Monterey One Water
Providing Cooperative Water Solutions
ADMINISTRATION OFFICE: 5 Harris Court, Bldg D, Monterey, CA 93940
MAIN: (831) 372-3367 or (831) 422-1001 **FAX:** (831) 372-6178
WEBSITE: www.montereyonewater.org

November 21, 2017

Peter von Langen, Ph.D., P.G.
Engineering Geologist
California Regional Water Quality Control Board
Central Coast Region
895 Aerovista Place, Suite 101
San Luis Obispo, CA. 93401-7906
By email: centralcoast@waterboards.ca.gov

SUBJECT: Report of Waste Discharge for NPDES Permit Reissuance (NPDES No. CA0048551) - Monterey One Water Regional Wastewater Treatment Plant

Dear Dr. von Langen:

Monterey One Water (M1W) is submitting the attached Report of Waste Discharge (ROWD) and requesting reissuance of NPDES Permit No. CA0048551 for the Regional Wastewater Treatment Plant (RTP). The RTP currently operates under Order No. R3-2014-0013 which expires on July 31, 2019, but planned additions to the permitted facility will significantly change the nature or increase the quantity of pollutants discharged. As required by 40 CFR§122.41(l)(ii), M1W provided advanced notice to the Central Coast Regional Water Quality Control Board (Regional Water Board) and has been discussing possible NPDES permit modifications since 2016. The relevant State and EPA forms (Cal EPA Form 200; EPA Forms 1, 2A and 2S) and supporting documentation are provided in this submittal.

M1W is implementing the Pure Water Monterey Groundwater Replenishment Project (Project) to augment water supplies in Northern Monterey County. The Project involves accepting new source waters at the RTP headworks, providing full advanced treatment at the new Advanced Water Purification Facility (AWPF), and injecting the highly purified recycled water into the Seaside Groundwater Basin for withdrawal and use as a municipal water supply. The Regional Water Board adopted Waste Discharge Requirements and Water Reclamation Requirements on March 9, 2017 (Order No. R3-2017-0003) to regulate AWPF operation and groundwater replenishment. The Project will also provide additional tertiary recycled water for agricultural irrigation in the northern Salinas Valley as part of the Castroville Seawater Intrusion Project (CSIP) and purified recycled water for landscape irrigation by the Marina Coast Water District (MCWD). The AWPF will produce reverse osmosis concentrate (RO concentrate) which will be discharged to Monterey Bay through M1W's existing outfall. The capacity of the AWPF was recently increased from 4 MGD to 5 MGD to accommodate the demand for MCWD's irrigation projects. The Project's Engineering Report (approved on November 7, 2016) has been revised to describe the new capacity and use of the purified recycled water. The revised Engineering Report is being provided to the Division of Drinking Water for review concurrently with submittal of this ROWD.

The current NPDES permit allows discharge of secondary effluent produced at the RTP and trucked waste (e.g., softener regenerant wastes and reverse osmosis concentrate) held at the RTP. M1W is requesting changes to the NPDES permit to allow discharge of secondary effluent produced at the RTP, trucked RO concentrate/brine waste, and RO concentrate produced at the AWPF. Capital project information and the requested NPDES permit modifications are summarized in the following sections.

CAPITAL PROJECTS AND NEW SOURCE WATERS

A 10-year Capital Improvement Plan is underway to refurbish and replace equipment in M1W's sewage conveyance system and at the RTP. A master plan was recently completed for the pump station/conveyance system. In 2017/18, master plans will be prepared for the RTP and the cogeneration system. Projects that affect wastewater treatment processes and quality of effluent discharged are highlighted in Form 2A, Part B.5. M1W is currently assessing treatment process performance at the RTP and evaluating ways to optimize effectiveness. M1W is also constructing the AWPF that will provide full advanced treatment and purified recycled water for groundwater replenishment. Groundwater injection is scheduled to commence in May 2019.

New source waters will be directed to the RTP headworks to increase the supply of recycled water for agricultural irrigation, landscape irrigation, and groundwater replenishment. The source waters are comprised of agricultural wash water from the City of Salinas, stormwater flows from the City of Salinas, stormwater/agricultural runoff from the Blanco Drain, and stormwater/agricultural runoff from the Reclamation Ditch. The source waters will be mixed with domestic sewage from the Cities of Monterey, Pacific Grove, Marina, and Salinas; the Seaside County Sanitation District; the Boronda County Sanitation District; the Seaside Community Services District, and the Fort Ord Community.

