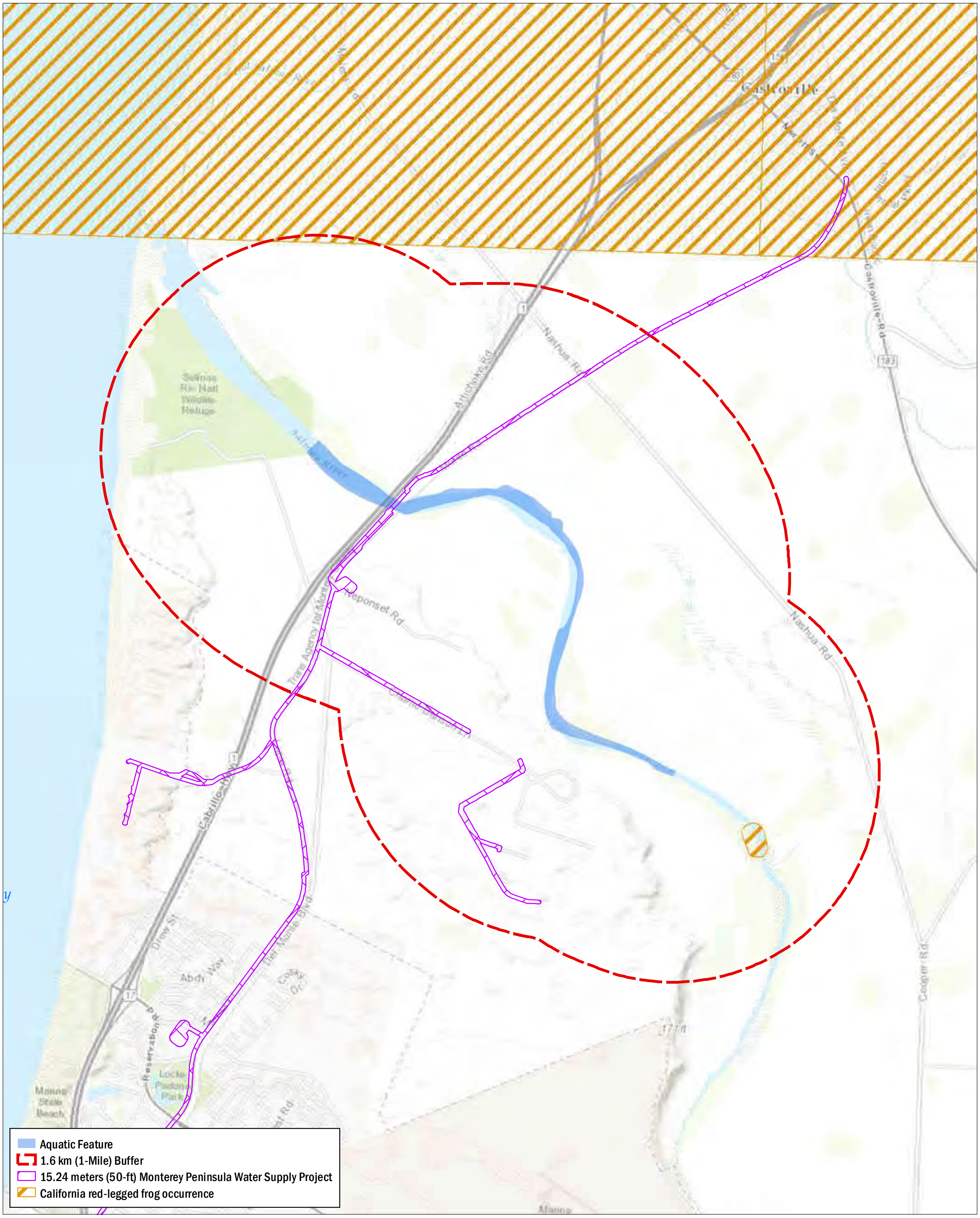
Occurrences of CRLF are documented along the Salinas River, 0.4 mi (0.7 kilometers) south east of the MPWSP (Figure 3-13).

**Species Observed**

During site assessment survey conducted at the Salinas River on April 25, 2016, abundant Sierran treefrogs and predatory bird species, such as herons, egrets, raptors, gulls, and belted kingfisher (*Megaceryle alcyon*) were observed.

**Suitability for CRLF**

Based on the PCE requirements outlined in Section 2.2, the Salinas River was found to have suitable habitat for CRLF.

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Basemap: ESRI, 2016
Data: CNDDB, 2016

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 3-13**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Salinas River*

**(1) Aquatic Breeding Habitat.**

Based on the PCE requirements, aquatic breeding habitat is suitable, holding areas of slow-moving water for more than 20 weeks. The Salinas River is a permanent water source, and there is emergent vegetation growing in it which appears to be healthy and native.

**(2) Aquatic Non-Breeding Habitat.**

Vegetation along the Salinas River could potentially provide refugia, shelter, foraging opportunities, or predator avoidance for juveniles, or adult CRLF.

**(3) Upland Habitat.**

Upland habitat can be found along the Salinas River edge. There is dense riparian habitat with leaf litter, and gopher burrows are abundant throughout the Salinas River bank that may potentially provide shelter, forage, and predator avoidance for CRLF.

**(4) Dispersal Habitat.**

The canal north of the proposed desalination plant connects to the Salinas River and CRLF could potentially reach the desalination plant by crossing agricultural fields in as short of distances as 180 feet (55 meters). CRLF could also potentially disperse to Neponset Road pond which is at its closest, is 1 mile (1.6 kilometers) south of the Salinas River.

**Conclusion**
Suitable CRLF habitat exists along the Salinas River. Given the occurrences of CRLF at the Salinas River and suitable aquatic breeding and nonbreeding, upland and dispersal habitat, CRLF are assumed present.

### 3.4.13 Tembladero Slough

**Habitat**
Tembladero Slough and adjacent upland habitat intersect the MPWSP. The MPWSP will cross under the slough by horizontal directional drill, at a point where the slough is roughly 30- 40 feet (9.1 to 12.2 meters) across. Salinity closest to the MPWSP is 1.08 ppt (CAMP 2016). The slough is flanked by agricultural lands, and beyond to the east, by State Route (SR) 183, although riparian and agricultural habitat are continuous across SR 183.

At the MPWSP crossing, the floodplain of on the south side of Tembladero Slough is bare silty soil. There is evidence that large flows scour the banks and deposit debris along the shoreline. Vegetation within this floodplain is principally non-native, herbaceous, and ruderal in nature. It includes bands of perennial pepper weed and Mediterranean mustard (*Hirschfeldia incana*) with some bristly ox-tongue (*Helminthotheca echioides*). On either side of the slough crossing are levees. On the northern bank, a canal which drains into the slough runs along the levee. The canal appears to originate roughly 1000 feet (304 meters) to the east (where it reaches SR 183) and it contributes to the formation of a series of wetlands that parallel the MPSWP. Within the canal and wetlands, small patches of plants including arroyo willow, California bulrush, bristly ox-tongue form a mosaic in and around the wetlands, while coyote brush, black mustard, wild radish, and California blackberry form the upland vegetation surrounding them. On the southern bank, the levee is bare, or has patches of ruderal vegetation. On either side of the levee in all directions, is agriculture or homesteads. A habitat map for Tembladero Slough can be viewed in Appendix D.

**Proximity to the MPWSP**

The MPWSP crosses the Tembladero Slough just south of Castroville Road (SR 183).

**Previous Occurrences**

Occurrences of CRLF are documented along the Tembladero Slough in the vicinity of the MPSWP (Figure 3-14).

**Species Observed**

During the site assessment survey conducted at Tembladero Slough on April 25, 2016, biologists observed red-winged blackbirds, double-crested cormorants (*Phalacrocorax auritus*), mourning doves (*Zenaida macroura*), and mallards. Additionally, raccoon tracks were also seen along the slough bank. During a night survey conducted on May 23, 2016, biologists observed two large bullfrogs and heard a few calling Sierran treefrogs.

**Suitability for CRLF**

Based on the PCE requirements outlined in 2.2, Tembladero Slough was found to have suitable habitat for CRLF.

**(1) Aquatic Breeding Habitat.**

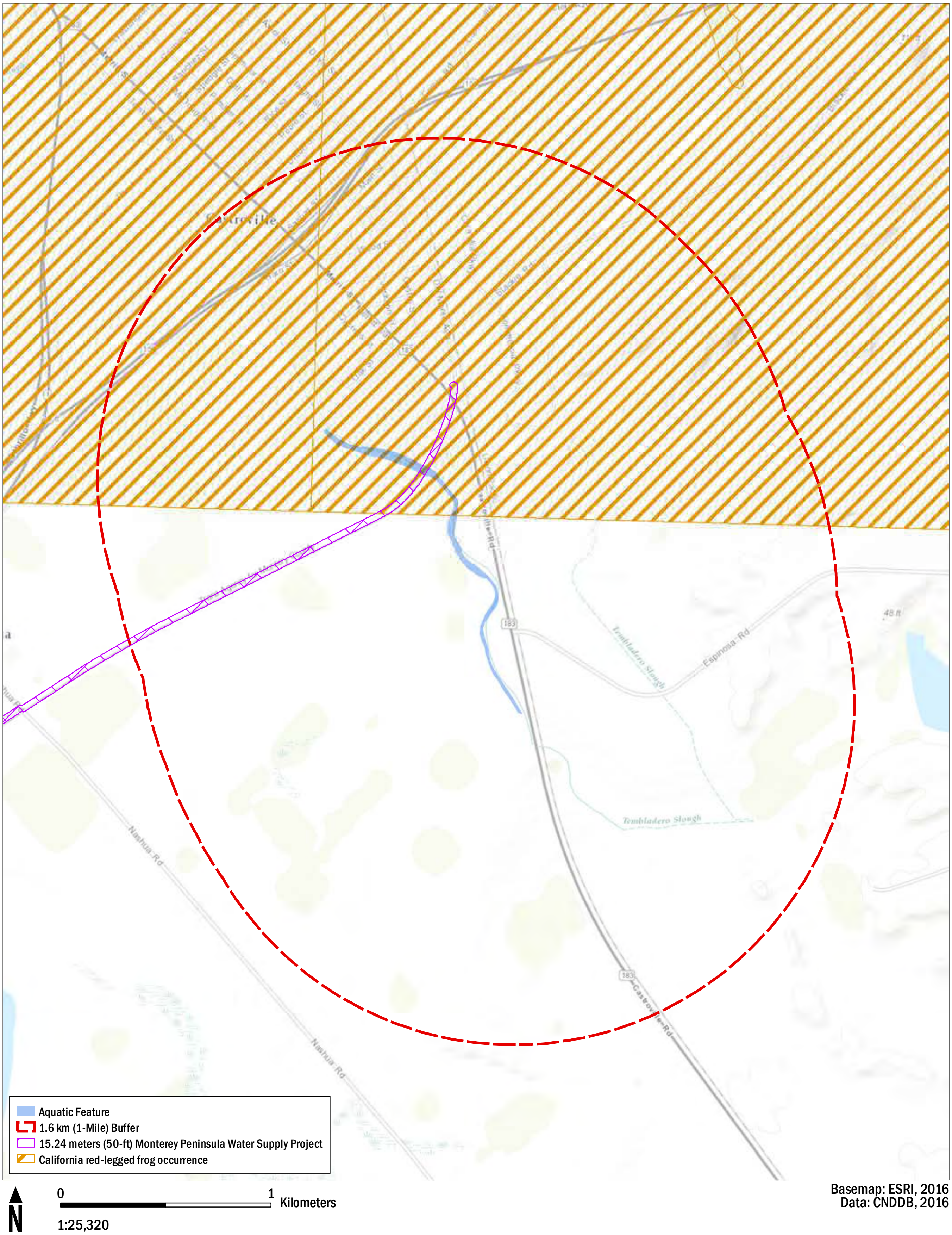
Based on the PCE requirements outlined in Section 1, aquatic breeding habitat is potentially suitable. Tembladero Slough is a permanent water source, and emergent vegetation growing in it appears to be persistent. Vegetative debris collecting on the trestle above the slough, and a floodplain devoid of woody plants suggest that Tembladero Slough experiences high flows which may scour vegetation and dislodge egg masses. However, it may be possible for CRLF to breed in the canal draining into the slough, or in small pools and backwater channels, if flows are too high in the main river. Tembladero Slough may provide aquatic breeding habitat for CRLF.

**(2) Aquatic Non-Breeding Habitat.**

Aquatic non-breeding habitat at Tembladero Slough is suitable for juvenile and adult CRLF; Tembladero Slough is a permanent water source and contains vegetation that could provide refugia, shelter, foraging opportunities, or predator avoidance for juveniles or adult CRLF.

**(3) Upland Habitat.**

Upland habitat can be found along the levee above Tembladero Slough and consists of patches of arroyo willow thickets with leaf litter. Botta's pocket gopher (*Thomomys bottae*) burrows were observed on the slough bank, as well. These features could provide non-breeding, feeding, and sheltering habitat for juvenile and adult CRLF.




Basemap: ESRI, 2016
Data: CNDDB, 2016

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 3-14**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Tembladero Slough*

**(4) Dispersal Habitat.**

Suitable upland habitat is adjacent to Tembladero Slough. There are native habitat, agricultural fields, and ditches directly surrounding the slough. Dispersal habitat exists along Tembladero Slough itself, which could allow CRLF to travel up or down the slough to areas that could potentially support other CRLF populations. Since surveys were not done in other parts of the slough, it is uncertain if there are portions containing suitable CRLF habitat. Also, existing CRLF occurrences within 1 mile (1.6 kilometers) of Tembladero Slough provide further evidence that dispersal to suitable sites is possible.

**Conclusion**

Tembledero Slough does support Sierran treefrogs; but it also harbors bullfrogs, which are competitors and predators of CRLF. Despite this, suitable CRLF habitat exists along the Tembladero Slough and aquatic breeding, non-breeding, upland and dispersal habitats occur around the MPWSP crossing. Given the previous occurrences of CRLF at Tembladero Slough, we assume presence of CRLF within the MPWSP.

### 3.4.14 Carmel River

**Habitat**

The Carmel River does not intersect the main MPWSP; however, the Carmel Valley Pump Station - a small disjunct part of the MPWSP - is located adjacent to the Carmel River. There is potential upland habitat for CRLF around this site. Habitats at the Carmel Valley Pump Station include black cottonwood (*Populus trichocarpa*) and Monterey pine (*Pinus radiata*), California buckeye (*Aesculus californica*), and coast live oak) coincide with California annual grassland, ruderal, and landscaped vegetation. These vegetation types occur in more or less natural states, and the southern bank of the river is largely undisturbed for a 200-300 foot -wide (61 to 91 meters) swath.

The Carmel River and upland habitat is bordered by urban residential communities with backyards and greenbelts which would not inhibit travel by CRLF or other species. A habitat map for the Carmel River can be viewed in Appendix D.

**Proximity to the MPWSP**

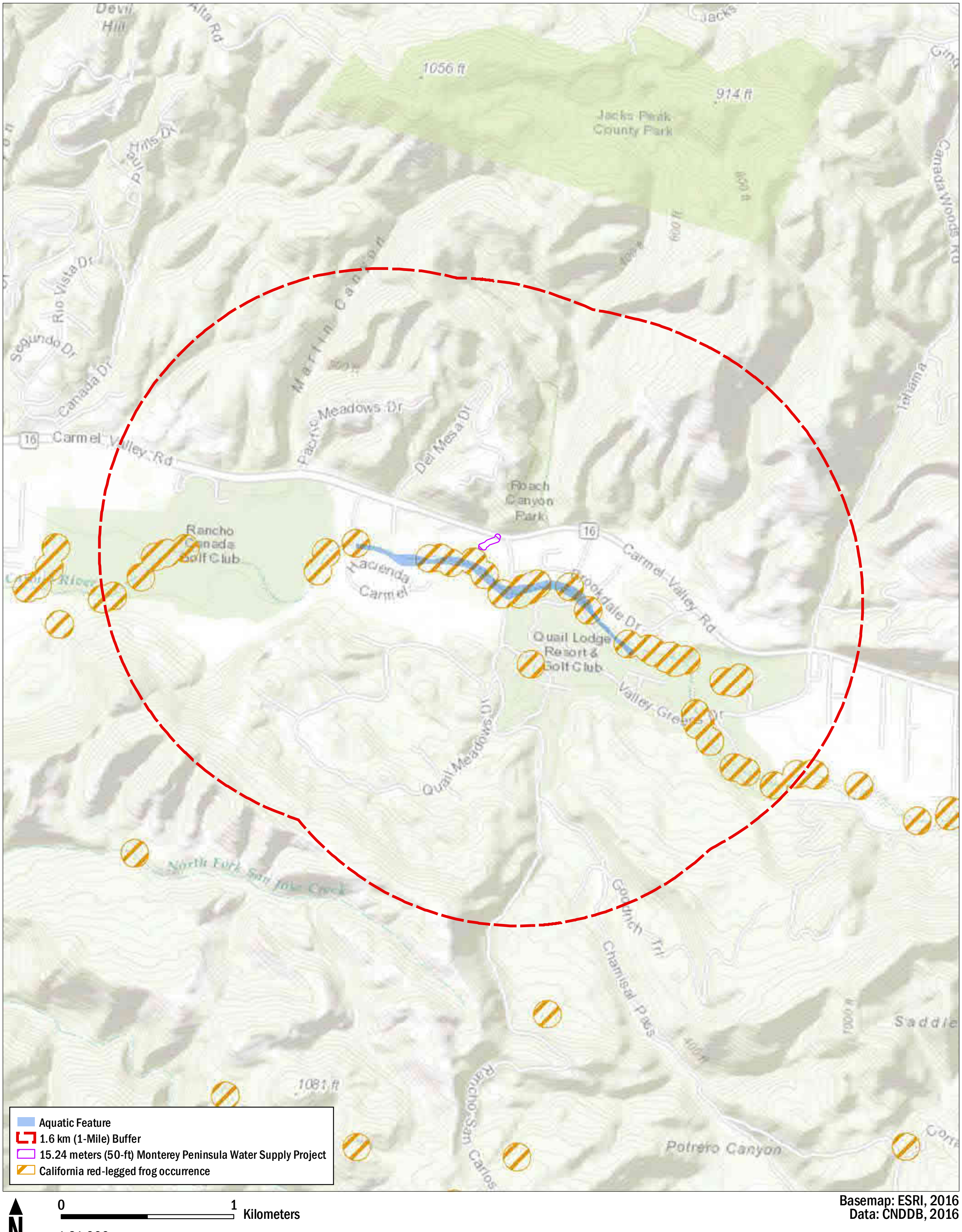
The main portion of the MPWSP in Pacific Grove and Monterey is approximately 3.7 miles (6 kilometers) from the Carmel River; the majority of the MPWSP is therefore too far from the river to contain dispersal habitat. The Carmel Valley Pump Station is 0.06 miles (0.1 kilometers) from the Carmel River. The entire Carmel Valley Pump Station portion of the MPWSP is in CRLF upland dispersal habitat.

**Previous Occurrences**

Occurrences of CRLF are documented along the Carmel River, 0.01 mi (0.2 kilometers) W of the MPWSP. The Carmel River is in designated critical habitat unit MNT-2 for CRLF (Figure 3-15).

**Species Observed**

During the site assessment survey conducted at Carmel River on May 23, 2016, there were numerous Sierran treefrogs and bird species such as red-tailed hawk, black phoebes (*Sayornis nigricans*) and California scrub-jays (*Aphelocoma californica*).




Basemap: ESRI, 2016
Data: CNDDB, 2016

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

**FIGURE 3-15**

*California Red-Legged Frog Occurrences Within 1.6 KM (1 Mile) of Carmel River*

### Suitability for CRLF

Based on the PCE requirements outlined in Section 2.2, the Carmel River was found to have suitable habitat for CRLF.

**(1) Aquatic Breeding Habitat.**

Based on the PCE requirements, aquatic breeding habitat is suitable, holding water for more than 20 weeks. The Carmel River contained flowing water until September in 2016. In September, multiple areas of ponding water were observed. The vegetation growing on the Carmel River, including emergent vegetation appears to be healthy and native.

**(2) Aquatic Non-Breeding Habitat.**

Aquatic non-breeding habitat at the Carmel River is suitable for juvenile and adult CRLF; the Carmel River contained areas of ponding water with vegetation that could provide refugia, shelter, foraging opportunities, or predator avoidance for juveniles, or adult CRLF.

**(3) Upland Habitat.**

Upland habitat can be found at the along the Carmel River edge. It consists of dense riparian habitat comprised of willows, oaks, and cottonwood with an understory of California blackberry, poison oak, and other shrubs. Leaf litter, rocks, and gopher burrows are abundant throughout the Carmel River bank; dense herbaceous vegetation also occurs which could provide moist refugia for CRLF occur.

**(4) Dispersal Habitat.**

There is suitable riparian habitat along and surrounding the Carmel River which could serve as dispersal habitat for CRLF to other habitat sites on the Carmel River. The river edges contain often dense stands of riparian habitat, sometimes 800 feet (244 meters) wide, often subtending grassland, oak woodland, or savannah-like habitats. Additionally, golf courses and agricultural lands adjacent to the river are likely to contain enough moisture to facilitate dispersal to large tracts of open space south of the river, and north, across Carmel Valley Road.

### Conclusion

Suitable breeding habitat exists along the Carmel River, and non-breeding and upland habitats occur around the Carmel River. Given the CRLF occurrence records and existence of appropriate dispersal habitat, we assume presence of CRLF within the MPWSP.

Populations of CRLF occurring at the Carmel River may be source populations for individuals which may disperse into the MPWSP at the Carmel Valley Pump Station.

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# 4 Conclusion

Based on a review of the USFWS range map (2002), the MPWSP occurs within the historic and current recognized range of the CRLF. In addition the Carmel River occurs in unit MNT-2 of CLRF designated critical habitat (75 FR 12816).

A desktop review revealed 14 aquatic features within potential CRLF dispersal distance of the MPWSP. All 14 features were assessed as suitable habitat for CRLF. Of those, seven do not contain habitats suitable to support populations of CRLF. One site, the Legion Way pond, was not fully assessed due to access issues. It is isolated and likely does not provide suitable habitat for CRLF. For the two sites which have potentially suitable habitat, protocol level surveys were conducted; these resulted in negative findings – no CRLF were observed during surveys. At five locations; Neponset Road pond, Salinas River, desalination plant site, Tembladero Slough, and the Carmel River, CRLF presence is assumed.

All of the aquatic features surveyed are within highly modified urban or agricultural areas. While CRLF are found in a wide variety of habitats, they do have specific habitat requirements. Some of the aquatic features surveyed did have appropriate hydroperiods and upland refugia, but many of these also harbored invasive, non-native predators, such as bullfrogs and predatory fish and/or may be subject to high salinities. Many of the sites are lacking in a key feature of CRLF habitat: a network of potential breeding ponds connected by permeable dispersal corridors. A summary of the CRLF findings are presented in Table 5.

**Table 5. Summary of CRLF Findings**

| Feature | Habitat | Protocol-level Survey performed | Historical occurrences | CRLF Observed | Other Species observed | Suitable Habitat for CRLF? |
|---|---|---|---|---|---|---|
| Eucalyptus Road pond | Retention basin with no natural bank. Surrounding upland habitat is intact coast live oak forest and chaparral | No | No | No | - | No |
| Robin Drive pond | Pond surrounded by coyote bush scrub and iceplant. Banks dominated by pickleweed. | No | No | No | Predatory birds such as herons | No |
| Lake Drive pond | Pond entirely surrounded by suburban development. Pond margin with patches of tule and iceplant. | No | No | No | - | No |
| Locke-Paddon Lake | Lake surrounded by suburban development. Lake margins with tule and willow thickets | Yes | No | No | Sierran treefrog, Non-native fish and cray fish. | Yes |

| Feature | Habitat | Protocol-level Survey performed | Historical occurrences | CRLF Observed | Other Species observed | Suitable Habitat for CRLF? |
|---|---|---|---|---|---|---|
| Reservation Road pond | Pond entirely surrounded by suburban development and roads. Pond margin with tule, willows, coyote brush. | Yes | No | No | Sierran treefrog, Non-native fish and cray fish. | Yes |
| Legion Way pond | Pond entirely surrounded by suburban development. Pond margin with patches of tule and willows. | No | No | No | - | No |
| Armstrong Sandhill Ranch LLC vernal pool | Vernal pool in grazed pasture. Surrounded by grazed, annual short grass. | No | No | No | Coyotes | No |
| Highway 1 wetland | Dry depression surrounded by dune vegetation, coyote brush scrub, and ice plant. | No | No | No | - | No |
| Lapis Road wetland | Dry depression surrounded by dune vegetation, coyote brush scrub, and ice plant. | No | No | No | - | No |
| Neponset Road pond | Pond surrounded by agricultural fields, pasture, and Dole plant. Pond with tule and willows | No | Yes | No | - | Yes |
| Proposed Desalination Plant Property wetland | Sloped hillside dominated by California annual grassland. Surrounded by agriculture land. An agricultural canal bordered by a narrow strip of wetland vegetation lies to the North. | No | Yes | No | Snakes | Yes |
| Salinas River | River with intact riparian habitats including tules, willows, and cottonwood. | No | Yes | No | Predatory birds such as herons. | Yes |
| Tembladero Slough | Slough surrounded by agricultural fields. Some wetlands and willow thickets. | No | Yes | No | Bullfrogs, raccoon track | Yes |
| Carmel River | River with intact riparian habitats including tules, willows, and cottonwood. | No | Yes | No | Sierran treefrog | Yes |

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# Appendix A.
# Site Assessment Datasheets and Habitat Maps

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**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

**Site Assessment reviewed by** ______ ______ ______
(FWS Field Office) (date) (biologist)

**Date of Site Assessment:** NO access to site. Remote assessment
(mm/dd/yyyy)

**Site Assessment Biologists:** Greer Natalie ______ ______
(Last name) (first name) (Last name) (first name)

Parr Ivan ______ ______
(Last name) (first name) (Last name) (first name)

**Site Location:** Eucalyptus Rd. Pond 36'37'23.76 N 121 48'47.78"W
**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: California American Water peninsula supply Project
Brief description of proposed action:

The MPWSP consist of installing pipeline facilities in Monterey County

1) Is this site within the current or historic range of the CRF (circle one)? (YES) NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES (NO)
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**

Size: 198 feet accross 32,705 sq feet

Maximum depth: unknown shallow retention base

Vegetation: emergent, overhanging, dominant species: Coast live oak, mock heather, maritime chapparal

Substrate: Sandy soil. Non-natural bottom; non-natural bank.

**(Perennial)** or **Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ______

**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

Retention basin + No bank

**STREAM:**

Bank full width: ____________

Depth at bank full: ____________

Stream gradient: ____________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ____________

Maximum depth of stream pools: ____________

Characterize non-pool habitat: run, riffle, glide, other: ____________

Vegetation: emergent, overhanging, dominant species: ____________

Substrate: ____________

Bank description: ____________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ____________

Other aquatic habitat characteristics, species observations, drawings, or comments:

This pond is a retention basin w/ no natural bank + no vegetation directly surrounding the pond

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

Robin Dr. Pond

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

This data sheet is to assist in the data collection of California red-legged frog habitat in the vicinity of projects or other land use activities, following the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance), issued by the U.S. Fish and Wildlife Service. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance.

The "Site Assessments" section of the Guidance details the data needed to complete a site assessment. When submitting a complete site assessment to the Service (one that has been done following the Guidance), one data sheet should be included for each aquatic habitat identified. If multiple aquatic habitats are identified within the project site, then multiple data sheets should be completed. A narrative description of the aquatic, riparian, and upland habitats should be provided to characterize the breeding habitat within the project site and the breeding and dispersal habitat within 1.6 kilometers (1 mile) of the project site. In addition to completing this data sheet, field notes, photographs, and maps should be provided to the appropriate Fish and Wildlife Service Office, as requested in the "Site Assessments" section of the Guidance.

**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

| |
|---|
| **Site Assessment reviewed by** ______ **(FWS Field Office)** **(date)** **(biologist)** |

**Date of Site Assessment:** 04/28/16
**(mm/dd/yyyy)**

**Site Assessment Biologists:** Greer Natalie
**(Last name)** **(first name)** **(Last name)** **(first name)**

Avila Rachel
**(Last name)** **(first name)** **(Last name)** **(first name)**

**Site Location:** Robin Dr. Pond E. of Hwy 1, Marina, CA 36.68982, -121.80611 (NAD 83)
**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

****ATTACH A MAP** (include habitat types, important features, and species locations)**

| |
|---|
| Proposed project name: California American Water Peninsula Supply Project |
| Brief description of proposed action: |
| The MPWSP consist of installing pipelines and facilites in unincorporated parts of Monterey county |

1) Is this site within the current or historic range of the CRF (circle one)? (YES) NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES (NO)
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**

Size: 2.7 acres Maximum depth: ~2 m

Vegetation: emergent, overhanging, dominant species: Herbaceous vegetation - iceplant (Carpobrotus sp.) rushes (Juncus sp.), other herbs, Schoenoplectus sp. Coyote brush (Baccharis pilularis) and Monterey cypress (Hesperocyparis macrocarpa) also dominate part of the bank, pickleweed main dominant

Substrate: Sandy soil

**(Perennial) or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ______
* dried up in 2014. Ephemeral in drought years

**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

Robin Dr. Pond.

**STREAM**:

Bank full width: ________________
Depth at bank full: ______________
Stream gradient: ________________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ________________________
Maximum depth of stream pools: ______________

Characterize non-pool habitat: run, riffle, glide, other: ______________________

Vegetation: emergent, overhanging, dominant species: ______________________

Substrate: ______________________

Bank description: ______________________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ______________________

Other aquatic habitat characteristics, species observations, drawings, or comments:

Species observed: mall, Eurecpeon Starling, western gull, gull sp, Americn crow

*tidal marsh influence + picklewead everywhe entire area is fenced; if there were presence of frogs no way for frogs to get out → would travel to peoples backyards

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

April 28, 2016

## Appendix D.

## California Red-legged Frog Habitat Site Assessment Data Sheet

Site Assessment reviewed by ____________ ____________ ____________
(FWS Field Office) (date) (biologist)

**Date of Site Assessment:** NO access. Surveyed remotely + on multiple occassions through fence
(mm/dd/yyyy)

**Site Assessment Biologists:** Parr Ivan ____________ ____________
(Last name) (first name) (Last name) (first name)

Greer Nathan ____________ ____________
(Last name) (first name) (Last name) (first name)

**Site Location:** Cave Drive Pond, 36°41'18 13"N 48'17, 20"W
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: California American water peninsula supply project
Brief description of proposed action:

The MPWSP consist of installing pipeline facilities in Monterey county

1) Is this site within the current or historic range of the CRF (circle one)? YES NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES NO
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**

Size: 271.66 feet across Maximum depth: ____________

Vegetation: emergent, overhanging, dominant species: Coyote brush scrub, ice plant, ~~[illegible]~~ Monterey cypress

Substrate: Sandy soils

**Perennial** or **Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ____________

**STREAM:**

Bank full width: ______

Depth at bank full: ______

Stream gradient: ______

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ______

Maximum depth of stream pools: ______

Characterize non-pool habitat: run, riffle, glide, other: ______

Vegetation: emergent, overhanging, dominant species: ______

Substrate: ______

Bank description: ______

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ______

Other aquatic habitat characteristics, species observations, drawings, or comments:

~~[illegible]~~ Heron observed flying overhead

- Ca bulrush & cattail observed when re-visited site in September pickleweed not observed

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

## Appendix D.
## California Red-legged Frog Habitat Site Assessment Data Sheet

Site Assessment reviewed by ________ (FWS Field Office) ________ (date) ________ (biologist)

**Date of Site Assessment:** 03/14/2016 (mm/dd/yyyy)

**Site Assessment Biologists:**

| (Last name) | (first name) | (Last name) | (first name) |
|---|---|---|---|
| Greer | Natalie | | |
| Avila | Rachel | | |

**Site Location:** Locke - Paddon Park, Monterey County
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).
36°41'29.51 N 121°48'08.33 W

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: California American Water Peninsula Water Supply Project

Brief description of proposed action:

The MPWSP consist of installing pipelines and facilities in unincorporated parts of Monterey County.

1) Is this site within the current or historic range of the CRF (circle one)? (YES) NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES (NO)
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**

Size: ~~3230~~ 269,000 sq ft Maximum depth: ________

Vegetation: emergent, overhanging, dominant species: Cat tails, willows, reeds, California poppy, ice plant, lupine blackberry, Monterey pine, grass

Substrate: Mud, sand, wood chips

**(Perennial)** or **Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ________

**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

**STREAM:** N/A

Bank full width: ____________

Depth at bank full: ____________

Stream gradient: ____________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ____________

Maximum depth of stream pools: ____________

Characterize non-pool habitat: run, riffle, glide, other: ____________

Vegetation: emergent, overhanging, dominant species: ____________

Substrate: ____________

Bank description: ____________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ____________

Other aquatic habitat characteristics, species observations, drawings, or comments:

Other species observed: pigeon, gull sp, Mallard American crow, red-winged black bird, song sparrow, shuffler, yellow-rumped warbler, white-crowned sparrow, western scrub jay, red-tailed hawk

**Necessary Attachments:**

* 1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

* All included in memo

Locke - Paddon

# Appendix E.
## California Red-legged Frog Survey Data Sheet

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service <u>shall</u> be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor <u>must</u> either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

**Appendix E.**

**California Red-legged Frog Survey Data Sheet**

**Survey results reviewed by** ________ (FWS Field Office) ________ (date) ________ (biologist)

**Date of Survey:** 05/24/16 (mm/dd/yyyy) **Survey Biologist:** Lim (Last name) Tammy (first name)

**Survey Biologist:** Gee (Last name) Nolan (first name)

**Site Location:** Loma-padon park (County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: California American water peninsula supply proj

Brief description of proposed action:

The MPWSP consists of installing pipeline + facilities in unincorporated parts of Monterey county

**Type of Survey (circle one): DAY** (circled) **NIGHT** **BREEDING NON-BREEDING**

**Survey number (circle one):** 1 (circled) 2 3 4 5 6 7 8

**Begin Time:** 1323 **End Time:** 1415

**Cloud cover:** 100% **Precipitation:** Ø

**Air Temperature:** 57° **Water Temperature:** 26°C

**Wind Speed:** 2 mph **Visibility Conditions:** Good

**Moon phase:** ________ **Humidity:** ________

**Description of weather conditions:** Cloudy with slight breeze

**Brand name and model of light used to conduct surveys:** N/A

**Were binoculars used for the surveys (circle one)? YES** (circled) **NO**

**Brand, model, and power of binoculars:** Celestron, 8x42

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS** . None

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| | | | | | |
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| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: ______

Other notes, observations, comments, *etc.*

Bulrush, poppys surrounding habitat.

Other species observed: Mall, RWBB, Grackle, Ropi gull sp, Golf, EUST, SOSP, WEGU, PBGR, MODO

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**Survey results reviewed by** ______ (FWS Field Office) ______ (date) ______ (biologist)

**Date of Survey:** 06/15/2016 (mm/dd/yyyy) **Survey Biologist:** Greer (Last name) Natalie (first name)

**Survey Biologist:** Lim (Last name) Tammy (first name)

**Site Location:** Coche-Padden park
**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name:
Brief description of proposed action:

MWSD

**Type of Survey** (circle one): **DAY** (circled) **NIGHT** **BREEDING** (circled) **NON-BREEDING**

**Survey number** (circle one): **1** **2** (circled) **3** **4** **5** **6** **7** **8**

**Begin Time:** 1124 **End Time:** 1218

**Cloud cover:** 15% **Precipitation:** None

**Air Temperature:** 60° F **Water Temperature:** 24° C

**Wind Speed:** 6.7 **Visibility Conditions:** Good

**Moon phase:** Waxing Gibbous **Humidity:** 54%

**Description of weather conditions:** Sunny with few clouds.

**Brand name and model of light used to conduct surveys:** N/A

**Were binoculars used for the surveys** (circle one)? **YES** (circled) **NO**
**Brand, model, and power of binoculars:** Celestron, 8x42

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS** : None Observed.

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| | | | | | |
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| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: Multiple Crayfish Observed

Other notes, observations, comments, *etc.*
Pickleweed along some portions of waters edge

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

## Appendix E.
## California Red-legged Frog Survey Data Sheet

Survey results reviewed by ____________________ ____________ ____________________
(FWS Field Office) (date) (biologist)

**Date of Survey:** 04/25/16 (mm/dd/yyyy) **Survey Biologist:** Greer (Last name) Natalie (first name)

**Survey Biologist:** Parr (Last name) Ivan (first name)

**Site Location:** Locke - paddon park
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: California American water peninsula supply project
Brief description of proposed action:

The mpwsp consist of installing pipeline + facility in unincorporated parts of Monterey county

~~**Type of Survey** (circle one): **DAY NIGHT**~~ ~~**BREEDING** **NON-BREEDING**~~

~~**Survey number** (circle one): 1 2 3 4 5 6 7 8~~

**Begin Time:** 2403 **End Time:** 2447

**Cloud cover:** 0% **Precipitation:** NO

**Air Temperature:** 52° **Water Temperature:** ____________

**Wind Speed:** 12 mph **Visibility Conditions:** high

**Moon phase:** Waning **Humidity:** ____________

**Description of weather conditions:** windy + clear

**Brand name and model of light used to conduct surveys:** ____________

**Were binoculars used for the surveys** (circle one)? **YES** **NO**
**Brand, model, and power of binoculars:** ____________

* too windy for protocol survey

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS**

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| Sierra tree frog | Multiple | H | | | |
| Sierra tree frog | 1 | O | A | | |
| Sierra tree frog | 2 | O | J | | |
| | | | | | |
| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: ______

Other notes, observations, comments, *etc.*

**Necessary Attachments:**

4. All field notes and other supporting documents
5. Site photographs
6. Maps with important habitat features and species locations

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**Survey results reviewed by** ____________________ (FWS Field Office) ________ (date) ____________ (biologist)

**Date of Survey:** 05/24/16 (mm/dd/yyyy)

**Survey Biologist:** Gres (Last name) Natay (first name)

**Survey Biologist:** Lim (Last name) Tammy (first name)

**Site Location:** Locke-paddon park
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: ____________________
Brief description of proposed action:

MWSD

**Type of Survey** (circle one): **DAY** **NIGHT** (circled) **BREEDING** (circled) **NON-BREEDING**

**Survey number** (circle one): **1** (circled) **2** **3** **4** **5** **6** **7** **8**

**Begin Time:** 2335 **End Time:** 2406

**Cloud cover:** 100% **Precipitation:** NONE

**Air Temperature:** 57° **Water Temperature:** 19°C

**Wind Speed:** 4.5 mph **Visibility Conditions:** Good

**Moon phase:** ________ **Humidity:** ________

**Description of weather conditions:** Cloudy with slight breeze

**Brand name and model of light used to conduct surveys:** ________

**Were binoculars used for the surveys (circle one)?** **YES** (circled) **NO**
**Brand, model, and power of binoculars:** Celestron, 8x42

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS**

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| Sierra treefrog | Multiple | H | - | - | 100 % |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: ____________________

____________________

____________________

____________________

____________________

Other notes, observations, comments, *etc.*

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**Survey results reviewed by** ________ (FWS Field Office) ________ (date) ________ (biologist)

**Date of Survey:** 05/23/16 (mm/dd/yyyy) **Survey Biologist:** Greer (Last name) Natalie (first name)

**Survey Biologist:** Parr (Last name) Ivan (first name)

**Site Location:** Lake-Padden Park
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

**ATTACH A MAP (include habitat types, important features, and species locations)**

Proposed project name: ________
Brief description of proposed action:

None

**Type of Survey** (circle one): **DAY NIGHT BREEDING NON-BREEDING** (circled: NIGHT, BREEDING)

**Survey number** (circle one): **1 2 3 4 5 6 7 8** (circled: 2)

**Begin Time:** 10:40 **End Time:** 11:45

**Cloud cover:** Clear **Precipitation:** Ø

**Air Temperature:** 52° **Water Temperature:** ________

**Wind Speed:** 8 mph **Visibility Conditions:** Good

**Moon phase:** ________ **Humidity:** ________

**Description of weather conditions:** Clear with breeze

**Brand name and model of light used to conduct surveys:** ________

**Were binoculars used for the surveys (circle one)? YES NO** (circled: YES)
**Brand, model, and power of binoculars:** Celestron, 8×42

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS**

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| Sierra treefrog | 2 | O | Adults | unknown | 100% |
| Sierra tree frog | multiple | H | Adult | unknown | 100% |
| | | | | | |
| | | | | | |
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Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: ______________________________

Other notes, observations, comments, *etc.*

species observed:
song sparrow

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**Survey results reviewed by** ________ (FWS Field Office) ________ (date) ________ (biologist)

**Date of Survey:** 06/15/2016 (mm/dd/yyyy) **Survey Biologist:** Greer (Last name) Natalie (first name)

**Survey Biologist:** Lim (Last name) Tammy (first name)

**Site Location:** Locke-Paddon Park (County, General location name, UTM Coordinates or Lat./Long. or T-R-S).

**ATTACH A MAP (include habitat types, important features, and species locations)**

Proposed project name:
Brief description of proposed action:

MWSD

**Type of Survey** (circle one): **DAY** **NIGHT** (circled) **BREEDING** (circled) **NON-BREEDING**

**Survey number** (circle one): 1 2 3 (circled) 4 5 6 7 8

**Begin Time:** 0929 **End Time:** 0950

**Cloud cover:** 10% **Precipitation:** NO

**Air Temperature:** 57°F **Water Temperature:** 17°C

**Wind Speed:** 1 mph **Visibility Conditions:** Good

**Moon phase:** waxing **Humidity:** 68%

**Description of weather conditions:** Clear

**Brand name and model of light used to conduct surveys:** ________

**Were binoculars used for the surveys (circle one)?** **YES** (circled) **NO**
**Brand, model, and power of binoculars:** Celestron 8×42

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS**

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| Sierratree frog | 2 | O | Adult | | |
| Siera tree frog | multiple | H | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: ______________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

______________________________________________________________

Other notes, observations, comments, *etc.*

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

Survey results reviewed by ____________ (FWS Field Office) ________ (date) ____________ (biologist)

**Date of Survey:** 6/24/2016 (mm/dd/yyyy) **Survey Biologist:** Parr (Last name) Ivan (first name)
**Survey Biologist:** Donalson (Last name) Jane (first name)

**Site Location:** Locke Paddon
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: MPWSP
Brief description of proposed action:

**Type of Survey** (circle one): **DAY NIGHT** (circled: NIGHT) **BREEDING NON-BREEDING** (circled: BREEDING)

**Survey number** (circle one): 1 2 3 4 5 6 7 8 (circled: 4)

**Begin Time:** 1018 **End Time:**

**Cloud cover:** Mostly clear **Precipitation:** Ø

**Air Temperature:** 58 **Water Temperature:**

**Wind Speed:** 2-4 **Visibility Conditions:** clear

**Moon phase:** waning 1/2 **Humidity:**

**Description of weather conditions:** Clear, breezy

**Brand name and model of light used to conduct surveys:** kestrel

**Were binoculars used for the surveys** (circle one)? **YES NO** (circled: YES)
**Brand, model, and power of binoculars:**

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

Locke Paddo.