PROJECTED EFFLUENT QUALITY

The ROWD includes actual RTP secondary effluent concentrations (measured from August 1, 2014 through September 30, 2017) for conventional pollutants and projected in-pipe concentrations for Ocean Plan constituents. To determine in-pipe concentrations of the Ocean Plan constituents, Trussell Technologies, Inc. modeled worst case effluent quality based on predicted volumes and monitoring results for the source waters, secondary effluent, hauled waste, and AWPF RO concentrate. The assumptions and the process used to calculate the flow-weighted average concentrations are described in the "Ocean Plan Compliance Technical Memorandum" (ROWD, Attachment 4). The proposed minimum initial dilution (Dm) values described below were used to determine the maximum effluent concentrations at the edge of zone of initial dilution (ZID) for each secondary effluent discharge scenario (Form 2A, Part D).

MINIMUM PROBABLE INITIAL DILUTION

A mixing zone analysis of the combined effluent discharge was conducted by Larry Walker Associates, Inc. The near-field mixing zone model, Visual Plumes, was used to delineate the effluent plume and define the edge of the mixing zone. The modeled scenarios included combinations of secondary effluent, RO concentrate, and hauled waste using the three different oceanic seasons defined in Monterey Bay (Upwelling, Oceanic, Davidson). Density data from sampling stations in the Monterey Bay were used to build density profiles and define water stratification conditions for each season. The ambient current was set to zero for all dilution simulations. For submarine discharges, such as the M1W outfall, the initial dilution is completed when the diluting effluent ceases to rise in the water column and first begins to spread horizontally.

The combined effluent density is less than the surrounding ambient density of the seawater at the discharge level. Therefore, the effluent is positively buoyant and tends to rise towards the surface. Four scenarios were selected to define the proposed minimum initial dilution (Dm) values for the NPDES permit. The dilution scenarios are based on set ranges of secondary effluent flowrates and represent conditions of predominantly RO concentrate flow (473:1), low secondary effluent flow (388:1), moderate secondary effluent flow (259:1), and predominantly secondary effluent flow (145:1). The assumptions and the process used to conduct the dilution modeling and select representative Dm values are described in the "Near-Field Mixing Zone and Dilution Analysis Technical Memorandum" (ROWD, Attachment 3).

MULTIPLE Dm NPDES PERMIT AND COMPLIANCE APPROACH

M1W is requesting four Dm values to assess compliance with water quality-based effluent limitations in the new NPDES permit. The addition of RO concentrate to the RTP secondary effluent will change the waste stream characteristics significantly (in particular, the density properties that affect near-field mixing processes). By assigning multiple Dm values, the commingled effluent will be characterized into four types of effluent waste streams permitted for discharge and representative conditions will be applied to adequately assess the impacts of these discharges to Monterey Bay.

For ease of reporting, M1W requests one set of effluent limits in the new NPDES permit that are equal to the Ocean Plan's numeric water quality objectives (WQOs). Calculated constituent concentrations at the edge of the ZID will be compared with the Ocean Plan's water quality objectives after initial dilution. M1W will continue collecting and analyzing samples of the in-pipe effluent discharge. However, instead of reporting in-pipe constituent concentrations, M1W will calculate constituent concentrations at the edge of the ZID based on measured in-pipe concentrations and the Dm corresponding to the secondary effluent flow rate measured during sampling. The reporting strategy is described in the "The Proposed Multiple Dilution NPDES Permitting Approach for Pure Water Monterey Waste Discharge" (ROWD, Attachment 2).

We look forward to working with you during the permit reissuance process. Please contact me at (831) 883-6125 or tamsen@my1water.org if you need additional information.

Sincerely,

Tamsen McNarie
Assistant General Manager

Enclosure: "Monterey One Water, Report of Waste Discharge for Regional Treatment Plant, NPDES Permit No. CA 0048551"

Cc: Bob Holden, Monterey One Water
Alison Imamura, Monterey One Water
James Dix, Monterey One Water
Mike McCullough, Monterey One Water
Denise Conners, Larry Walker Associates

NOVEMBER 2017

MONTEREY ONE WATER

Report of Waste Discharge for Regional Wastewater Treatment Plant NPDES Permit No. CA0048551

Submitted to:

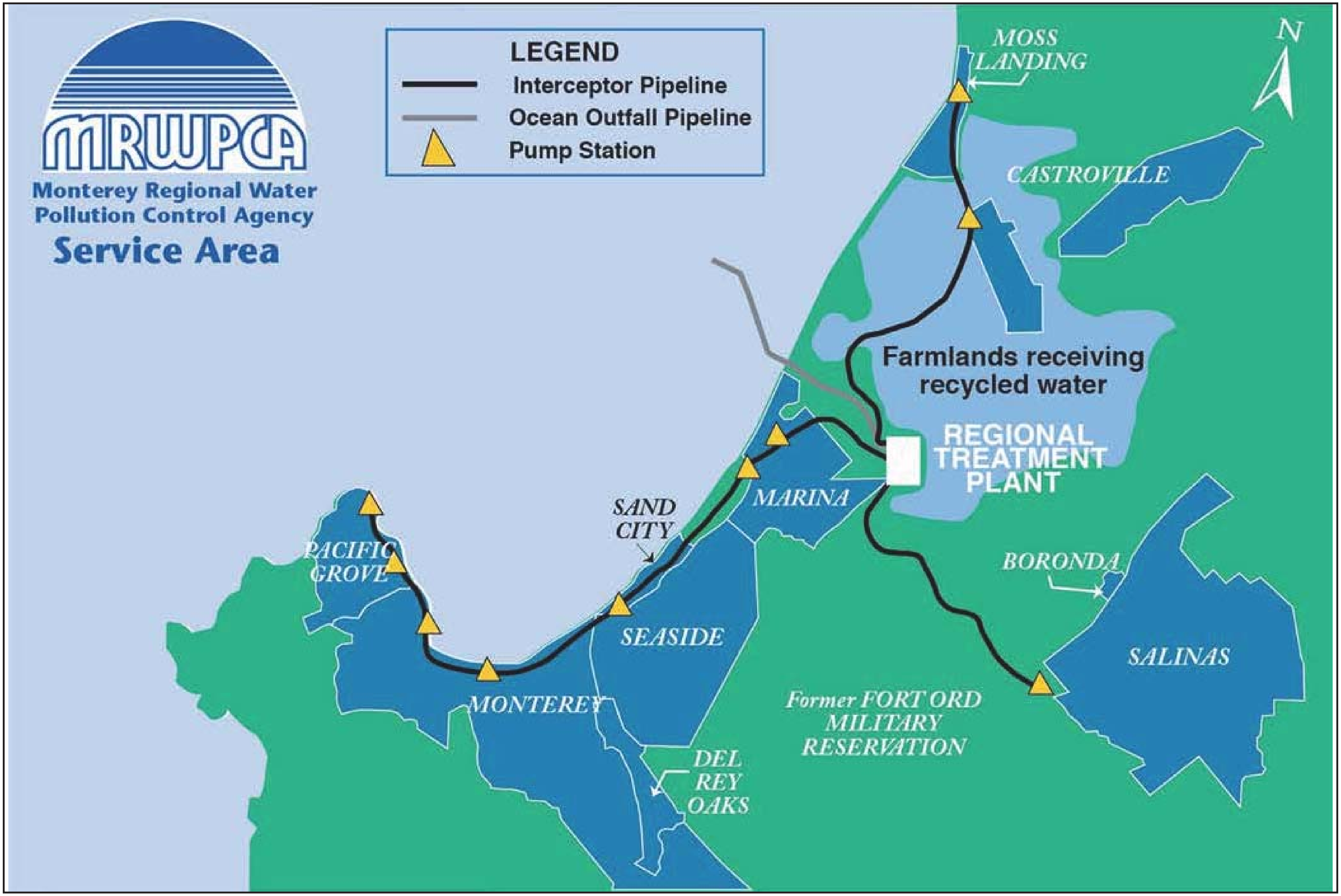
CENTRAL COAST REGIONAL WATER QUALITY CONTROL BOARD

Prepared by:

LARRY WALKER ASSOCIATES

Table of Contents

I. Location Maps



Monterey One Water Service Area Map

April 2015

Monterey One Water Regional Wastewater Treatment Plant Facility

April 2015

II. Treatment Processes

1. Treatment process narrative
2. Treatment process schematic

Treatment Process Narrative

Monterey One Water operates three separate treatment facilities located at 14811 Del Monte Blvd in Marina, California:

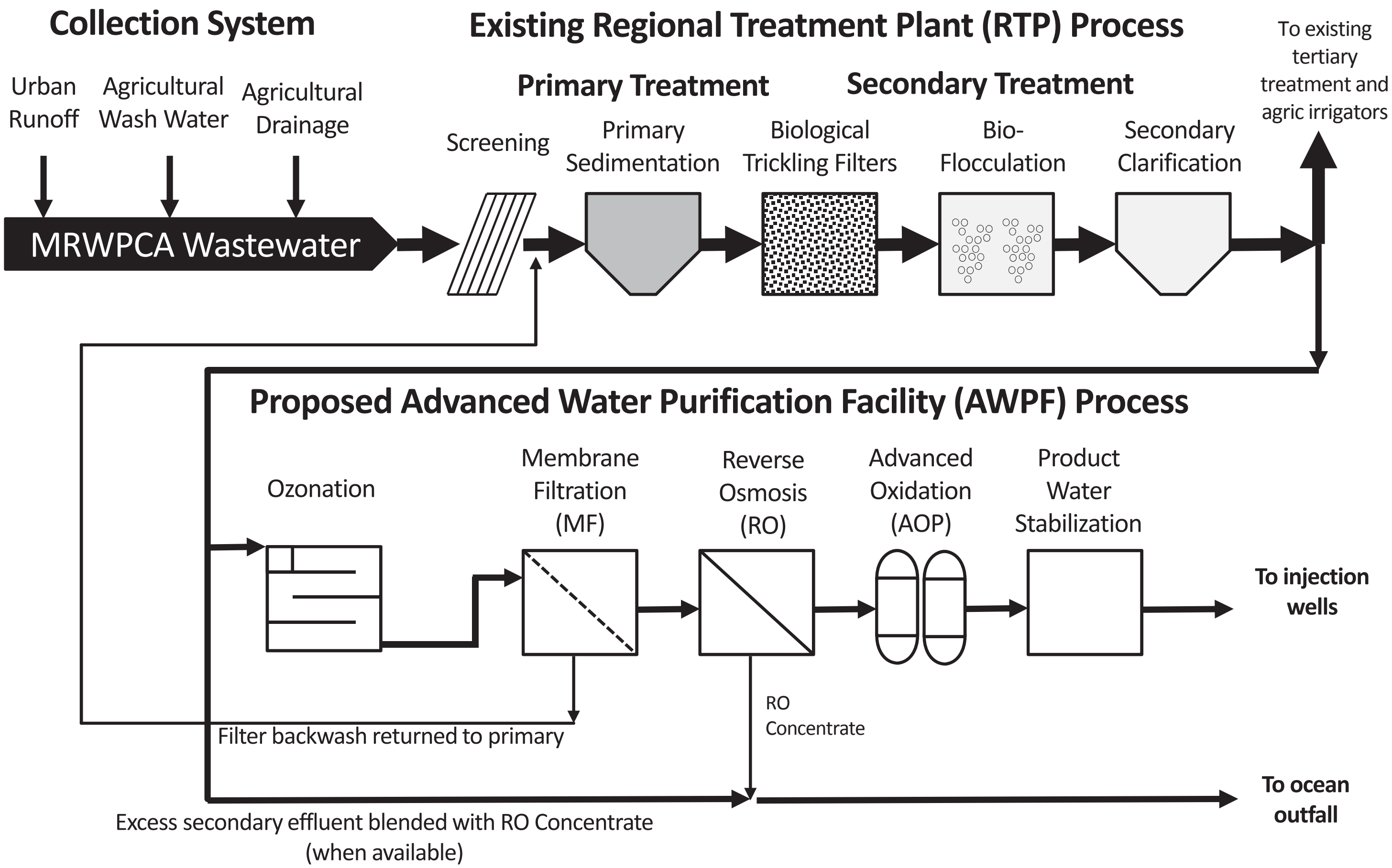
1. Regional Wastewater Treatment Plant (RTP) provides primary and secondary treatment. Wastewater treatment at the RTP includes primary screening, aerated grit removal, primary clarification, trickling filters, solids contact, and secondary clarification. Treated effluent is discharged through a diffuser, positioned 9,900 feet offshore at a depth of approximately 100 feet, to Discharge Point 001 in Monterey Bay. The RTP also accepts trucked reverse osmosis concentrate waste ("hauled waste") for ocean discharge, which is stored in a pond and mixed with secondary effluent prior to being discharged. During the summer months, secondary effluent is mainly sent to the Salinas Valley Reclamation Project.

Sludge at the RTP is thickened with gravity and dissolved-air flotation, stabilized with anaerobic digestion (pathogen reduction) and cationic chemical conditioning, and dewatered with screw presses. Dewatered biosolids are occasionally moved to adjacent sludge drying beds for additional drying. Two large sludge lagoons are used to stockpile additional sludge or as emergency sludge storage during periods of repair. Sludge from the lagoons is sent directly to the drying beds for air drying. Dried biosolids are hauled to the Monterey Regional Waste Management District's landfill in Marina, California, adjacent to the RTP, for use as solid waste cover material in the active landfill disposal cell.

2. The Salinas Valley Reclamation Project (SVRP) provides tertiary treatment, including coagulation, flocculation, granular media filtration, and disinfection with chlorine. During summer months, tertiary treated effluent is sent to an 80 acre-foot storage pond and then distributed for agricultural irrigation as part of the Castroville Seawater Intrusion Project (CSIP). Sludge generated by the SVRP is sent to the RTP. SVRP operation is governed by WRRs Order No. R3-1994-0082.