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

## AMPHIBIAN OBSERVATIONS

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| PS SI | ∞ | H | Ad. | | Positive |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: ______________________________

Other notes, observations, comments, *etc.*

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

PCÊS
1 ✓
2 ✓
3 ✓
4 ✓
5 ✓

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**Survey results reviewed by**__________ __________ __________
(FWS Field Office) (date) (biologist)

**Date of Survey:** 09/19/16 (mm/dd/yyyy)

**Survey Biologist:** Greer (Last name) Natalie (first name)

**Survey Biologist:** Parc (Last name) Ivan (first name)

**Site Location:** Locke-Paddon
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: __________
Brief description of proposed action:

MpWSP

**Type of Survey** (circle one): **DAY** (circled) **NIGHT** **BREEDING** **NON-BREEDING** (circled)

**Survey number** (circle one): 1 (circled) 2 3 4 5 6 7 8

**Begin Time:** 1250 **End Time:** 1330

**Cloud cover:** 50% **Precipitation:** 0%

**Air Temperature:** 66° **Water Temperature:** __________

**Wind Speed:** 5 mph **Visibility Conditions:** High

**Moon phase:** Waning Gibbous **Humidity:** 66%

**Description of weather conditions:** partly cloudy, light breeze

**Brand name and model of light used to conduct surveys:** N/A

**Were binoculars used for the surveys** (circle one)? **YES** (circled) **NO**
**Brand, model, and power of binoculars:** Celestron 8x42

**Appendix E.**

**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS** : N/A

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| Sierra tree frog | 1 | H | | | 100% |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: ____________________

Other notes, observations, comments, *etc.*

MAWR, WEGU, ANHU, AMCR, CSJA, RWBB

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**Survey results reviewed by** ______________ ______ ______________
(FWS Field Office) (date) (biologist)

**Date of Survey:** 09/21/2016 (mm/dd/yyyy) **Survey Biologist:** Greer Natane (Last name) (first name)

**Survey Biologist:** Parr Iva (Last name) (first name)

**Site Location:** Cocke-paddon
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: ______________
Brief description of proposed action:
MPWSP

**Type of Survey** (circle one): **DAY** **NIGHT** (circled) **BREEDING** **NON-BREEDING** (circled)

**Survey number** (circle one): **1** (circled) **2** **3** **4** **5** **6** **7** **8**

**Begin Time:** 0910 **End Time:** 1009

**Cloud cover:** 0% **Precipitation:** 0%

**Air Temperature:** 57° **Water Temperature:** ______

**Wind Speed:** 9 mph **Visibility Conditions:** High

**Moon phase:** Waning Gibbous **Humidity:** 77%

**Description of weather conditions:** Clear + cool

**Brand name and model of light used to conduct surveys:** Fenix E20

**Were binoculars used for the surveys** (circle one)? **YES** (circled) **NO**
**Brand, model, and power of binoculars:** Celestron 8x42

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

## AMPHIBIAN OBSERVATIONS

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| Sierra tree frog | 1 | H | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: RACOON hunting on the shore, Oppossum

Other notes, observations, comments, *etc.*

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

**Site Assessment reviewed by** ______________ ______ ______________
**(FWS Field Office)** **(date)** **(biologist)**

**Date of Site Assessment:** 05/23/2016
**(mm/dd/yyyy)**

**Site Assessment Biologists:** Greer, Natalie — Lim, Tammy
**(Last name)** **(first name)** **(Last name)** **(first name)**

______________ ______________
**(Last name)** **(first name)** **(Last name)** **(first name)**

**Site Location:** Reservation Rd.
**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: MPWP
Brief description of proposed action:

- installing pipeline in Monterey County

1) Is this site within the current or historic range of the CRF (circle one)? **YES** (circled) NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES **NO** (circled)
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**
Size: 67.9ft x 466.27 ft. Maximum depth: ______________

Vegetation: emergent, overhanging, dominant species: ______________

Substrate: Sandy soil

**Perennial** (circled) or **Ephemeral** *(circle one).* If ephemeral, date it goes dry: ______________

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

**STREAM:**

Bank full width: N/A
Depth at bank full: ________________
Stream gradient: ________________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ________________
Maximum depth of stream pools: ________________

Characterize non-pool habitat: run, riffle, glide, other: ________________

Vegetation: emergent, overhanging, dominant species: ________________

Substrate: ________________

Bank description: ________________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ________________

Other aquatic habitat characteristics, species observations, drawings, or comments:

- ~~grass~~ Non-native annual grasses, native shrubs, willow thickets + Ca bulrush.
- Pickleweed + saltgrass

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

Reservation Road Pond

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

| |
|---|
| **Survey results reviewed by** ______ (FWS Field Office) ______ (date) ______ (biologist) |

**Date of Survey:** 05/23/14 (mm/dd/yyyy) **Survey Biologist:** Greer (Last name) Natalie (first name)

**Survey Biologist:** Lim (Last name) Tammy (first name)

**Site Location:** Reservation Rd
**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

****ATTACH A MAP** (include habitat types, important features, and species locations)****

| |
|---|
| Proposed project name:<br>Brief description of proposed action: |

**Type of Survey** (circle one): **DAY** (circled) **NIGHT** **BREEDING** (circled) **NON-BREEDING**

**Survey number** (circle one): 1 (circled) **2** **3** **4** **5** **6** **7** **8**

**Begin Time:** 1242 **End Time:** ______

**Cloud cover:** ______ **Precipitation:** ______

**Air Temperature:** ______ **Water Temperature:** ______

**Wind Speed:** ______ **Visibility Conditions:** ______

**Moon phase:** ______ **Humidity:** ______

**Description of weather conditions:** ______

**Brand name and model of light used to conduct surveys:** N/A

**Were binoculars used for the surveys (circle one)?** **YES** (circled) **NO**
**Brand, model, and power of binoculars:** Celestron, 8 x 42

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS**

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
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| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: Multiple crayfish and mosquito fish observed at location.

Other notes, observations, comments, *etc.*

A lot of bulrush and reeds.

Salt grass
Pickleweed ] Both present along waters edge

Other species observed: GUST, RWBB, WT SW, Gull sp.

-Surrounded by heavily used road

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

## Appendix E.
## California Red-legged Frog Survey Data Sheet

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

## Appendix E.
## California Red-legged Frog Survey Data Sheet

**Survey results reviewed by** ______ (FWS Field Office) ______ (date) ______ (biologist)

**Date of Survey:** 06/15/2016 (mm/dd/yyyy) **Survey Biologist:** Greer (Last name) Natalie (first name)

**Survey Biologist:** Lin (Last name) Tammy (first name)

**Site Location:** Beach Rd + Reservation Rd
**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name:
Brief description of proposed action:

**Type of Survey** (circle one): **DAY** (circled) **NIGHT** **BREEDING** **NON-BREEDING**

**Survey number** (circle one): **1** **2** (circled) **3** **4** **5** **6** **7** **8**

**Begin Time:** 1230 **End Time:** 1258

**Cloud cover:** 15% **Precipitation:** None

**Air Temperature:** 61° F **Water Temperature:** 23°C

**Wind Speed:** 5 mph **Visibility Conditions:** Good

**Moon phase:** waxing Gibbous **Humidity:** 54%

**Description of weather conditions:** Sunny with a few clouds

**Brand name and model of light used to conduct surveys:** N/A

**Were binoculars used for the surveys (circle one)?** **YES** (circled) **NO**
**Brand, model, and power of binoculars:** Celestron, 8x42

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS** : None

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
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| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: Multiple Crayfish observed, Schools of mosquito fish

Other notes, observations, comments, *etc.*

-Pickleweed and Salt grass observed at some portions along the waters edge.

· Red-eared Slider

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

## Appendix E.
## California Red-legged Frog Survey Data Sheet

Survey results reviewed by ______ (FWS Field Office) ______ (date) ______ (biologist)

**Date of Survey:** 05/31/16 (mm/dd/yyyy)

**Survey Biologist:** Greer (Last name) Natalie (first name)

**Survey Biologist:** Parr (Last name) Lucy (first name)

**Site Location:** Reservation Rd Pond
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S).

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: ______
Brief description of proposed action:

**Type of Survey** (circle one): **DAY** **NIGHT** (circled) **BREEDING** (circled) **NON-BREEDING**

**Survey number** (circle one): **1** (circled) **2 3 4 5 6 7 8**

**Begin Time:** 1015 **End Time:** 1035

**Cloud cover:** ______ **Precipitation:** ______

**Air Temperature:** ______ **Water Temperature:** ______

**Wind Speed:** ______ **Visibility Conditions:** ______

**Moon phase:** ______ **Humidity:** ______

**Description of weather conditions:** ______

**Brand name and model of light used to conduct surveys:** ______

**Were binoculars used for the surveys** (circle one)? **YES** (circled) **NO**
**Brand, model, and power of binoculars:** Celestron, 8×32

## Appendix E.
## California Red-legged Frog Survey Data Sheet

**AMPHIBIAN OBSERVATIONS**: None

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: High density of both cray fish and mosquito fish present.

Other notes, observations, comments, *etc.*

- obvious pond → CRLF occurences would be ~~too~~ recorded if CRLF were known from pond.

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

## Appendix E.
## California Red-legged Frog Survey Data Sheet

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

| | | |
|---|---|---|
| **Survey results reviewed by** (FWS Field Office) | (date) | (biologist) |

**Date of Survey:** 06/15/2016 (mm/dd/yyyy) **Survey Biologist:** Greer (Last name) Natalie (first name)

**Survey Biologist:** Lim (Last name) Tammy (first name)

**Site Location:** Beach Rd + Reservation Rd
**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name:
Brief description of proposed action:

**Type of Survey** (circle one): **DAY** **NIGHT** (circled) **BREEDING** (circled) **NON-BREEDING**

**Survey number** (circle one): **1** **2** (circled) **3** **4** **5** **6** **7** **8**

**Begin Time:** 0953 **End Time:** 1020

**Cloud cover:** 10% **Precipitation:** None

**Air Temperature:** 58°F **Water Temperature:** 20°C

**Wind Speed:** 1 mph **Visibility Conditions:** Good

**Moon phase:** waxing **Humidity:** 68%

**Description of weather conditions:** Clear and calm

**Brand name and model of light used to conduct surveys:**

**Were binoculars used for the surveys** (circle one)? **YES** (circled) **NO**
**Brand, model, and power of binoculars:** Celestron, 8x42

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS** : None

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons:
Multiple Crayfish observed. Multiple fish (mosquito) observed

Other notes, observations, comments, *etc.*

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

**Appendix E.**

**California Red-legged Frog Survey Data Sheet**

| Survey results reviewed by ______ (FWS Field Office) ______ (date) ______ (biologist) |
|---|

**Date of Survey:** 6/24/16 (mm/dd/yyyy)

**Survey Biologist:** Parr Ivan (Last name) (first name)

**Survey Biologist:** Donaldson Jane (Last name) (first name)

**Site Location:** Reservation Rd.

(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

**ATTACH A MAP** (include habitat types, important features, and species locations)**

| Proposed project name: ______<br>Brief description of proposed action: |
|---|

**Type of Survey** (circle one): **DAY NIGHT** (circled) **BREEDING** (circled) **NON-BREEDING**

**Survey number** (circle one): **1 2 3** (circled) **4 5 6 7 8**

**Begin Time:** 11:18 **End Time:** 11:51

**Cloud cover:** Partly cloudy **Precipitation:** Ø

**Air Temperature:** 58 **Water Temperature:** ______

**Wind Speed:** 1 mph **Visibility Conditions:** ______

**Moon phase:** waning 1/2 **Humidity:** ______

**Description of weather conditions:** Clear, light breeze, Calm

**Brand name and model of light used to conduct surveys:** ______

**Were binoculars used for the surveys** (circle one)? **YES** (circled) **NO**

**Brand, model, and power of binoculars:** ______

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS** Reservation Rd.

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| Ø | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: Cawfish, feral cat, Mosquito fish

Other notes, observations, comments, *etc.*
Crawfish abundant 1 per m.

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

PCEs
1 ✓
2 ✓
3 ✓
4 ✓ → hillside for dispersal / aestivation
5

## Appendix E.
## California Red-legged Frog Survey Data Sheet

This data sheet is to assist in the data collection during surveys for California red-legged frogs in areas with potential habitat. This data sheet is intended to assist in the preparation of a final report on the field surveys as detailed in the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance) issued by the U.S. Fish and Wildlife Service (Service). Before completing this data sheet, a site assessment should have been conducted using the Guidance and the Service should have been contacted to determine whether surveys are required. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance. To avoid and minimize the potential of harassment to California red-legged frogs, all survey activities shall cease once an individual California red-legged frog has been identified in the survey area, unless prior approval has been received from the appropriate Service Fish and Wildlife Office. The Service shall be notified within three (3) working days by the surveyor once a California red-legged frog is detected, at which point the Service will provide further guidance. Surveys should take place in consecutive breeding/non-breeding seasons (*i.e.,* the entire survey period, including breeding and non-breeding surveys should not exceed 9 months). It is important that both the breeding and non-breeding survey be conducted during the time period specified in the Guidance. Site specific conditions may warrant modifications to the timing of survey periods, modifications must be made with the Service's approval. The survey consists of two (2) day and four (4) night surveys during the breeding season and one (1) day and one (1) night surveys during the non-breeding season.

All California red-legged frog life stages should be surveyed for. Surveyors may detect larvae but not be able to identify this life stage to species as handling any life stage of the California red-legged frog necessitates a valid 10(a)(1)(A) permit. If the larval life stage is the only life stage detected and the larvae are not identified to species, the surveyor must either return to the habitat to identify the frog in another life stage or have a valid 10(a)(1)(A) permit allowing the surveyor to handle California red-legged frogs and larvae. In order for the Service to consider a survey to be complete, all frogs encountered must be accurately identified.

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**Survey results reviewed by** ______________________
(FWS Field Office) (date) (biologist)

**Date of Survey:** 06/27/2016 (mm/dd/yyyy) **Survey Biologist:** Greer (Last name) Natalie (first name)
**Survey Biologist:** Donaldson (Last name) Jon (first name)

**Site Location:** Reservation Rd
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: ______________________
Brief description of proposed action:

**Type of Survey** (circle one): **DAY** **NIGHT** (circled) **BREEDING** (circled) **NON-BREEDING**

**Survey number** (circle one): **1 2 3 4** (circled) **5 6 7 8**

**Begin Time:** 2200 **End Time:** 2230

**Cloud cover:** 0% **Precipitation:** None

**Air Temperature:** 56°F **Water Temperature:** ______

**Wind Speed:** 3-5 mph gust to 8 **Visibility Conditions:** high

**Moon phase:** Last quarter Moon **Humidity:** 78%

**Description of weather conditions:** Clear and calm

**Brand name and model of light used to conduct surveys:** ______________________

**Were binoculars used for the surveys** (circle one)? **YES** (circled) **NO**
**Brand, model, and power of binoculars:** ______________________

No amphibias observed

**Appendix E.**

**California Red-legged Frog Survey Data Sheet**

**Survey results reviewed by** ____________ **(FWS Field Office)** ______ **(date)** ____________ **(biologist)**

**Date of Survey:** 09/19/2016 **(mm/dd/yyyy)**

**Survey Biologist:** Greer **(Last name)** Natalie **(first name)**

**Survey Biologist:** Parr **(Last name)** Ivan **(first name)**

**Site Location:** Reservation Rd pond

**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

****ATTACH A MAP** (include habitat types, important features, and species locations)******

Proposed project name: ____________

Brief description of proposed action:

**Type of Survey** (circle one): **DAY** (circled) **NIGHT** **BREEDING** **NON-BREEDING** (circled)

**Survey number** (circle one): **1** (circled) **2** **3** **4** **5** **6** **7** **8**

**Begin Time:** 1205 **End Time:** 1242

**Cloud cover:** 100% **Precipitation:** 0%

**Air Temperature:** 68° **Water Temperature:** ____________

**Wind Speed:** 5 mph **Visibility Conditions:** High

**Moon phase:** Waning Gibbous **Humidity:** 66%

**Description of weather conditions:** Slightly windy, sun breaks out occasionally

**Brand name and model of light used to conduct surveys:** N/A

**Were binoculars used for the surveys (circle one)?** **YES** (circled) **NO**

**Brand, model, and power of binoculars:** Celestron 8x42

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS**

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| Sierra tree frog | 3 | O | Adults | | 50% |
| Sierra tree Frog | 1 | O | Adult | | 100% |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: Non-native fish present in lake ~~[illegible]~~

Other notes, observations, comments, *etc.*

RWBB, non-native fish, AMCR, mosquito fish ~~[illegible]~~, CSJA
WEGU

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

## Appendix E.
## California Red-legged Frog Survey Data Sheet

**Survey results reviewed by** ____________ ____________ ____________
**(FWS Field Office)** **(date)** **(biologist)**

**Date of Survey:** 09/21/2016 **(mm/dd/yyyy)**

**Survey Biologist:** Greer Natalie **(Last name)** **(first name)**

**Survey Biologist:** Parr Ivan **(Last name)** **(first name)**

**Site Location:** Reservation Rd
**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: ____________
Brief description of proposed action:

**Type of Survey** (circle one): **DAY** **NIGHT** (circled) **BREEDING** **NON-BREEDING** (circled)

**Survey number** (circle one): **1** (circled) **2** **3** **4** **5** **6** **7** **8**

**Begin Time:** 1015 **End Time:** 1043

**Cloud cover:** 0% **Precipitation:** 0%

**Air Temperature:** 57 **Water Temperature:** ____________

**Wind Speed:** 9 mph **Visibility Conditions:** High

**Moon phase:** Waning Gibbous **Humidity:** 77%

**Description of weather conditions:** Clear + cool

**Brand name and model of light used to conduct surveys:** Fenix E20, Coleman 250 lumens

**Were binoculars used for the surveys (circle one)?** **YES** (circled) **NO**
**Brand, model, and power of binoculars:** Celestron 8x42

**Appendix E.**
**California Red-legged Frog Survey Data Sheet**

**AMPHIBIAN OBSERVATIONS:** None

| Species | # of indiv. | Observed (O) Heard (H) | Life Stages | Size Class | Certainty of Identification |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |
| | | | | | |

Describe potential threats to California red-legged frogs observed, including non-native and native predators such as fish, bullfrogs, and raccoons: skunk on shore
mosquito fish, crayfish

Other notes, observations, comments, *etc.*

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species locations

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

**Site Assessment reviewed by** ______________ ______ ______________
**(FWS Field Office)** **(date)** **(biologist)**

**Date of Site Assessment:** No access to site. Remote survey
**(mm/dd/yyyy)**

**Site Assessment Biologists:** Parr Ivan ______________
**(Last name)** **(first name)** **(Last name)** **(first name)**

Greer Natae ______________
**(Last name)** **(first name)** **(Last name)** **(first name)**

**Site Location:** Legion Way Pond, 36°41'54.08"N 121°47'53.04W
**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: California American water peninsul supply re
Brief description of proposed action:

The MPWSP consist of installing pipeline facilities in Monterey county

1) Is this site within the current or historic range of the CRF (circle one)? YES (circled) NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES NO (circled)
**If yes, attach a list of all known CRF records with a map showing all locations.**

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**

Size: Unknown → covered in veg/ wetland Maximum depth: Unknown

Vegetation: emergent, overhanging, dominant species: Bulrush marsh, coyote brush, willow

Substrate: Sandy - dune soil

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: Unknown

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

**STREAM**:

Bank full width: ________________
Depth at bank full: ________________
Stream gradient: ________________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ________________
Maximum depth of stream pools: ________________

Characterize non-pool habitat: run, riffle, glide, other: ________________

Vegetation: emergent, overhanging, dominant species: ________________

Substrate: ________________

Bank description: ________________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ________________

Other aquatic habitat characteristics, species observations, drawings, or comments:

surrounded by housing community,
frogs have no way out

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

**Site Assessment reviewed by** ______ ______ ______
(FWS Field Office) (date) (biologist)

**Date of Site Assessment:** ~~23-may~~ May 23, 2016
(mm/dd/yyyy)

**Site Assessment Biologists:** Parr Ivan
(Last name) (first name) (Last name) (first name)

Greer Natalie
(Last name) (first name) (Last name) (first name)

**Site Location:** Rural Marina vernal pools, 36° 42'25.97 N 47'36.21" W
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S).

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: California American Water Peninsula Supply Project
Brief description of proposed action:

The purpose consists of installing piping facility in Monterey County

1) Is this site within the current or historic range of the CRF (circle one)? YES NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES NO
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**

Size: 1378 ft x 246 ft at max Maximum depth: Shallow vernal pool few feet of water

Vegetation: emergent, overhanging, dominant species: Dune vegetation : iceplant, coyote brush, mock heather

Substrate: Sandy Soil

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ~~Wett~~ Unknown

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

**STREAM:**

Bank full width: ____________________

Depth at bank full: ____________________

Stream gradient: ____________________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ____________________

Maximum depth of stream pools: ____________________

Characterize non-pool habitat: run, riffle, glide, other: ____________________

Vegetation: emergent, overhanging, dominant species: ____________________

Substrate: ____________________

Bank description: ____________________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ____________________

Other aquatic habitat characteristics, species observations, drawings, or comments:

Coyotes observed hunting in upland habitat

Red-tailed hawk pair, Golden eagle, western meadowlark

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

March 16, 2016

## Appendix D.
## California Red-legged Frog Habitat Site Assessment Data Sheet

Site Assessment reviewed by ______ (FWS Field Office) ______ (date) ______ (biologist)

**Date of Site Assessment:** NO access remote survey (mm/dd/yyyy)

**Site Assessment Biologists:** Parr (Last name) Ivan (first name) ______ (Last name) ______ (first name)

Greer (Last name) Natalie (first name) ______ (Last name) ______ (first name)

**Site Location:** Hwy 1 wetland, 36°42" 19.18° N, 121 48.04.24° W
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: California American water peninsula water supply project

Brief description of proposed action:

The MPWSP consists of installing pipelines + facilities in Monterey County

1) Is this site within the current or historic range of the CRF (circle one)? **(YES)** NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES **(NO)**
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND**:

Size: 292 ft x 100 ft Maximum depth: wetland, can rest during winter

Vegetation: emergent, overhanging, dominant species: Brush scrub, ice plant, heather, dune vegetation

Substrate: Sandy soil

**Perennial or (Ephemeral)** *(circle one)*. If ephemeral, date it goes dry: Unknown

Appendix D.
California Red-legged Frog Habitat Site Assessment Data Sheet

**STREAM:**

Bank full width: ________________

Depth at bank full: ________________

Stream gradient: ________________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ________________

Maximum depth of stream pools: ________________

Characterize non-pool habitat: run, riffle, glide, other: ________________

Vegetation: emergent, overhanging, dominant species: ________________

Substrate: ________________

Bank description: ________________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ________________

Other aquatic habitat characteristics, species observations, drawings, or comments:

S. of cement plant

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

## Appendix D.
## California Red-legged Frog Habitat Site Assessment Data Sheet

| Site Assessment reviewed by ______ (FWS Field Office) ______ (date) ______ (biologist) |
|---|

**Date of Site Assessment:** ~~20~~ May 23, 2016
(mm/dd/yyyy)

**Site Assessment Biologists:** Lim Tammy
(Last name) (first name) (Last name) (first name)

Greer Natalie
(Last name) (first name) (Last name) (first name)

Lapis Road wetland

**Site Location:** Unincorporated Monterey County, between Hwy 1 and Lapis rd. 36°42'55.3"N 121°47'37.35"W
**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

****ATTACH A MAP** (include habitat types, important features, and species locations)******

Proposed project name: California America water peninsula water supply project
Brief description of proposed action:

The MPWSP consists of installing pipelines and facilities in ~~unincorporated~~ Monterey County

1) Is this site within the current or historic range of the CRF (circle one)? **(YES)** NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES **(NO)**
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**
Size: 18,500 sq. ft. Maximum depth: 0 dry at time of survey.

Vegetation: emergent, overhanging, dominant species: Mock heather scrub ~~and~~, ice plant mats, ~~agricultural~~ coyote brush scrub

Substrate: sandy; stabilized dunes

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: Ephemeral
It is unclear if this feature ever holds water

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

**STREAM:** N/A

Bank full width: ________________

Depth at bank full: ________________

Stream gradient: ________________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ________________

Maximum depth of stream pools: ________________

Characterize non-pool habitat: run, riffle, glide, other: ________________

Vegetation: emergent, overhanging, dominant species: ________________

Substrate: ________________

Bank description: ________________

**Perennial or Ephemeral** *(circle one).* If ephemeral, date it goes dry: ________________

Other aquatic habitat characteristics, species observations, drawings, or comments:

No other species observed; Active construction occurring at site w/ excavator use

unclear if this feature ever holds water. → May not

after construction

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species location

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

**Site Assessment reviewed by** ______________ (FWS Field Office) ______________ (date) ______________ (biologist)

**Date of Site Assessment:** May 23, 2016 (mm/dd/yyyy)

**Site Assessment Biologists:**

| (Last name) | (first name) | (Last name) | (first name) |
|---|---|---|---|
| Greer | Natalie | | |
| Lim | Tammy | | |

**Site Location:** Unincorporated Monterey Co., immediately E. of Hwy 1 and Dole plant Neponset Pond (County, General location name, UTM Coordinates or Lat./Long. or T-R-S ). 36°43'27 N 121°46'52.61 W

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: California American Water peninsula water supply project

Brief description of proposed action:

The MPWSP consists of installing pipelines and facilities in Monterey County.

1) Is this site within the current or historic range of the CRF (circle one)? **(YES)** NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES **(NO)**
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**

Size: 49,500 sq. ft. Maximum depth: unknown

Vegetation: emergent, overhanging, dominant species: Arroyo willow, California bulrush, upland vegetation is dominated by coyote brush, mock heather, iceplant, and agricultural fields.

Substrate: Sandy

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: Perennial

**STREAM:**

Bank full width: ______________

Depth at bank full: ______________

Stream gradient: ______________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ______________

Maximum depth of stream pools: ______________

Characterize non-pool habitat: run, riffle, glide, other: ______________

Vegetation: emergent, overhanging, dominant species: ______________

Substrate: ______________

Bank description: ______________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ______________

Other aquatic habitat characteristics, species observations, drawings, or comments:

surrounded by housing community,

frogs have no way out

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

**STREAM:**

Bank full width: ____________________
Depth at bank full: ____________________
Stream gradient: ____________________

Are there pools (circle one)? YES NO
If yes,
Size of stream pools: ____________________
Maximum depth of stream pools: ____________________

Characterize non-pool habitat: run, riffle, glide, other: ____________________

Vegetation: emergent, overhanging, dominant species: ____________________

Substrate: ____________________

Bank description: ____________________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ____________________

Other aquatic habitat characteristics, species observations, drawings, or comments:

Coyotes observed hunting in upland habitat

Red-tailed hawk pair, Golden eagle, western meadowlark

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

**STREAM:**

Bank full width: ________________

Depth at bank full: ________________

Stream gradient: ________________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ________________

Maximum depth of stream pools: ________________

Characterize non-pool habitat: run, riffle, glide, other: ________________

Vegetation: emergent, overhanging, dominant species: ________________

Substrate: ________________

Bank description: ________________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ________________

Other aquatic habitat characteristics, species observations, drawings, or comments:

S. of cemet plan

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

**STREAM:** N/A

Bank full width: ________________

Depth at bank full: ________________

Stream gradient: ________________

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ________________

Maximum depth of stream pools: ________________

Characterize non-pool habitat: run, riffle, glide, other: ________________

Vegetation: emergent, overhanging, dominant species: ________________

Substrate: ________________

Bank description: ________________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ________________

Other aquatic habitat characteristics, species observations, drawings, or comments:

no other species observed; Active construction occuring at site w/ excavator use

unclear if this feature ever holds water. → may not

after construction

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species location

**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

**STREAM:** N/A

Bank full width: ______

Depth at bank full: ______

Stream gradient: ______

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ______

Maximum depth of stream pools: ______

Characterize non-pool habitat: run, riffle, glide, other: ______

Vegetation: emergent, overhanging, dominant species: ______

Substrate: ______

Bank description: ______

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ______

Other aquatic habitat characteristics, species observations, drawings, or comments:

None

E of pole plan

close to Salinas + Desal plant

Surrounded by Ag land.

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species location

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

**STREAM:** N/A

Bank full width: ______

Depth at bank full: ______

Stream gradient: ______

Are there pools (circle one)? YES NO

If yes,

Size of stream pools: ______

Maximum depth of stream pools: ______

Characterize non-pool habitat: run, riffle, glide, other: ______

Vegetation: emergent, overhanging, dominant species: ______

Substrate: ______

Bank description: ______

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ______

Other aquatic habitat characteristics, species observations, drawings, or comments:

None

E of Dole plan

close to Salinas + Desal plat

Surrounded by Ag land.

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs
3. Maps with important habitat features and species location

**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

**Site Assessment reviewed by** ______________ ______________ ______________
**(FWS Field Office)** **(date)** **(biologist)**

**Date of Site Assessment:** 04/25/2016
**(mm/dd/yyyy)**

**Site Assessment Biologists:** Greer, Natalie — Parr, Ivan
**(Last name)** **(first name)** **(Last name)** **(first name)**

______________ ______________
**(Last name)** **(first name)** **(Last name)** **(first name)**

**Site Location:** Desalination Plant Wetland
**(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).**

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: MPSWP
Brief description of proposed action:

-Installing pipeline in Monterey County

1) Is this site within the current or historic range of the CRF (circle one)? YES (circled) NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES NO (circled)
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND**:
Size: ______________ Maximum depth: ______________

Vegetation: emergent, overhanging, dominant species: ______________

Substrate: ______________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ______________

**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

**STREAM:**

Bank full width: [illegible]

Depth at bank full: ~~Don't know~~

Stream gradient: ____________

Are there pools (circle one)? YES (NO)

If yes,

Size of stream pools: ____________

Maximum depth of stream pools: ____________

Characterize non-pool habitat: run, riffle, glide, other: ____________

Vegetation: emergent, overhanging, dominant species: ____________

Substrate: Sandy, soil

Bank description: wetland veg, not a steep bank emergent vegetation

**(Perennial)** or **Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ____________

| Other aquatic habitat characteristics, species observations, drawings, or comments: |
|---|
| -Wetland area 40 ft above ag. canal<br>-most likely pestizides in water were seen being sprayed<br><br>- slow moving water<br>-grassland |

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

"Weeping [illegible] Pond"
[illegible]
Salinas River

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

This data sheet is to assist in the data collection of California red-legged frog habitat in the vicinity of projects or other land use activities, following the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance), issued by the U.S. Fish and Wildlife Service. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance.

The "Site Assessments" section of the Guidance details the data needed to complete a site assessment. When submitting a complete site assessment to the Service (one that has been done following the Guidance), one data sheet should be included for each aquatic habitat identified. If multiple aquatic habitats are identified within the project site, then multiple data sheets should be completed. A narrative description of the aquatic, riparian, and upland habitats should be provided to characterize the breeding habitat within the project site and the breeding and dispersal habitat within 1.6 kilometers (1 mile) of the project site. In addition to completing this data sheet, field notes, photographs, and maps should be provided to the appropriate Fish and Wildlife Service Office, as requested in the "Site Assessments" section of the Guidance.

Appendix D.

**California Red-legged Frog Habitat Site Assessment Data Sheet**

**Site Assessment reviewed by** ______ ______ ______
(FWS Field Office) (date) (biologist)

**Date of Site Assessment:** 04/25/16
(mm/dd/yyyy)

**Site Assessment Biologists:** Greer Natalie ______ ______
(Last name) (first name) (Last name) (first name)

Deichsel Saana ______ ______
(Last name) (first name) (Last name) (first name)

**Site Location:** Salinas River; 36.73541, -121.78961 (W end), 36.71332, -121.75718
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S). (E end) (NAD83)

****ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: California American Water Peninsula Supply Project

Brief description of proposed action:

The MPWSP consist of installing pipelines and facilities in unincorporated parts of Monterey County

1) Is this site within the current or historic range of the CRF (circle one)? YES (circled) NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES (circled) NO
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**

Size: ______ Maximum depth: ______

Vegetation: emergent, overhanging, dominant species: ______

Substrate: ______

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ______

Appendix D.

**California Red-legged Frog Habitat Site Assessment Data Sheet**

Salinas River

**STREAM:**

Bank full width: 130m max. width; 50m min width
Depth at bank full: 2m+
Stream gradient: ~~[illegible]~~ 0.077%

Are there pools (circle one)? YES (NO circled)
If yes,
Size of stream pools: ______
Maximum depth of stream pools: ______

Characterize non-pool habitat: run, riffle, glide, other: Slow-moving glide close to mouth of river.

Vegetation: emergent, overhanging, dominant species: Oak and willow riparian forest; ~~[illegible]~~ tule (Schoenoplectus sp.), sedges (Carex sp.), Potentilla anserina, giant reed (Arundo donax), Coyote brush (Baccharis pilularis), Knotweed

Substrate: Sandy soil, Rocks, seeds

Bank description: ~~Riparian forest with emergent vegetation on immediate bank.~~ Flat, densely vegetated near banks

**Perennial** (circled) **or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ______

Other aquatic habitat characteristics, species observations, drawings, or comments:

So. SOSP, WEGU, RWBB, AMCR, DCCO

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

**Appendix D.**

**California Red-legged Frog Habitat Site Assessment Data Sheet**

This data sheet is to assist in the data collection of California red-legged frog habitat in the vicinity of projects or other land use activities, following the August 2005, *Revised Guidance on Site Assessment and Field Surveys for California Red-legged Frogs* (Guidance), issued by the U.S. Fish and Wildlife Service. Prior to collecting the data requested on this form, the biologist should be familiar with and understand the Guidance.

The "Site Assessments" section of the Guidance details the data needed to complete a site assessment. When submitting a complete site assessment to the Service (one that has been done following the Guidance), one data sheet should be included for each aquatic habitat identified. If multiple aquatic habitats are identified within the project site, then multiple data sheets should be completed. A narrative description of the aquatic, riparian, and upland habitats should be provided to characterize the breeding habitat within the project site and the breeding and dispersal habitat within 1.6 kilometers (1 mile) of the project site. In addition to completing this data sheet, field notes, photographs, and maps should be provided to the appropriate Fish and Wildlife Service Office, as requested in the "Site Assessments" section of the Guidance.

**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

| **Site Assessment reviewed by** _______ (FWS Field Office) | _______ (date) | _______ (biologist) |
|---|---|---|

**Date of Site Assessment:** 04/25/16
(mm/dd/yyyy)

**Site Assessment Biologists:**

| (Last name) | (first name) | (Last name) | (first name) |
|---|---|---|---|
| Greer | Natalie | | |
| Deichsel | Saara | | |

**Site Location:** Tembladero Slough, -121.742952, 36.748221
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

**ATTACH A MAP** (include habitat types, important features, and species locations)**

Proposed project name: California American Water Peninsula Supply Project
Brief description of proposed action:

The MPWSP consist of installing pipelines and facilities in unincorporated parts of Monterey County

1) Is this site within the current or historic range of the CRF (circle one)? **YES** (circled) NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? **YES** (circled) NO
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**

Size: ____________ Maximum depth: ____________

Vegetation: emergent, overhanging, dominant species: ____________

Substrate: ____________

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ____________

**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

Tembladero Slough

**STREAM**:

Bank full width: ~~[illegible]~~ 7m

Depth at bank full: ~~[illegible]~~ 0.5m

Stream gradient: <0.1%

Are there pools (circle one)? YES (NO)

If yes,

Size of stream pools: ____

Maximum depth of stream pools: ____

Characterize non-pool habitat: run, riffle, glide, other: glides ~~and runs~~ in ~~[illegible]~~ channels ~~that~~ are braided in sections

Vegetation: emergent, overhanging, dominant species: mustard, black berry, thistle sp, fox tail, stinging nettle, willows, Rumex sp, Poison hemlock, ~~[illegible]~~ Schoenoplectus sp, Coyote brush.

Substrate: Clay and loamy soil

Bank description: small ~~[illegible]~~ earthen levees with herbaceous vegetation or sometimes bare earth. Adjacent to agricultural fields

(**Perennial**) or ~~**Ephemeral**~~ *(circle one)*. If ephemeral, date it goes dry: ____

Other aquatic habitat characteristics, species observations, drawings, or comments:

- Drainage flows into slough from concrete channels and Agriculture ditchs.
- sulfuric smell
- seasonal marsh nearby
- Racoon tracks, RWBB, DCCO, no DO, may

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

**Site Assessment reviewed by** ______ (FWS Field Office) ______ (date) ______ (biologist)

**Date of Site Assessment:** 5/23/2014
(mm/dd/yyyy)

**Site Assessment Biologists:** Greer (Last name) Natalie (first name) ______ (Last name) ______ (first name)

Parr (Last name) Ivan (first name) ______ (Last name) ______ (first name)

**Site Location:** Carmel River, 36.53818, -121.87300
(County, General location name, UTM Coordinates or Lat./Long. or T-R-S ).

****ATTACH A MAP** (include habitat types, important features, and species locations)******

Proposed project name: California American Water Peninsula Supply Project
Brief description of proposed action:
The MPWSP consists of installing pipelines and facilities in Monterey ~~[illegible]~~ County.

1) Is this site within the current or historic range of the CRF (circle one)? YES (circled) NO

2) Are there known records of CRF within 1.6 km (1 mi) of the site (circle one)? YES (circled) NO
If yes, attach a list of all known CRF records with a map showing all locations.

## GENERAL AQUATIC HABITAT CHARACTERIZATION

*(if multiple ponds or streams are within the proposed action area, fill out one data sheet for each)*

**POND:**
Size: ______ Maximum depth: ______

Vegetation: emergent, overhanging, dominant species: ______

Substrate: ______

**Perennial or Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ______

**Appendix D.**
**California Red-legged Frog Habitat Site Assessment Data Sheet**

**STREAM**:

Bank full width: 40m max, 10m min

Depth at bank full: 2m

Stream gradient: 0.2%

Are there pools (circle one)? (YES) (NO)

If yes,

Size of stream pools: 4 ft x 5 ft m

Maximum depth of stream pools: 1 ft

Characterize non-pool habitat: run, riffle, glide, other: Large riffle areas dominate this section of river, with some runs.

Vegetation: emergent, overhanging, dominant species: Riparian forest - Coast live oak.

Substrate: Rocky / gravelly

Bank description: Rocky, steep bank.

**(Perennial)** or **Ephemeral** *(circle one)*. If ephemeral, date it goes dry: ________

Other aquatic habitat characteristics, species observations, drawings, or comments:

Sierran tree frog

AMCR, RTHA, BLPH, SCJA

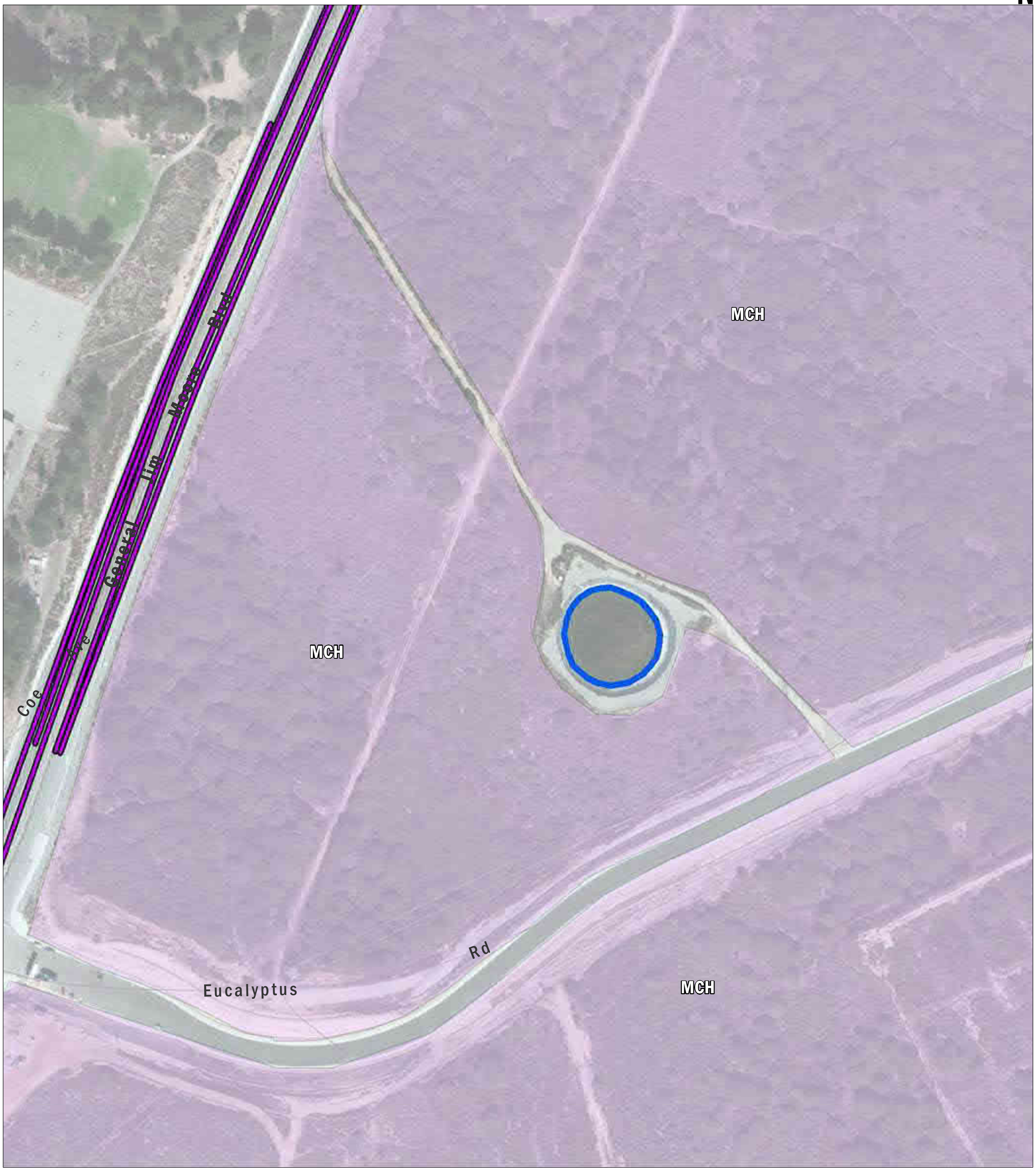
→ Bank was ~~completely dry~~ dry when surveyed in September w/ the exception of a few ponds.