3. The Advanced Water Purification Facility (AWPF) is under construction with scheduled completion in May 2019, as part of the Pure Water Monterey Project (PWM). The AWPF will provide full advanced treatment including ozone, membrane filtration, reverse osmosis (RO), advanced oxidation using ultraviolet light and hydrogen peroxide, and finished water stabilization, before groundwater injection in the Seaside Basin and landscape irrigation by Marina Coast Water District. The RO concentrate waste will be mixed with secondary effluent from the RTP and discharged at Discharge Point 001. Sludge generated by the AWPF will be sent to the RTP for processing. AWPF operation and groundwater injection are governed by WDRs-WRRs Order No. R3-2017-0003.

PURE WATER MONTEREY - TREATMENT



Collection System

Urban Runoff

Agricultural Wash Water

Agricultural Drainage

MRWPCA Wastewater

Existing Regional Treatment Plant (RTP) Process

Primary Treatment

Screening

Primary Sedimentation

Secondary Treatment

Biological Trickling Filters

Bio-Flocculation

Secondary Clarification

To existing tertiary treatment and agric irrigators

Proposed Advanced Water Purification Facility (AWPF) Process

Ozonation

Membrane Filtration (MF)

Reverse Osmosis (RO)

Advanced Oxidation (AOP)

Product Water Stabilization

To injection wells

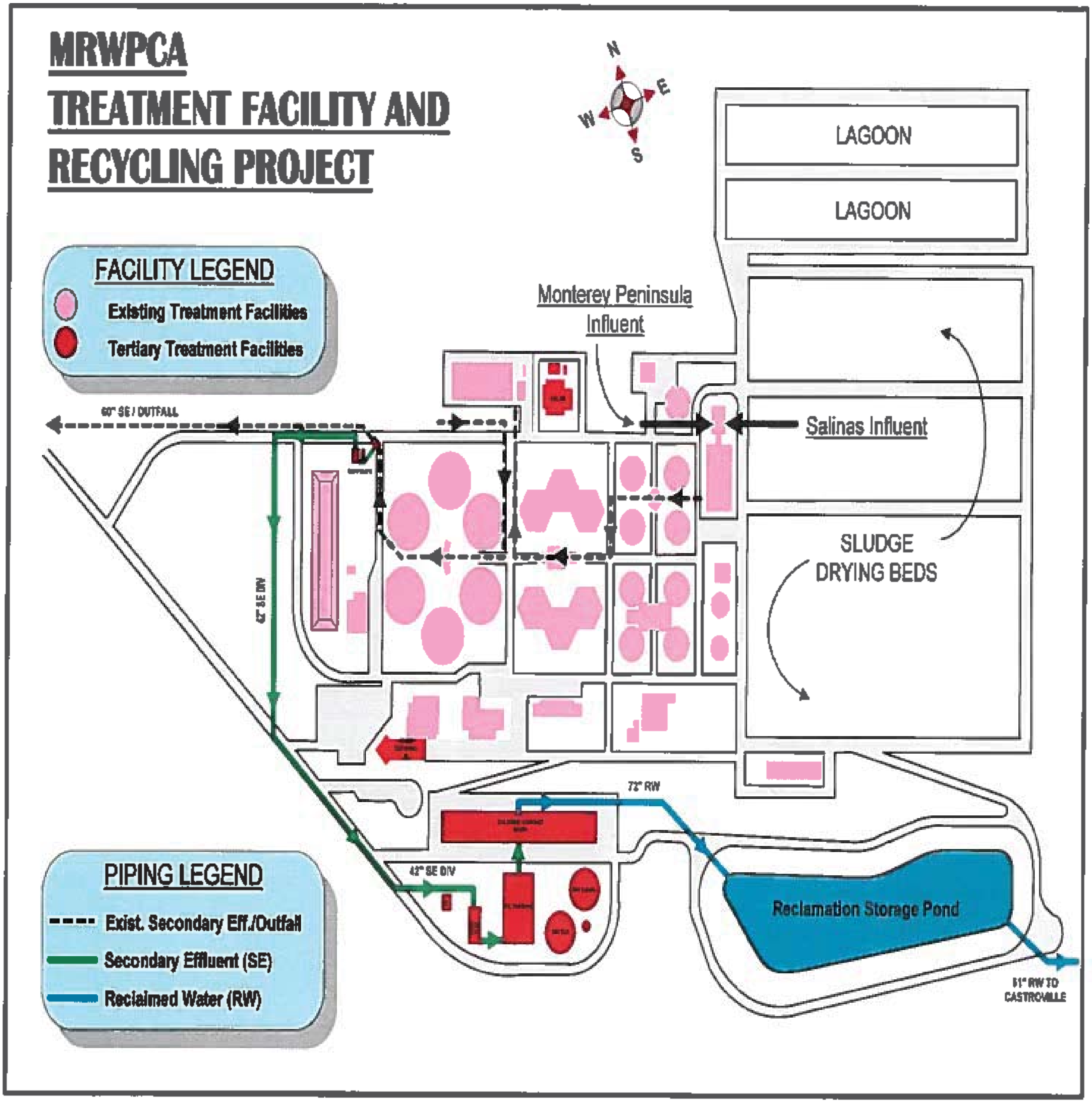
RO Concentrate

Filter backwash returned to primary

Excess secondary effluent blended with RO Concentrate (when available)