**Necessary Attachments:**

1. All field notes and other supporting documents
2. Site photographs

Maps with important habitat features and species location

1:3,200 0 50 Meters N




AECOM

**California American Water**

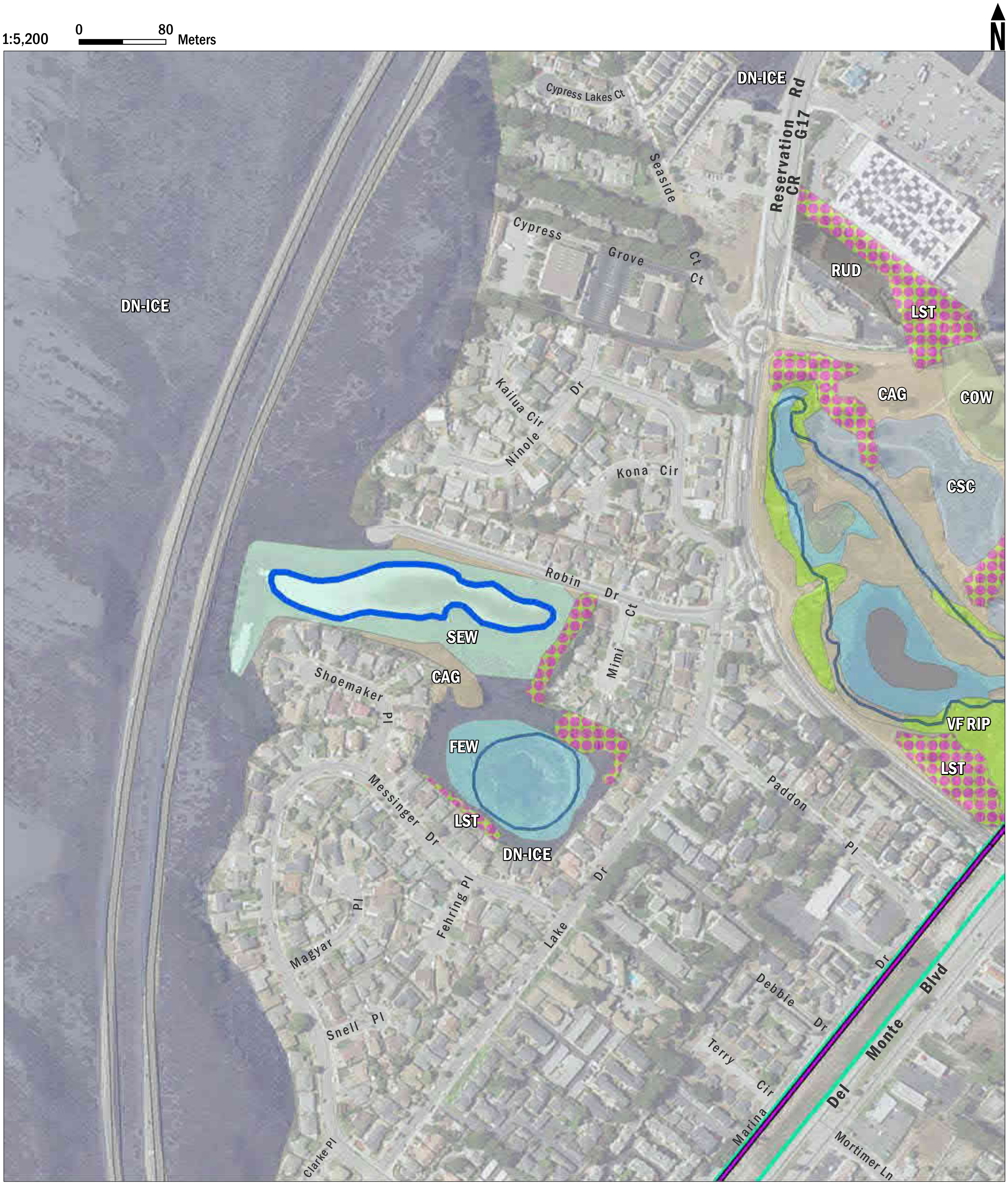
*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP


# HABITAT MAP AROUND EUCALYPTUS ROAD POND

Imagery: ESRI, 2016

Note:*Water Features Mapped by NWI(National Wetalnd Inventory)

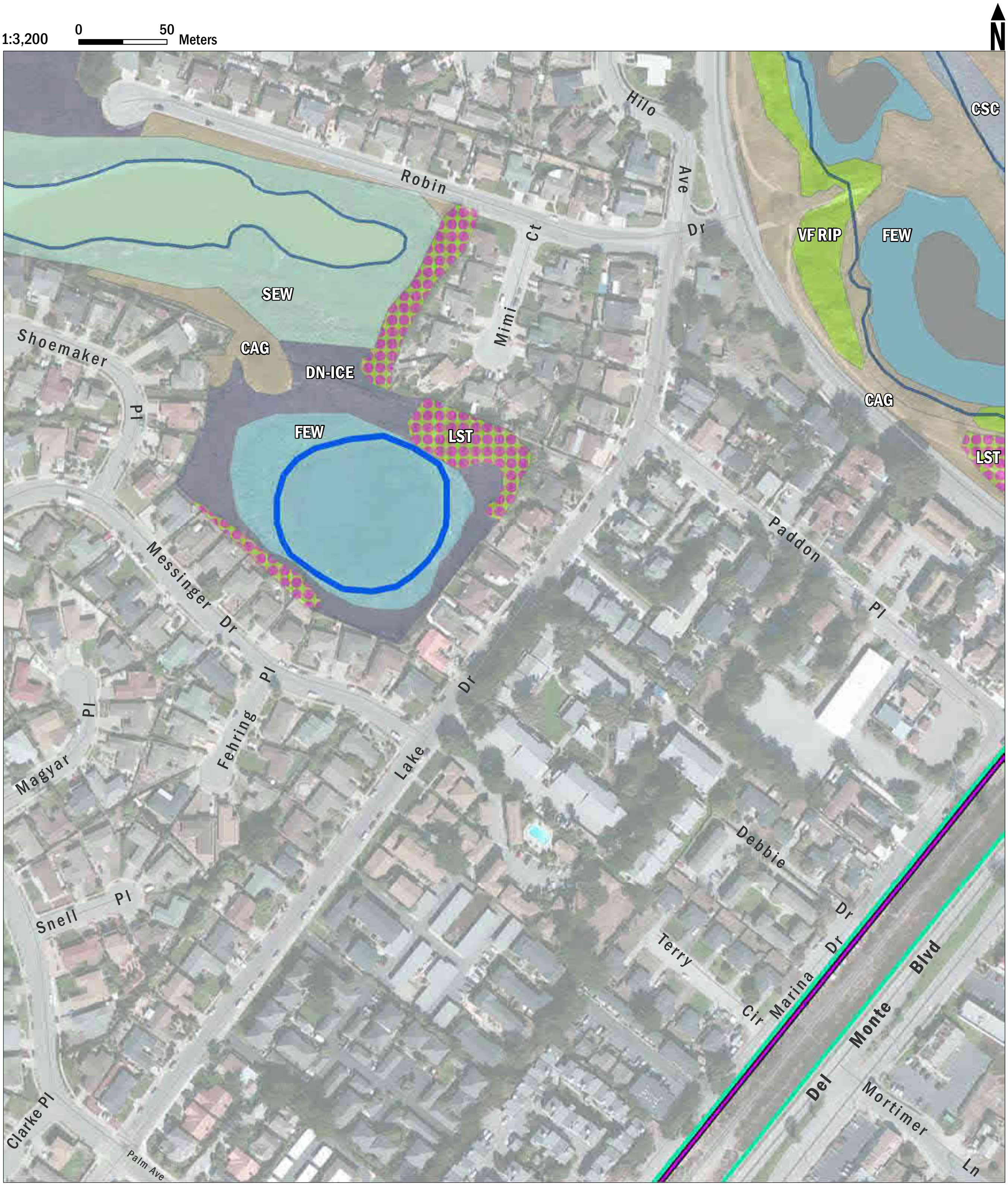



TAMC ROW
Monterey Peninsula Water Supply Project
**Site Name***
Robin Drive Pond
Other Wetland Features*
**Habitat Type**
California Annual Grassland (CAG)
Coastal Oak Woodland (COW)
Coastal Scrub (CSC)
Dune Habitat with Iceplant Mats (DN-ICE)
Freshwater Emergent Wetland (FEW)
Landscaped Trees (LST)
Ruderal (RUD)
Saline Emergent Wetland (SEW)
Valley/Foothill Riparian (VF RIP)

AECOM
**California American Water**
*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP


# HABITAT MAP AROUND ROBIN DRIVE POND

Imagery: ESRI, 2016
Note:*Water Features Mapped by NWI(National Wetalnd Inventory)

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*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP


# HABITAT MAP AROUND LAKE DRIVE POND

Imagery: ESRI, 2016
Note:*Water Features Mapped by NWI(National Wetalnd Inventory)


TAMC ROW
Monterey Peninsula Water Supply Project
**Site Name***
Locke-Paddon Lake
**Habitat Type**
California Annual Grassland (CAG)
Coastal Oak Woodland (COW)
Coastal Scrub (CSC)
Freshwater Emergent Wetland (FEW)
Landscaped Trees (LST)
Ruderal (RUD)
Valley/Foothill Riparian (VF RIP)

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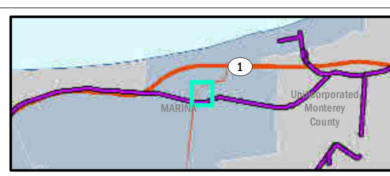
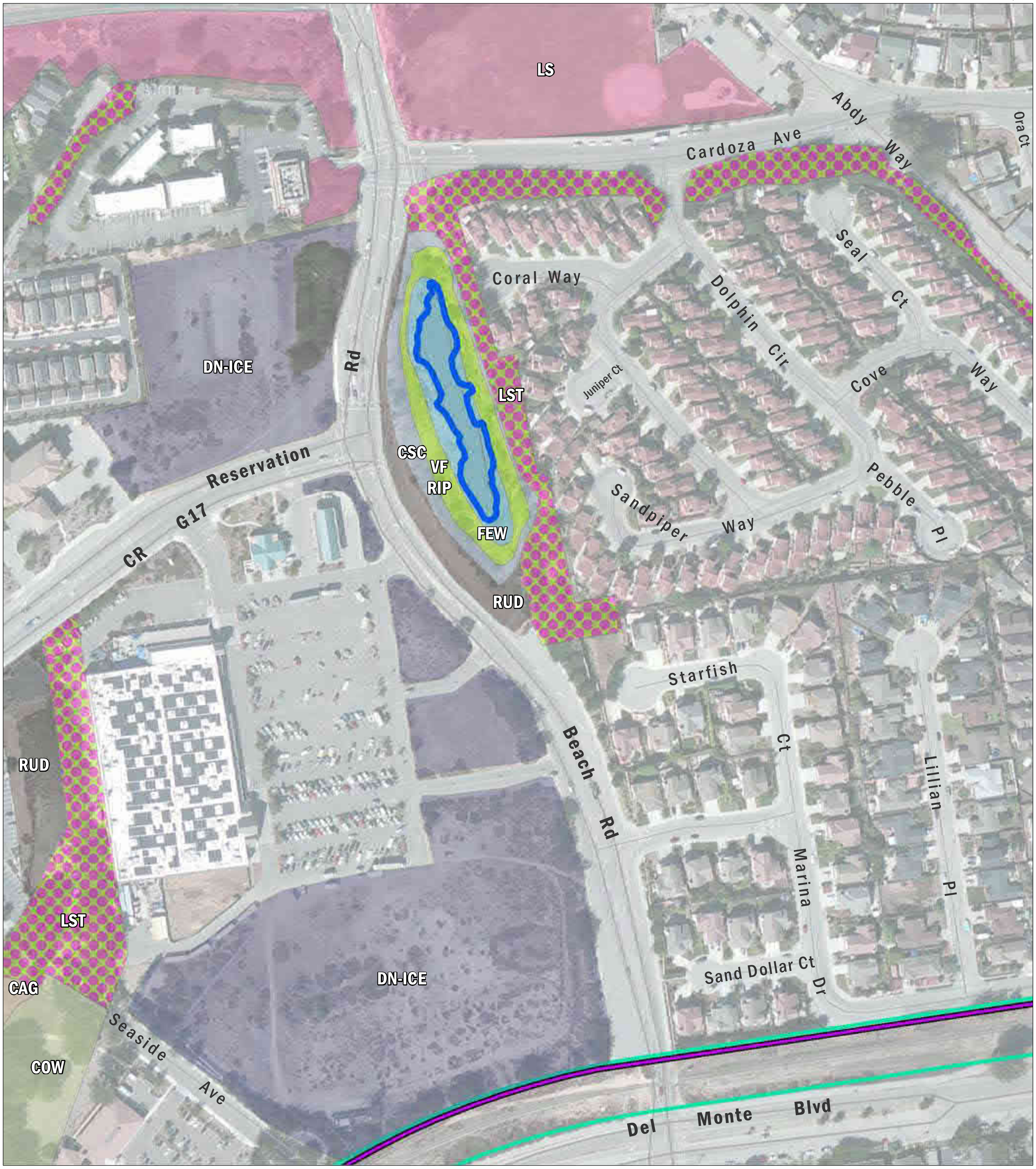
**California American Water**
*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP




**HABITAT MAP AROUND LOCKE-PADDON LAKE**

Imagery: ESRI, 2016
Note:*Water Features Mapped by NWI(National Wetalnd Inventory)

1:3,200 0 50 Meters




- TAMC ROW
- Monterey Peninsula Water Supply Project

**Site Name***

- Reservation Road Pond

**Habitat Type**

- California Annual Grassland (CAG)
- Coastal Oak Woodland (COW)
- Coastal Scrub (CSC)
- Dune Habitat with Iceplant Mats (DN-ICE)
- Freshwater Emergent Wetland (FEW)
- Landscaped (LS)
- Landscaped Trees (LST)
- Ruderal (RUD)
- Valley/Foothill Riparian (VF RIP)

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California American Water

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP


# HABITAT MAP AROUND RESERVATION ROAD POND

Imagery: ESRI, 2016
Note:*Water Features Mapped by NWI(National Wetalnd Inventory)

1:3,200 0 50 Meters N


TAMC ROW
Monterey Peninsula Water Supply Project

**Site Name***

Legion Way Pond

**Habitat Type**

California Annual Grassland (CAG)
Freshwater Emergent Wetland (FEW)
Landscaped (LS)
Landscaped Trees (LST)
Ruderal (RUD)
Valley/Foothill Riparian (VF RIP)

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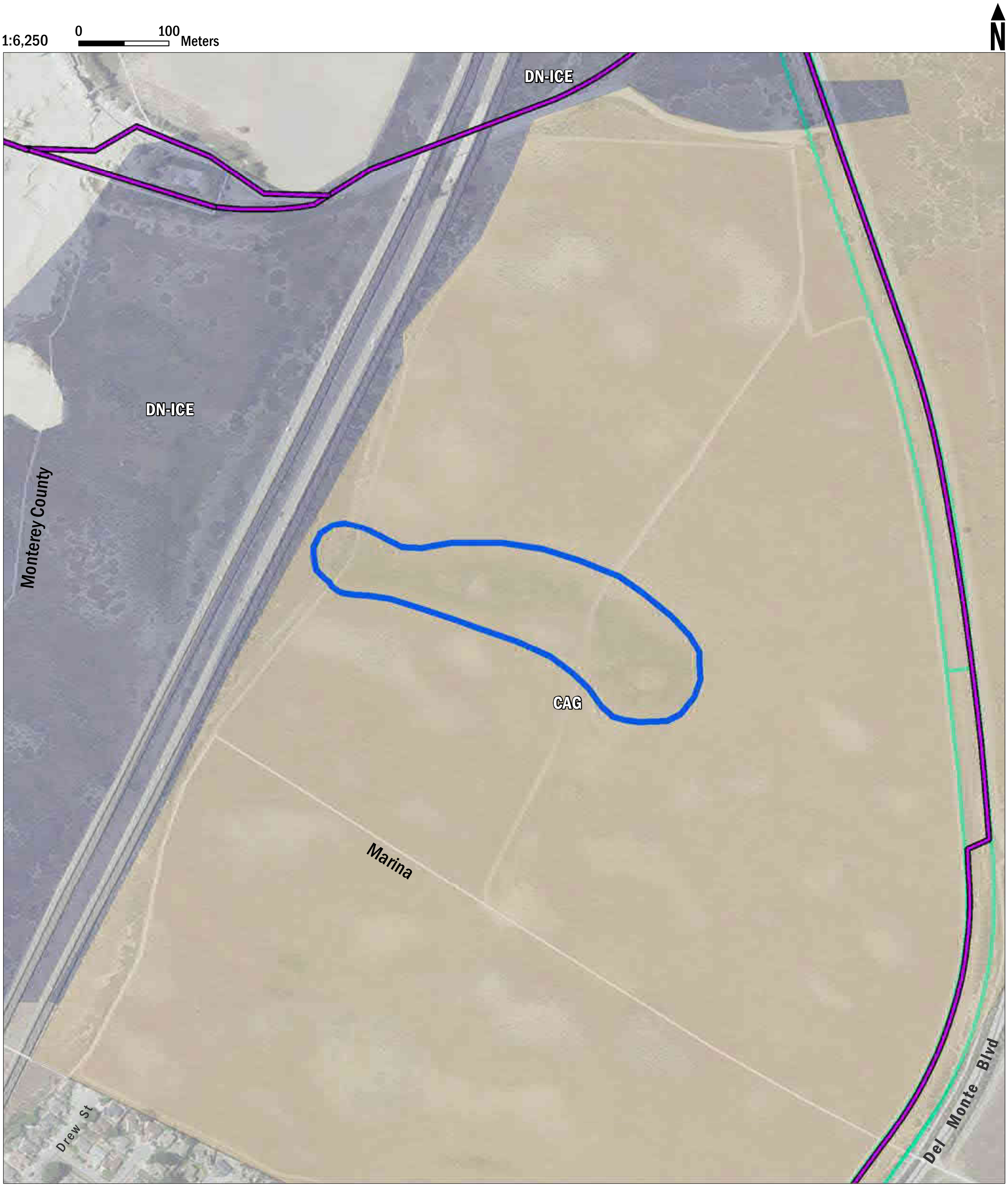
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP


# HABITAT MAP AROUND LEGION WAY POND

Imagery: ESRI, 2016
Note:*Water Features Mapped by NWI(National Wetalnd Inventory)




TAMC ROW

Monterey Peninsula Water Supply Project

**Site Name***

Armstrong Sandhill Ranch LLC Vernal Pools

**Habitat Type**

California Annual Grassland (CAG)

Dune Habitat with Iceplant Mats (DN-ICE)

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**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP


# HABITAT MAP AROUND ARMSTRONG SANDHILL RANCH LLC VERNAL POOLS

Imagery: ESRI, 2016

Note:*Water Features Mapped by NWI(National Wetalnd Inventory)


Monterey Peninsula Water Supply Project

**Site Name***

Highway 1 Wetland

Other Wetland Features*

**Habitat Type**

California Annual Grassland (CAG)

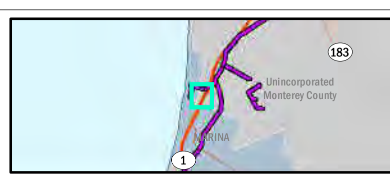
Dune Habitat with Iceplant Mats (DN-ICE)

**AECOM**

**California American Water**

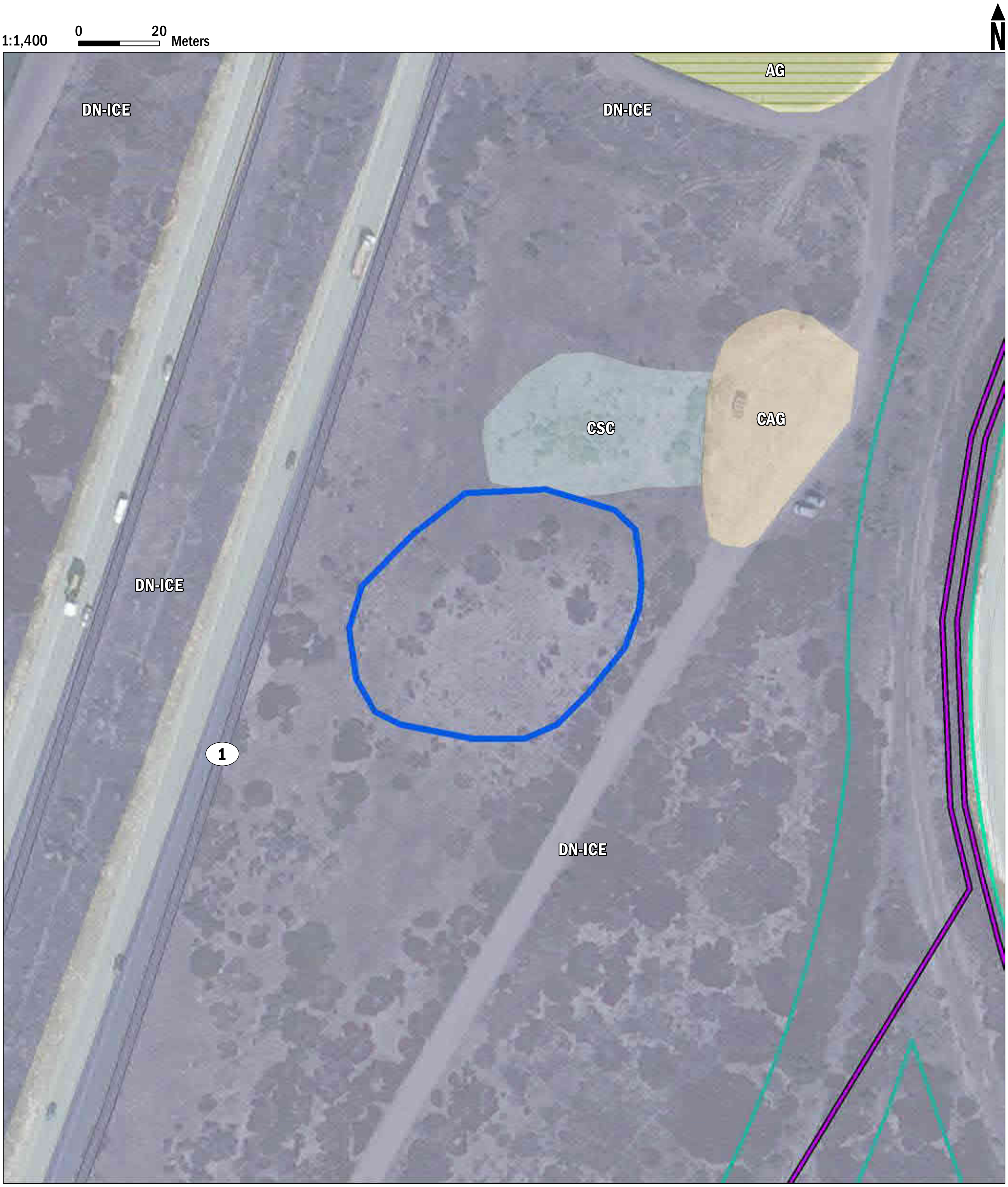
*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP




# HABITAT MAP AROUND HIGHWAY 1 WETLAND

Imagery: ESRI, 2016
Note: *Water Features Mapped by NWI(National Wetalnd Inventory)




TAMC ROW
Monterey Peninsula Water Supply Project
**Site Name***
Lapis Road Wetland
**Habitat Type**
Agriculture (AG)
California Annual Grassland (CAG)
Coastal Scrub (CSC)
Dune Habitat with Iceplant Mats (DN-ICE)

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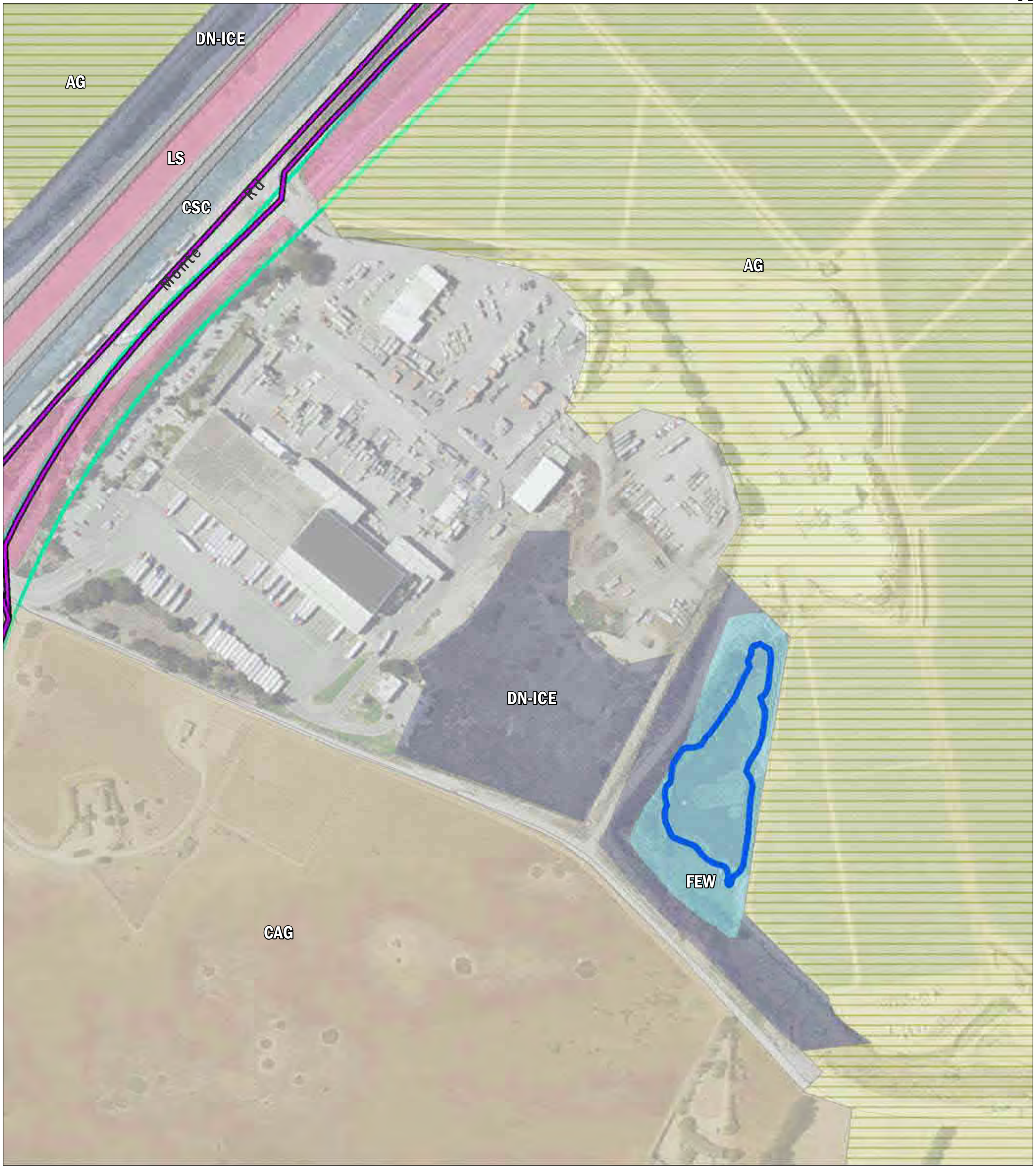
**California American Water**
*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP


# HABITAT MAP AROUND LAPIS ROAD WETLAND

Imagery: ESRI, 2016
Note:*Water Features Mapped by NWI(National Wetalnd Inventory)

1:4,400 0 70 Meters

N



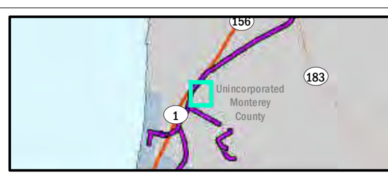

TAMC ROW
Monterey Peninsula Water Supply Project
**Site Name***
Neponset Road Pond
**Habitat Type**
Agriculture (AG)
California Annual Grassland (CAG)
Coastal Scrub (CSC)
Dune Habitat with Iceplant Mats (DN-ICE)
Freshwater Emergent Wetland (FEW)
Landscaped (LS)

AECOM

**California American Water**

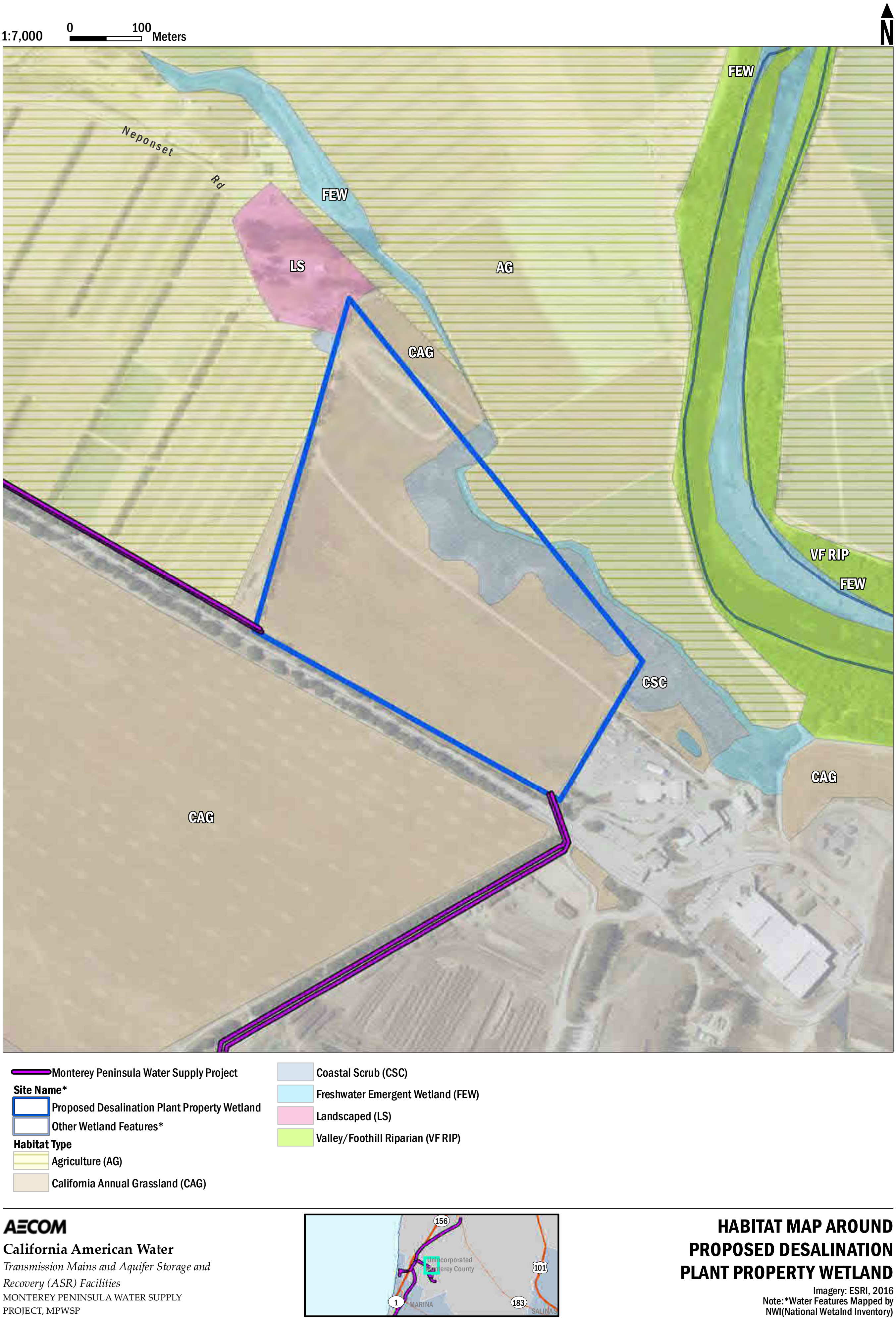
*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP




# HABITAT MAP AROUND NEPONSET ROAD POND

Imagery: ESRI, 2016
Note:*Water Features Mapped by NWI(National Wetalnd Inventory)




Monterey Peninsula Water Supply Project

**Site Name***

Proposed Desalination Plant Property Wetland

Other Wetland Features*

**Habitat Type**

Agriculture (AG)

California Annual Grassland (CAG)

Coastal Scrub (CSC)

Freshwater Emergent Wetland (FEW)

Landscaped (LS)

Valley/Foothill Riparian (VF RIP)

AECOM

**California American Water**

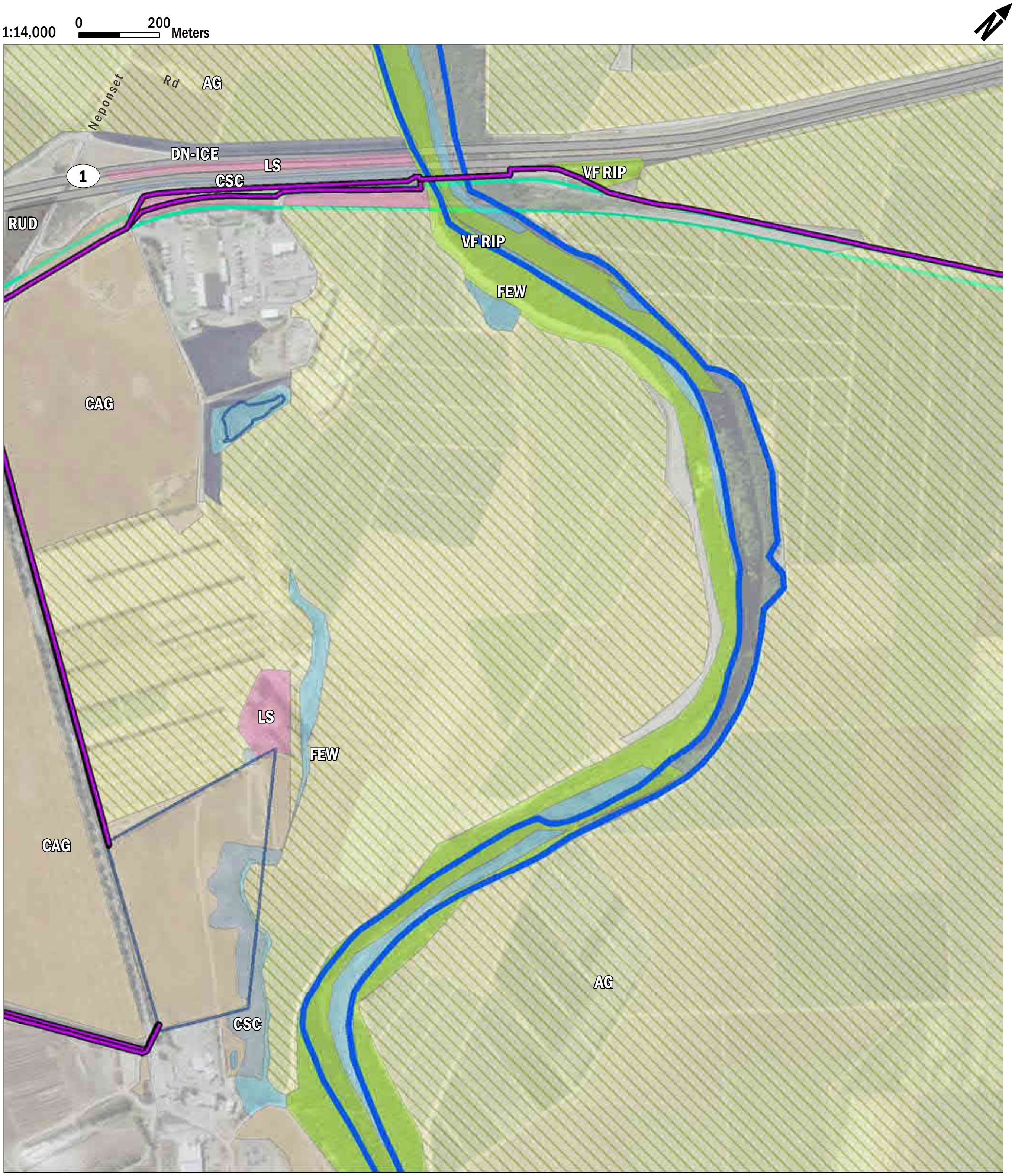
*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# HABITAT MAP AROUND PROPOSED DESALINATION PLANT PROPERTY WETLAND

Imagery: ESRI, 2016

Note:*Water Features Mapped by NWI(National Wetalnd Inventory)



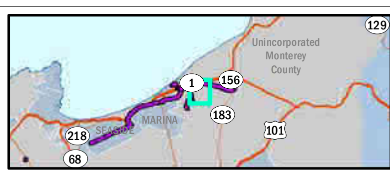

TAMC ROW
Monterey Peninsula Water Supply Project
**Site Name***
Salinas River
Other Wetland Features*
**Habitat Type**
Agriculture (AG)
California Annual Grassland (CAG)
Coastal Scrub (CSC)
Dune Habitat with Iceplant Mats (DN-ICE)
Freshwater Emergent Wetland (FEW)
Landscaped (LS)
Ruderal (RUD)
Valley/Foothill Riparian (VF RIP)

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

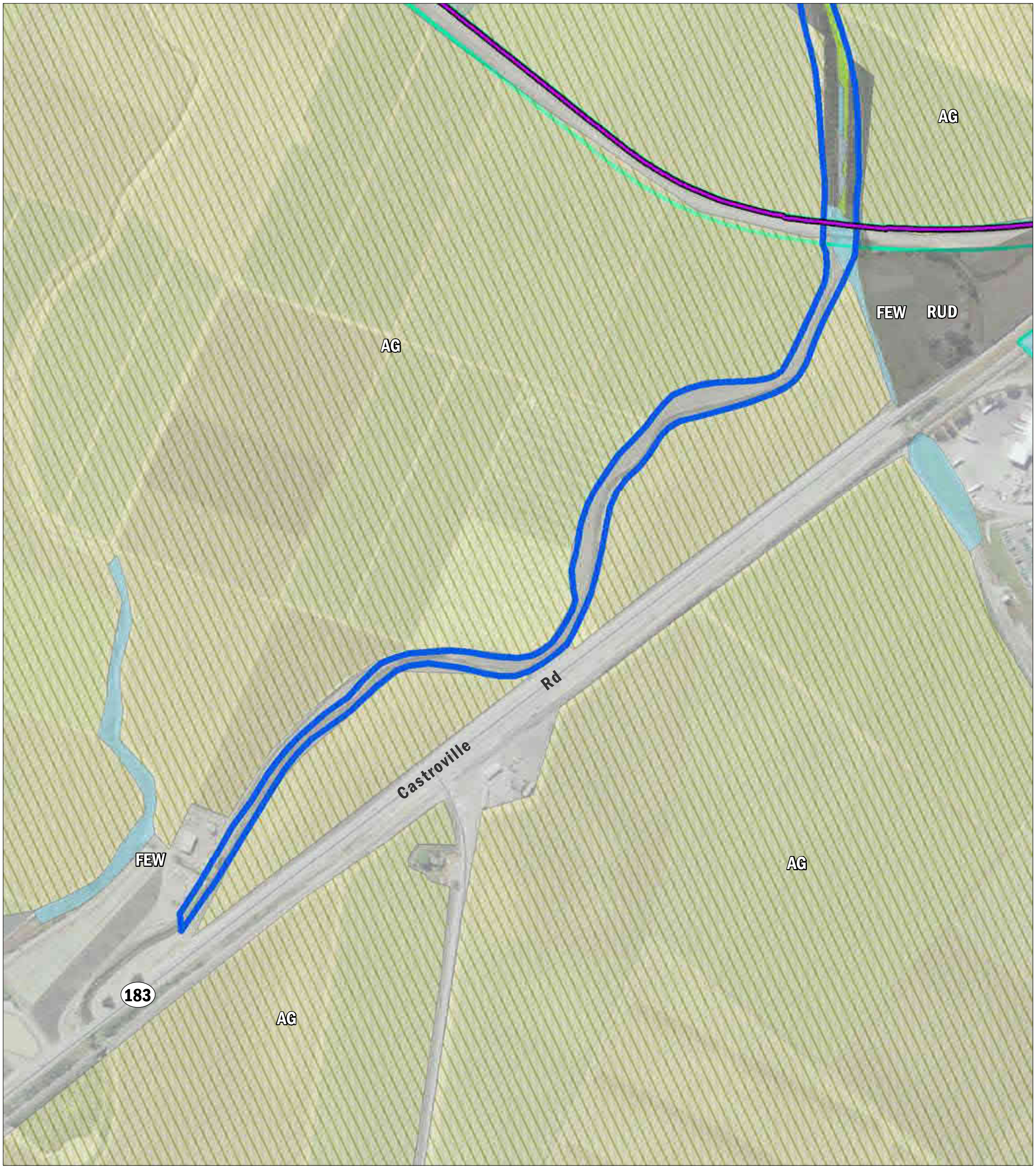
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP




# HABITAT MAP AROUND SALINAS RIVER

Imagery: ESRI, 2016
Note:*Water Features Mapped by NWI(National Wetalnd Inventory)

1:7,500 0 100 Meters



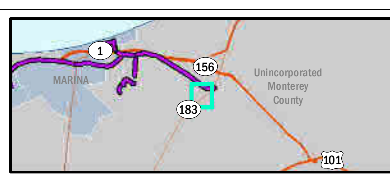

TAMC ROW
Monterey Peninsula Water Supply Project
**Site Name***
Tembladero Slough
**Habitat Type**
Agriculture (AG)
Coastal Scrub (CSC)
Freshwater Emergent Wetland (FEW)
Ruderal (RUD)
Valley/Foothill Riparian (VF RIP)

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

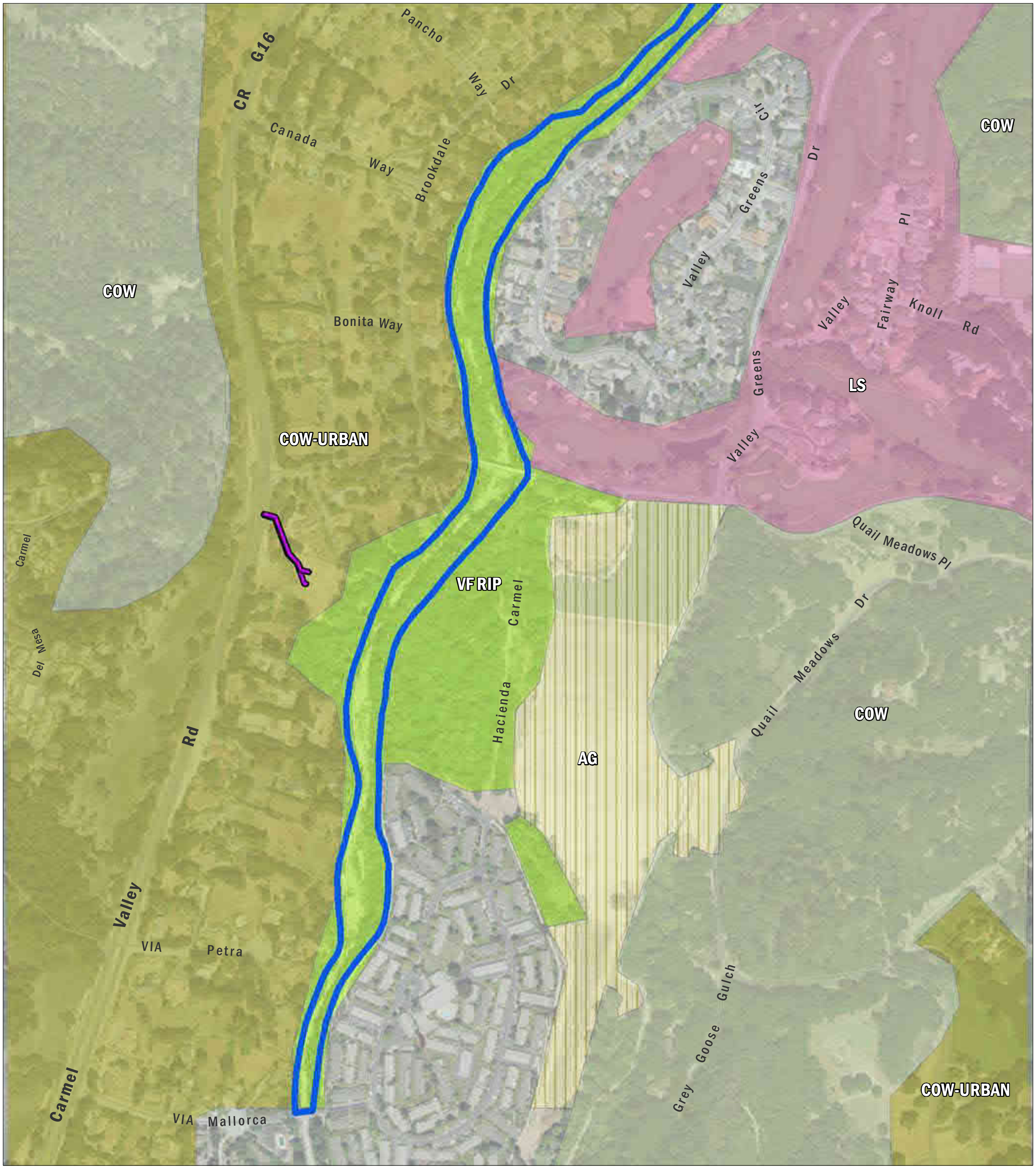
MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP




# HABITAT MAP AROUND TEMBLADERO SLOUGH

Imagery: ESRI, 2016
Note:*Water Features Mapped by NWI(National Wetalnd Inventory)

1:8,000 0 100 Meters




Monterey Peninsula Water Supply Project

**Site Name***

Carmel River

**Habitat Type**

Agriculture (AG)

Coastal Oak Woodland (COW)

Coastal Oak Woodland with Urban Infrastructure (COW-URBAN)

Landscaped (LS)

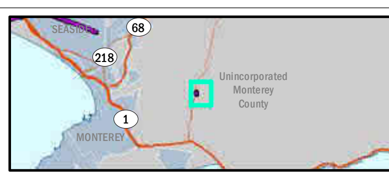
Valley/Foothill Riparian (VF RIP)

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP




# HABITAT MAP AROUND CARMEL RIVER

Imagery: ESRI, 2016
Note:*Water Features Mapped by NWI(National Wetalnd Inventory)

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# Appendix B.
# Site Photograph Locations and Site Photographs

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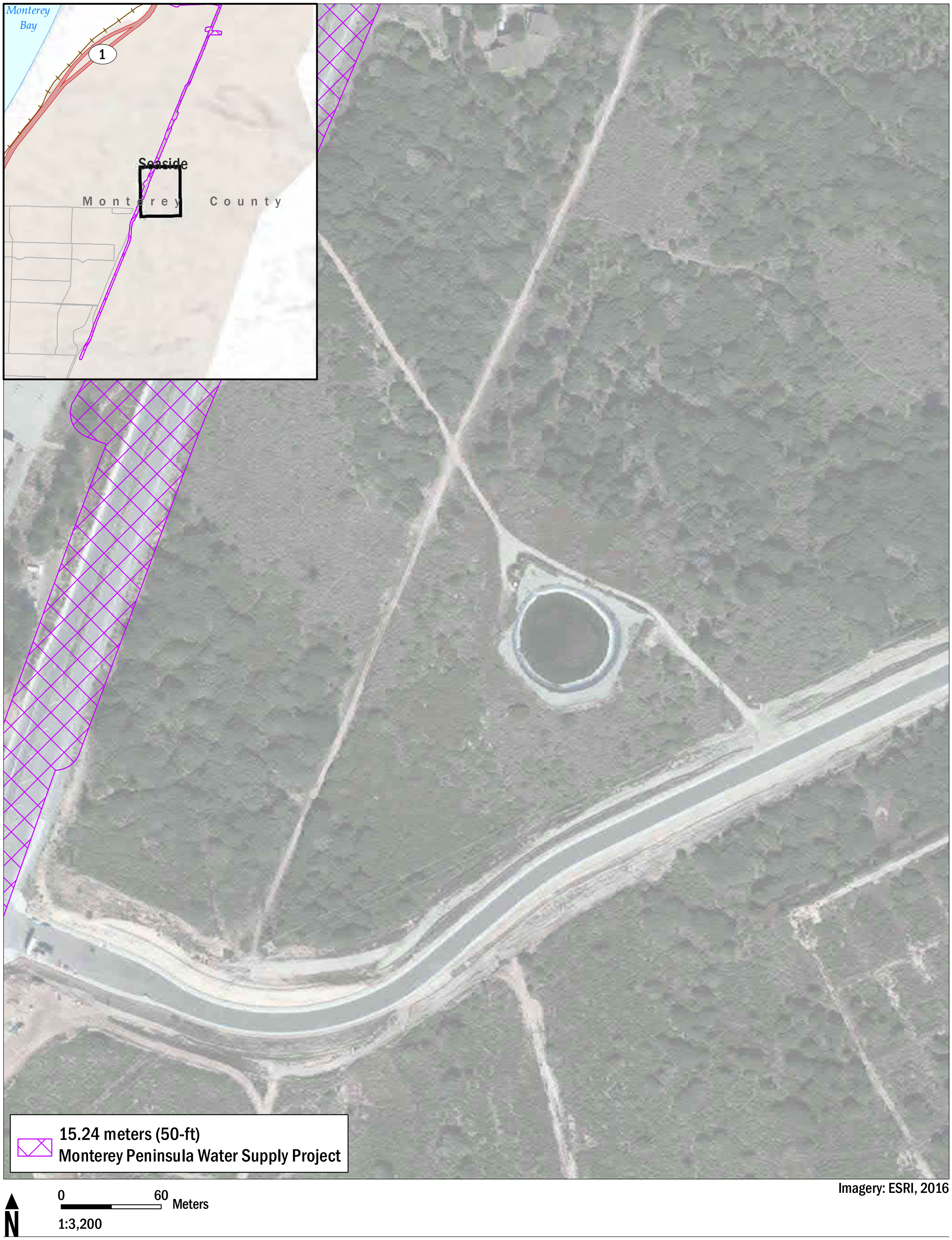



AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND EUCALYPTUS ROAD POND


Imagery: ESRI, 2016

N

0 100 Meters

1:5,200

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND ROBIN DRIVE POND


AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND LAKE DRIVE POND

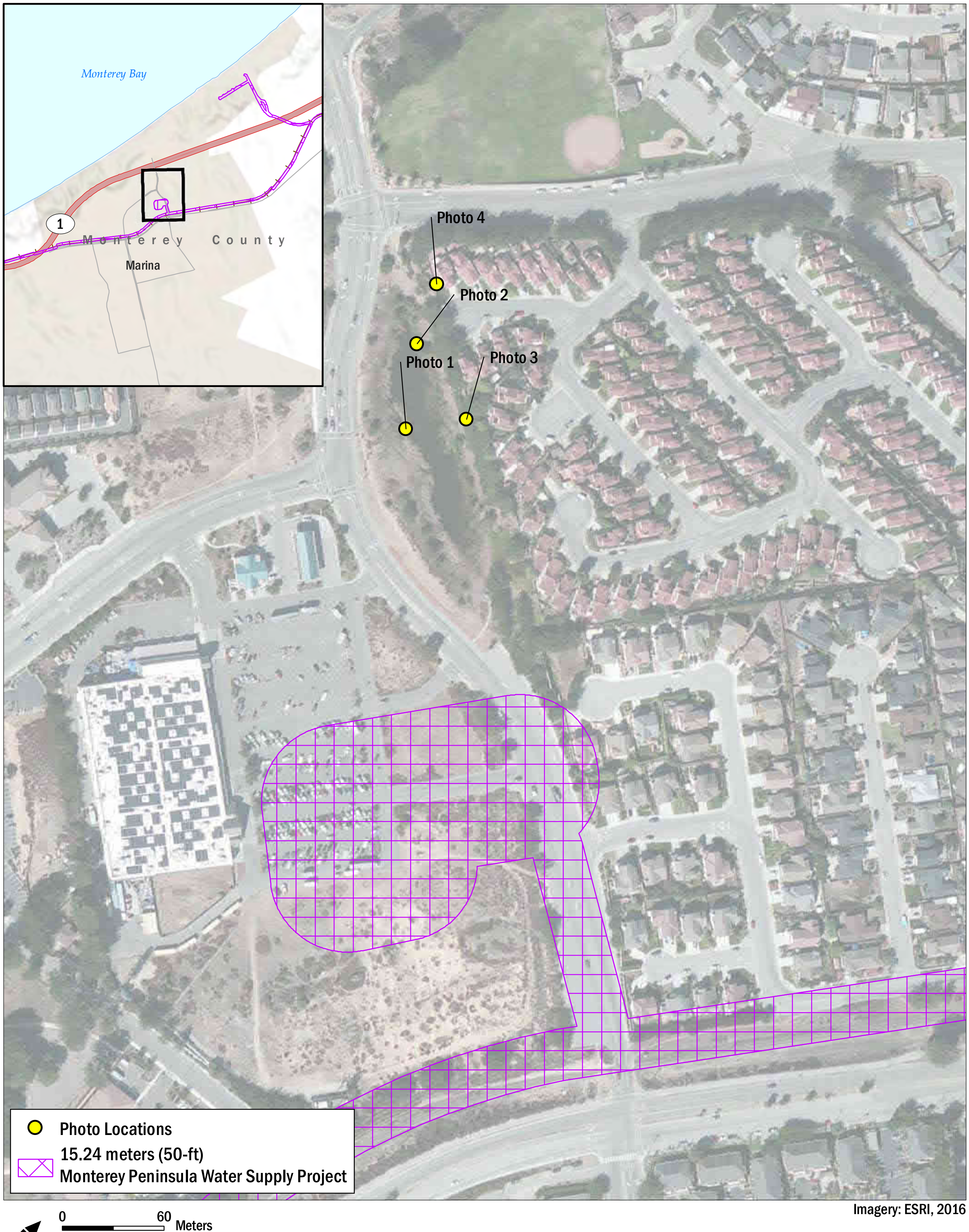

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND LOCKE-PADDON LAKE




AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND RESERVATION ROAD POND

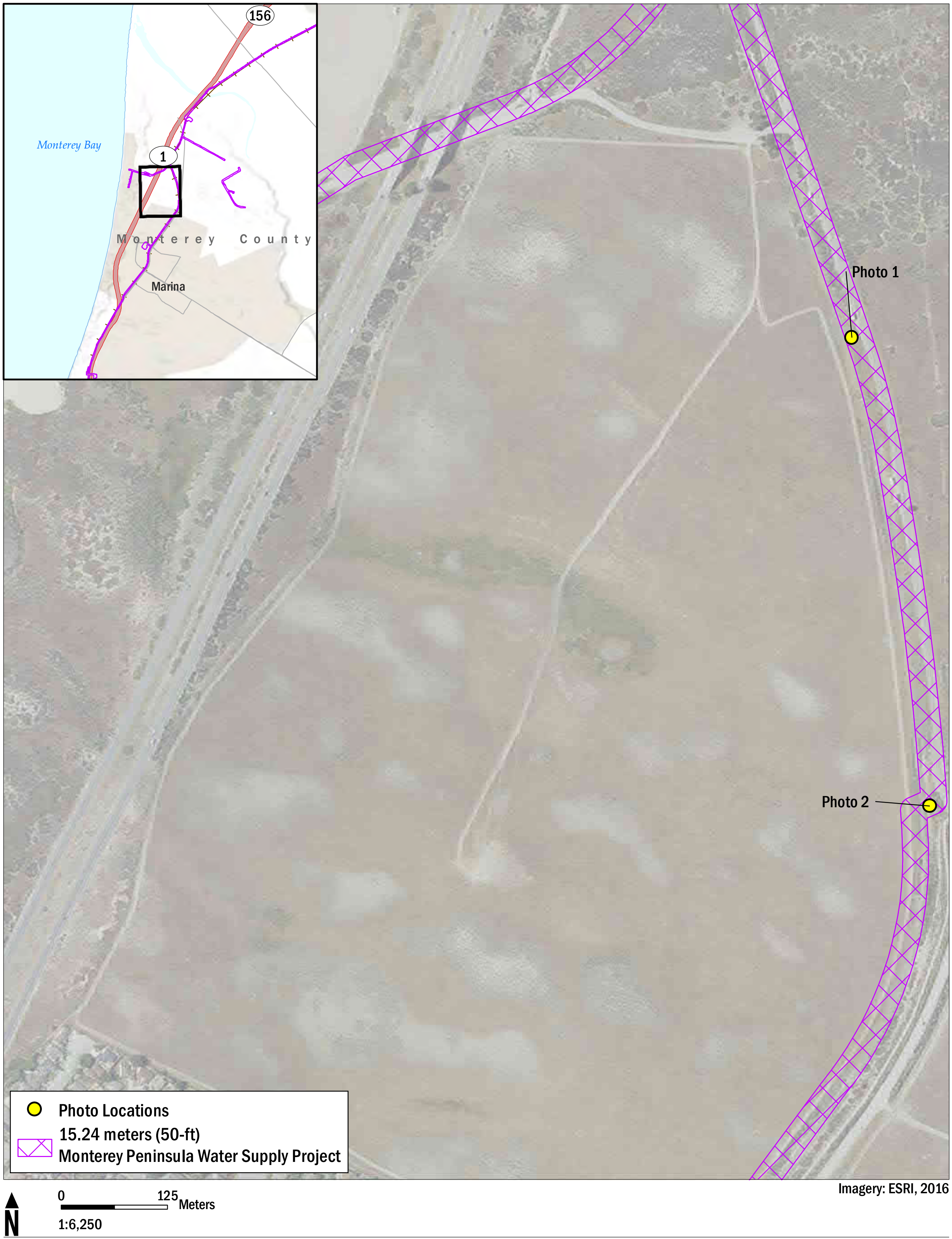

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND LEGION WAY POND




AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND ARMSTRONG SANDHILL RANCH LLC VERNAL POOLS


Imagery: ESRI, 2016

N
0 100 Meters
1:5,200

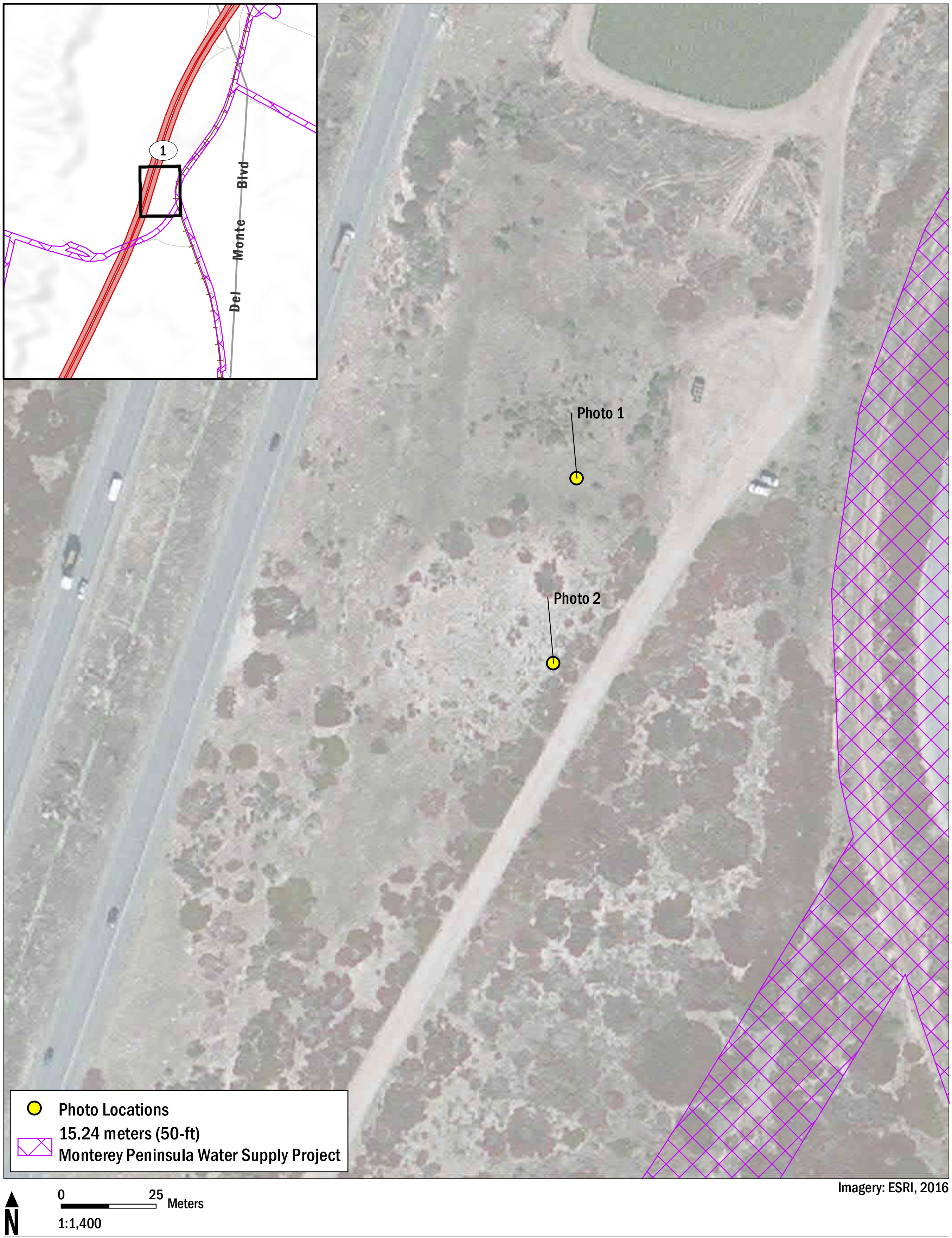
AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND HIGHWAY 1 WETLAND