To ocean outfall

MRWPCA TREATMENT FACILITY AND RECYCLING PROJECT



EHO 1/27/98

III. California EPA Form 200

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

STATE WATER RESOURCES CONTROL BOARD
CALIFORNIA

APPLICATION/REPORT OF WASTE DISCHARGE GENERAL INFORMATION FORM FOR WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

I. FACILITY INFORMATION

A. Facility:

Name: Regional Wastewater Treatment Plant and Advanced Water Purification Facility
Address: 14811 Del Monte Blvd
City: Marina **County:** Monterey **State:** CA **Zip Code:** 93933
Contact Person: James Dix, Operations Manager **Telephone Number:** (831) 883-6183

B. Facility Owner:

Name: Monterey One Water
Address: 5 Harris Ct. Building D
City: Monterey **State:** CA **Zip Code:** 93940
Contact Person: Tamsen McNarie **Telephone Number:** (831) 883-6125 **Federal Tax ID:** 94-2424202

Owner Type (Check One)
1. ☐ Individual 2. ☐ Corporation
3. ☑ Governmental Agency 4. ☐ Partnership
5. ☐ Other: ____________

C. Facility Operator (The agency or business, not the person):

Name: Monterey One Water
Address: 5 Harris Ct. Bld. D
City: Monterey **State:** CA **Zip Code:** 93940
Contact Person: James Dix, Operations Manager **Telephone Number:** (831) 883-6183

Operator Type (Check One)
1. ☐ Individual 2. ☐ Corporation
3. ☑ Governmental Agency 4. ☐ Partnership
5. ☐ Other: ____________

D. Owner of the Land:

Name: Monterey One Water
Address: 5 Harris Ct. Bld. D
City: Monterey **State:** CA **Zip Code:** 93940
Contact Person: Tamsen McNarie **Telephone Number:** (831) 883-6125

Owner Type (Check One)
1. ☐ Individual 2. ☐ Corporation
3. ☑ Governmental Agency 4. ☐ Partnership
5. ☐ Other: ____________

E. Address Where Legal Notice May Be Served:

Address: 5 Harris Ct. Bld. D
City: Monterey **State:** CA **Zip Code:** 93940
Contact Person: Tamsen McNarie **Telephone Number:** (831) 883-6125

F. Billing Address:

Address: 5 Harris Ct. Bld. D
City: Monterey **State:** CA **Zip Code:** 93940
Contact Person: Tamsen McNarie **Telephone Number:** (831) 883-6125

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

STATE WATER RESOURCES CONTROL BOARD
EUREKA
CALIFORNIA

APPLICATION/REPORT OF WASTE DISCHARGE GENERAL INFORMATION FORM FOR WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

II. TYPE OF DISCHARGE

Check Type of Discharge(s) Described in this Application (A or B):

☐ **A. WASTE DISCHARGE TO LAND** ☑ **B. WASTE DISCHARGE TO SURFACE WATER**

Check all that apply:

- ☑ Domestic/Municipal Wastewater Treatment and Disposal
- ☐ Cooling Water
- ☐ Mining
- ☐ Waste Pile
- ☑ Wastewater Reclamation
- ☐ Other, please describe: ____________________
- ☐ Animal Waste Solids
- ☐ Land Treatment Unit
- ☐ Dredge Material Disposal
- ☐ Surface Impoundment
- ☐ Industrial Process Wastewater
- ☐ Animal or Aquacultural Wastewater
- ☑ Biosolids/Residual
- ☐ Hazardous Waste (see instructions)
- ☐ Landfill (see instructions)
- ☐ Storm Water

III. LOCATION OF THE FACILITY

Describe the physical location of the facility.

1. Assessor's Parcel Number(s)	**2. Latitude**	**3. Longitude**
Facility: 175-011-041-000	**Facility:** 36, 42', 23" N	**Facility:** 121, 46', 12" W
Discharge Point: Pacific Ocean	**Discharge Point:** 36, 43', 40" N	**Discharge Point:** 121, 50', 15" W

IV. REASON FOR FILING

- ☐ New Discharge or Facility
- ☑ Change in Design or Operation
- ☐ Change in Quantity/Type of Discharge
- ☐ Changes in Ownership/Operator (see instructions)
- ☑ Waste Discharge Requirements Update or NPDES Permit Reissuance
- ☑ Other: Addition of wastestream from AWPF.

V. CALIFORNIA ENVIRONMENTAL QUALITY ACT (CEQA)

Name of Lead Agency: Monterey One Water

Has a public agency determined that the proposed project is exempt from CEQA? ☐ **Yes** ☑ **No**

If Yes, state the basis for the exemption and the name of the agency supplying the exemption on the line below.

Basis for Exemption/Agency: ____________________

Has a "Notice of Determination" been filed under CEQA? ☑ **Yes** ☐ **No**

If Yes, enclose a copy of the CEQA document, Environmental Impact Report, or Negative Declaration. If no, identify the expected type of CEQA document and expected date of completion.

Expected CEQA Documents:

☑ **EIR** ☐ **Negative Declaration**

Expected CEQA Completion Date: October 2017

CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

State of California
Regional Water Quality Control Board

APPLICATION/REPORT OF WASTE DISCHARGE GENERAL INFORMATION FORM FOR WASTE DISCHARGE REQUIREMENTS OR NPDES PERMIT

VI. OTHER REQUIRED INFORMATION

Please provide a COMPLETE characterization of your discharge. A complete characterization includes, but is not limited to, design and actual flows, a list of constituents and the discharge concentration of each constituent, a list of other appropriate waste discharge characteristics, a description and schematic drawing of all treatment processes, a description of any Best Management Practices (BMPs) used, and a description of disposal methods.

Also include a site map showing the location of the facility and, if you are submitting this application for an NPDES permit, identify the surface water to which you propose to discharge. Please try to limit your maps to a scale of 1:24,000 (7.5' USGS Quadrangle) or a street map, if more appropriate.

VII. OTHER

Attach additional sheets to explain any responses which need clarification. List attachments with titles and dates below:

See the attached NPDES Forms 2A and 2S, which include a complete effluent characterization, site maps, narratives and schematics. The Advanced Water Purification Facility (AWPF) is under construction (scheduled completion date is May 2019) as part of the Pure Water Monterey Project. See below.

You will be notified by a representative of the RWQCB within 30 days of receipt of your application. The notice will state if your application is complete or if there is additional information you must submit to complete your Application/Report of Waste Discharge, pursuant to Division 7, Section 13260 of the California Water Code.

VIII. CERTIFICATION

"I certify under penalty of law that this document, including all attachments and supplemental information, were prepared under my direction and supervision in accordance with a system designed to assure that qualified personnel properly gathered and evaluated the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment."

Print Name: Tamsen McNarie **Title:** Assistant General Manager

Signature: **Date:** 11·21·17

The AWPF will produce advanced treated recycled water for groundwater injection in the Seaside Basin and for landscape irrigation in the Marina Coast Water District service area. The AWPF operation and production are governed by WDRs-WRRs Order No. R3-2017-0003. The AWPF wastestream will be discharged through Monterey One Water's outfall in Monterey Bay.

FOR OFFICE USE ONLY

Date Form 200 Received:	Letter to Discharger:	Fee Amount Received:	Check #:

IV. USEPA Form 1

Please print or type in the unshaded areas only
(fill-in areas are spaced for elite type, i.e., 12 characters/inch).

For Approved. OMB No. 2040-0086. Approval expires 5-31-92

FORM
1
GENERAL

U.S. ENVIRONMENTAL PROTECTION AGENCY

GENERAL INFORMATION

Consolidated Permits Program

(Read the "General Instructions" before starting.)

I. EPA I.D. NUMBER

S		T/A	C
F	CA0048551		D
1	2 13	14	15

LABEL ITEMS

- **I. EPA I.D. NUMBER**
- **III. FACILITY NAME**
- **V. FACILITY MAILING LIST**
- **VI. FACILITY LOCATION**

PLEASE PLACE LABEL IN THIS SPACE

GENERAL INSTRUCTIONS

If a preprinted label has been provided, affix it in the designated space. Review the information carefully; if any of it is incorrect, cross through it and enter the correct data in the appropriate fill-in area below. Also, if any of the preprinted data is absent *(the area to the left of the label space lists the information that should appear)*, please provide it in the proper fill-in area*(s)* below. If the label is complete and correct, you need not complete Items I, III, V, and VI*(except VI-B which must be completed regardless)*. Complete all items if no label has been proved. Refer to the instructions for detailed item descriptions and for the legal authorization under which this data is collected.