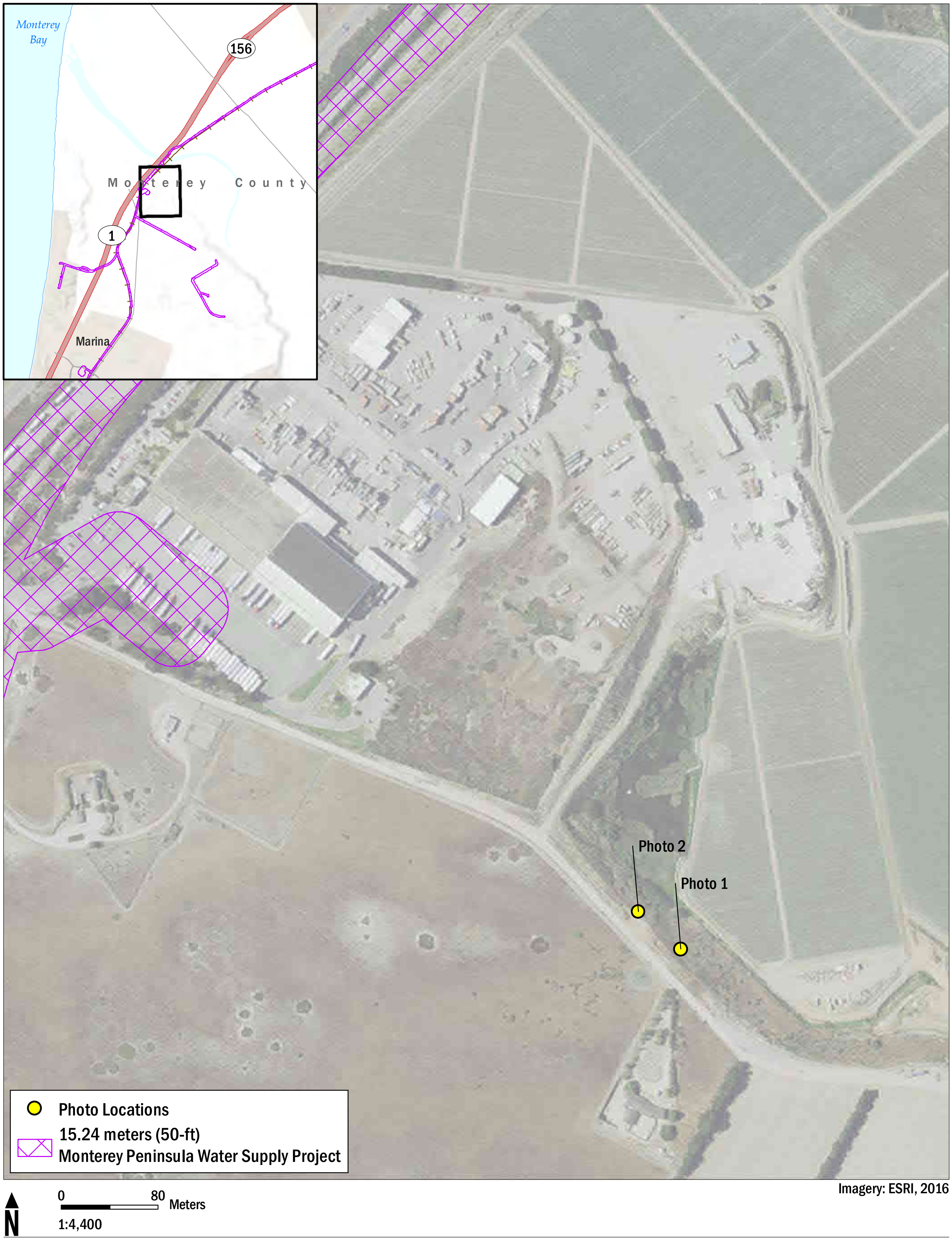

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND LAPIS ROAD WETLAND



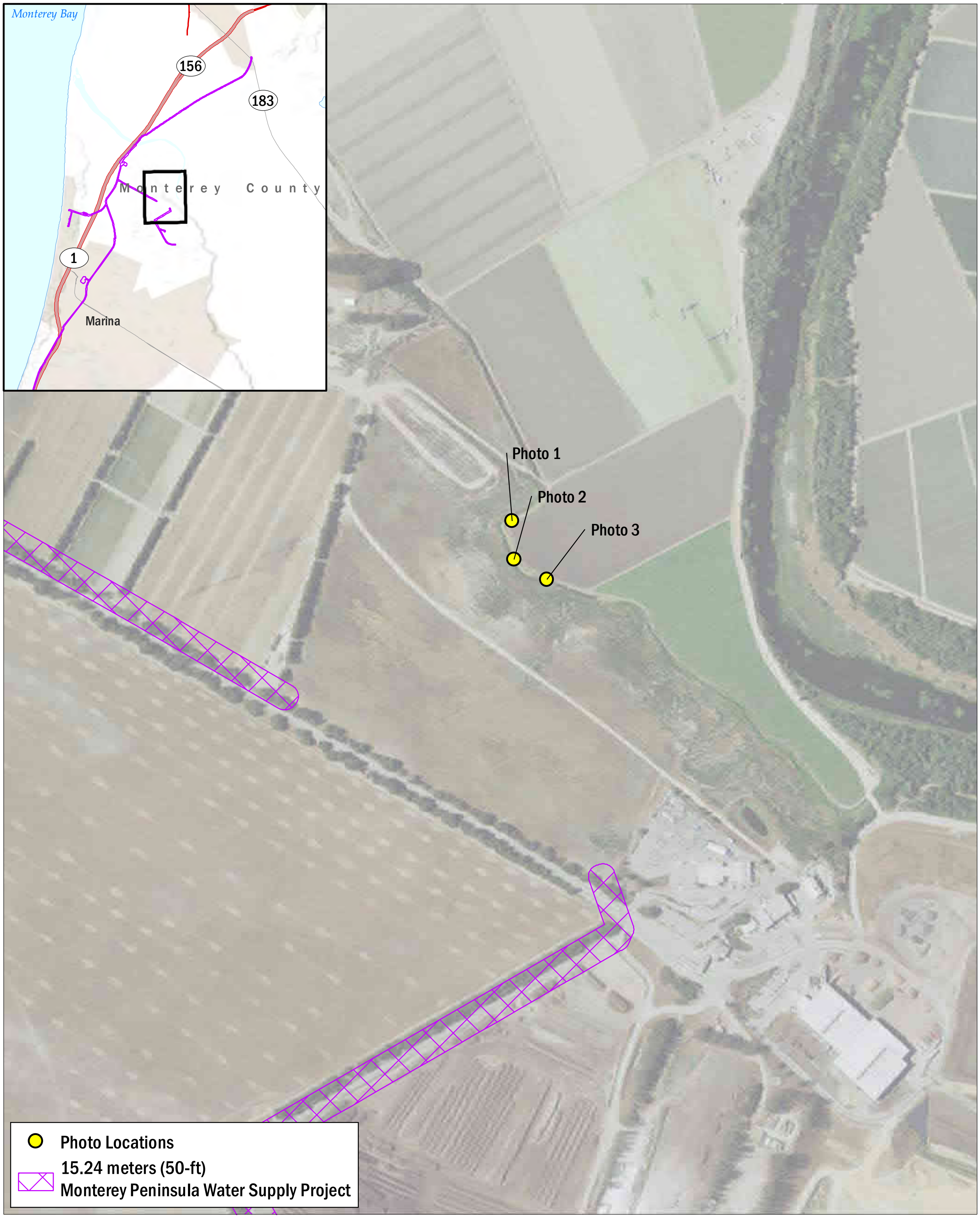

AECOM

**California American Water**

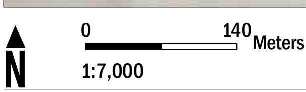
*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND NEPONSET ROAD POND




Imagery: ESRI, 2016



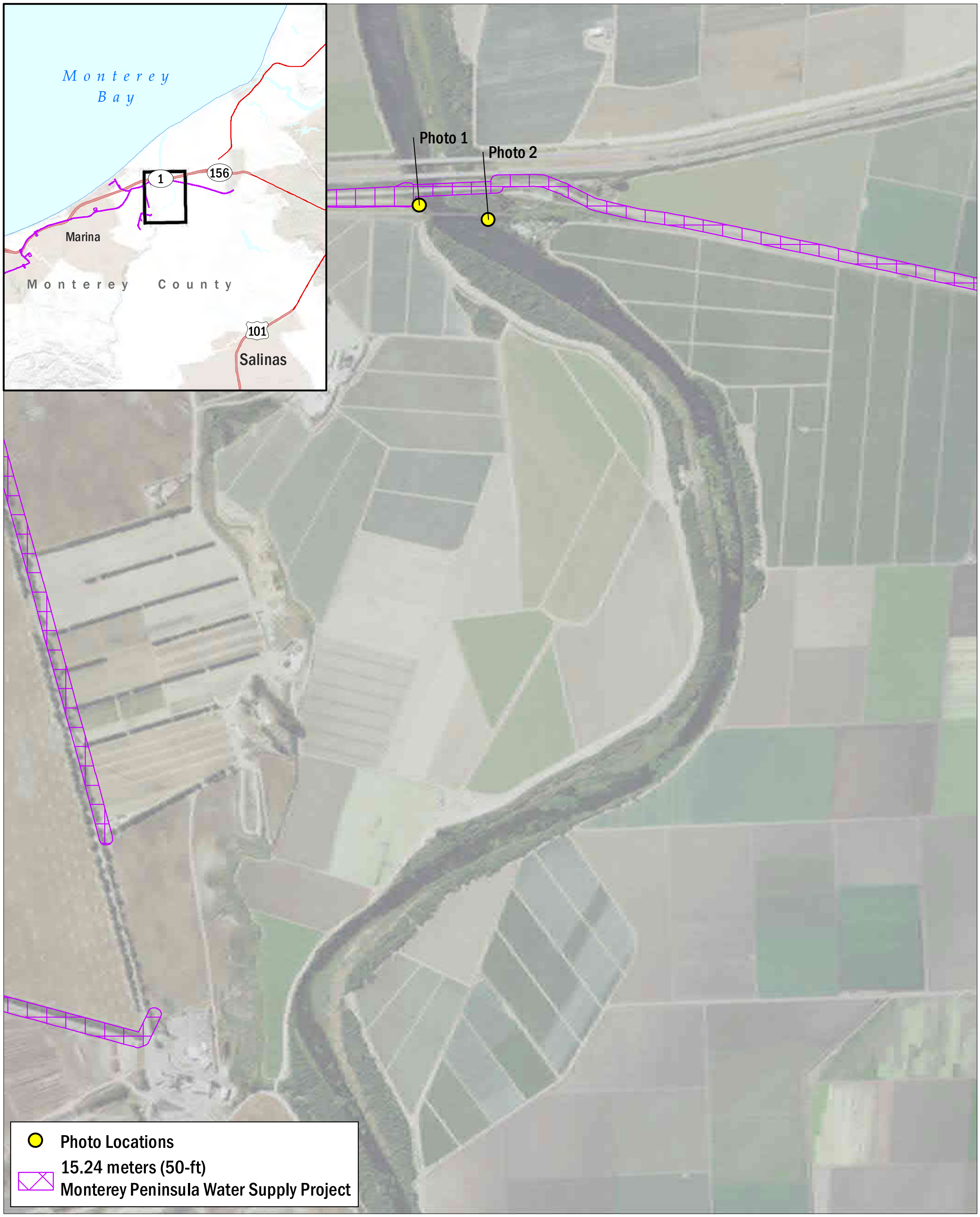

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND PROPOSED DESALINATION PLANT PROPERTY WETLAND




Imagery: ESRI, 2016

0 280 Meters

1:14,000

AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND SALINAS RIVER


AECOM

California American Water

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND TEMBLADERO SLOUGH


AECOM

**California American Water**

*Transmission Mains and Aquifer Storage and Recovery (ASR) Facilities*

MONTEREY PENINSULA WATER SUPPLY PROJECT, MPWSP

# PHOTO POINTS AROUND CARMEL RIVER

# Robin Drive pond

**Photo 1: The western end of Robin Drive pond, facing south. Marsh jaumea, pickleweed, rushes and ice plant line the pond edge. The upland habitat on the southern edge is dominated by coyote brush and Monterey cypress.**

**Photo 2: The eastern end of Robin Drive pond, facing south. Marsh Jaumea, Pickleweed, and rushes line the pond edge. The upland habitat on the southern edge is dominated by coyote bush and Monterey cypress.**

# Locke-Paddon Park

**Photo 1: Northern part of Locke-Paddon Lake, viewed from its western side. California poppies (*Eschscholzia californica*), annual grasses, and seaside woolly sunflower (*Eriophyllum staechadifolium*) are found in the foreground grassland area, with willows bordering the lagoon. Monterey cypress and the Monterey County Library can be seen in background, on the opposite side of the lagoon area.**

**Photo 2: Southern part of Locke-Paddon Lake viewed at the edge of its southwestern projection. Coyote brush shrubs grow among ice plant and California blackberry. Willows can be seen on both shores, with California bulrush submerged in shallow parts of the lagoon.**

**Photo 3: Upland habitat in the southeastern section of Locke-Paddon Park, looking away from the northern lagoon. Ice plant and California sagebrush (*Artemisia californica*) dominate the disturbed foreground habitat. The row of Monterey cypress leads to the Monterey County Library.**

# Reservation Road pond

**Photo 1: The Reservation Road pond, from the south bank. California bulrush and willows dominate the banks.**

**Photo 2. A view of the California bulrush lining the pond at Reservation Road and the gas station and roads adjacent.**

**Photo 3. A view of the upland habitat in Reservation Road pond.**

Armstrong Sandhill Ranch LLC vernal pools

**Photo 1. A view of the vernal pools in a depression in a grazed pasture dominated by California annual grassland. Dominant vegetation to the west of this pasture includes mock heather and ice plant.**

**Photo 2. The Armstrong Ranch vernal pools, facing west.**

# Lapis Road wetland

**Photo 1: This depression between Lapis Road and Highway 1 does not appear to act as a wetland. It has been recently cleared of vegetation by heavy equipment. Surrounding dominant vegetation includes mock heather and ice plant.**

**Photo 2: Recently cleared ice plant in the depression between Lapis Road and Highway 1.**

# Neponset Road wetland

**Photo 1: This wetland is bounded by Neponset Road, agricultural fields, and the Dole plant. The wetland margins are dominated by arroyo willow and California bulrush.**

**Photo 2: Upland vegetation surrounding the wetland includes coyote bush, mock heather, ice plant, and non-native annual grasses such as ripgut brome.**

# Desalination Plant property

**Photo 1: Desalination Plant site canal, photographed from northern bank, looking south towards the proposed desalination plant site. Black mustard, poison hemlock, and other weedy species are visible in the foreground. Yellow bush-lupine and coyote brush are visible in the upland.**

**Photo 2: The bank of the Desalination Plant site canal. The bank vegetation is composed of tall flatsedge (*Cyperus eragrostis*), water parsley, and rushes. Duckweed grows on the surface of the water in the canal.**

**Photo 3: The bank of the Desalination Plant site canal, at another location. The bank vegetation is composed of poison hemlock, wild radish, wild mustard, and water parsley. Duckweed grows on the surface of the water in the canal.**

# Salinas River

**Photo 1: South bank of Salinas River, facing northwest toward Monte Road Bridge. The immediate bank is dominated by wild radish and mustard.**

**Photo 2: North bank of Salinas River, facing southwest. The top of bank is dominated by California annual grasses and mustard.**

# Tembladero Slough

**Photo 1: Tembladero Slough, facing south. The river bank has perennial pepper weed.**

**Photo 2: View east towards Tembladero Slough and Castroville Rd. (SR 183). The dominant vegetation along the bank is perennial pepper weed.**

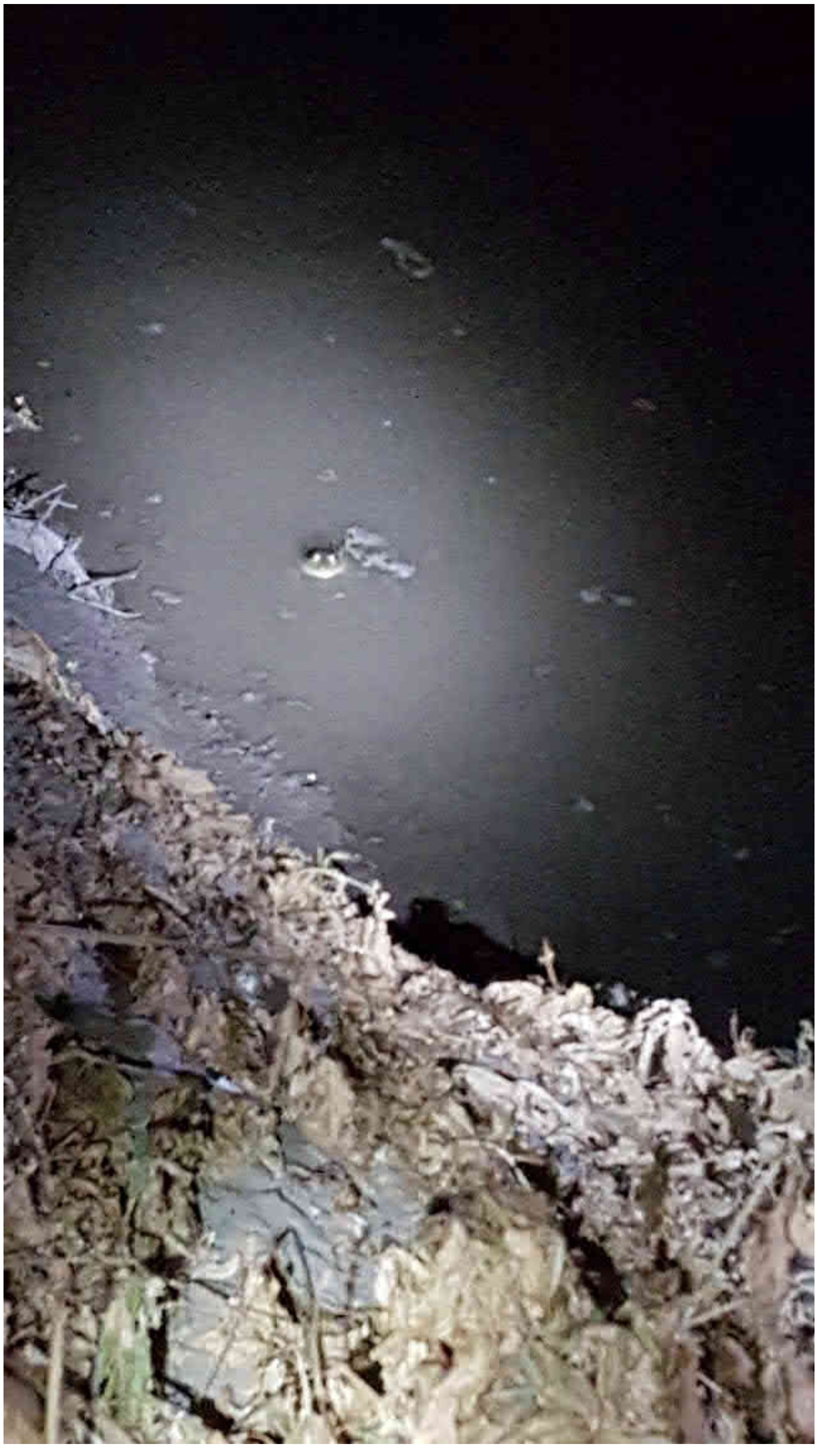


**Photo 3: A bullfrog observed in the Tembladero Slough channel during a night survey.**

# Carmel River

**Photo 1. A view of the river water and rocks lining the river's edge.**

**Photo 2. The nearly-dry riverbed of Carmel River.**

**Photo 3. Sierran treefrog in ponded water in the Carmel River.**