II. POLLUTANT CHARACTERISTICS

INSTRUCTIONS: Complete A through J to determine whether you need to submit any permit application forms to the EPA. If you answer "yes" to any questions, you must submit this form and the supplemental from listed in the parenthesis following the question. Mark "X" in the box in the third column if the supplemental form is attached. If you answer "no" to each question, you need not submit any of these forms. You may answer "no" if your activity is excluded from permit requirements; see Section C of the instructions. See also, Section D of the instructions for definitions of **bold-faced terms**.

SPECIFIC QUESTIONS	MARK "X"			SPECIFIC QUESTIONS	MARK "X"		
	YES	NO	FORM ATTACHED		YES	NO	FORM ATTACHED
A. Is this facility a **publicly owned treatment works** which results in a **discharge** to **waters of the U.S.?** (FORM 2A)	☒ 16	☐ 17	☐ 18	B. Does or will this facility *(either existing or proposed)* include a **concentrated animal feeding operation** or **aquatic animal production facility** which results in a **discharge** to **waters of the U.S.?** (FORM 2B)	☐ 19	☒ 20	☐ 21
C. Is this facility which currently results in **discharges** to **waters of the U.S.** other than those described in A or B above? (FORM 2C)	☐ 22	☒ 23	☐ 24	D. Is this proposal facility *(other than those described in A or B above)* which will result in a **discharge** to **waters of the U.S.?** (FORM 2D)	☐ 25	☒ 26	☐ 27
E. Does or will this facility treat, store, or dispose of **hazardous wastes?** (FORM 3)	☐ 28	☒ 29	☐ 30	F. Do you or will you inject at this facility industrial or municipal effluent below the lowermost stratum containing, within one quarter mile of the well bore, underground sources of drinking water? (FORM 4)	☐ 31	☒ 32	☐ 33
G. Do you or will you inject at this facility any produced water other fluids which are brought to the surface in connection with conventional oil or natural gas production, inject fluids used for enhanced recovery of oil or natural gas, or inject fluids for storage of liquid hydrocarbons? (FORM 4)	☐ 34	☒ 35	☐ 36	H. Do you or will you inject at this facility fluids for special processes such as mining of sulfer by the Frasch process, solution mining of minerals, in situ combustion of fossil fuel, or recovery of geothermal energy? (FORM 4)	☐ 37	☒ 38	☐ 39
I. Is this facility a proposed **stationary source** which is one of the 28 industrial categories listed in the instructions and which will potentially emit 100 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment area?** (FORM 5)	☐ 40	☒ 41	☐ 42	J. Is this facility a proposed **stationary source** which is NOT one of the 28 industrial categories listed in the instructions and which will potentially emit 250 tons per year of any air pollutant regulated under the Clean Air Act and may affect or be located in an **attainment are?** (FORM 5)	☐ 43	☒ 44	☐ 45

III. NAME OF FACILITY

C	SKIP	
1		***Regional Wastewater Treatment Plant and Advanced Water Purification Facility***
15	16-29	30 69

IV. FACILITY CONTACT

C	A. NAME & TITLE *(last, first, & title)*	B. PHONE *(area code & no.)*		
2	**Dix, James, RTP Operations Manager**	**831**	**883**	**6183**
15	16 45	46 48	49 51	52 55

V. FACILITY MAILING ADDRESS

C	A. STREET OR P.O. BOX
3	**5 Harris Ct. Building D**
15	16 45

C	B. CITY OR TOWN	C. STATE	D. ZIP CODE
4	**Monterey**	**CA**	**93940**
15	16 40	41 42	47 51

VI. FACILITY LOCATION

C	A. STREET, ROUTE NO. OR OTHER SPECIFIC IDENTIFIER
5	**14811 Del Monte Boulevard**
15	16 45

B. COUNTY NAME
Monterey
46 70

C	C. CITY OR TOWN	D. STATE	E. ZIP CODE	F. COUNTY CODE
6	**Marina**	**CA**	**93933**	**1874**
15	16 40	41 42	47 51	52 54

CONTINUED ON REVERSE

CONTINUED FROM THE FRONT

VII. SIC CODES *(4-digit, in order of priority)*

A. FIRST			B. SECOND		
C 7 15	4952 16 17	*(specify)* **Sewerage Systems**	7 7 15	16 19	*(specify)*

C. THIRD			D. FOURTH		
C 7 15	16 17	*(specify)*	7 7 15	16 19	*(specify)*

VIII. OPERATOR INFORMATION

	A. NAME	B. Is the name listed in Item VIII-A also the owner?
C 8 18	**Monterey One Water** 19 55	☒ YES ☐ NO

C. STATUS OF OPERATOR *(Enter the appropriate letter into the answer box; if "Other," specify.)*

				D. PHONE *(area code & no.)*			
F = FEDERAL S = STATE P = PRIVATE	M = PUBLIC *(other than federal or state)* O = OTHER *(specify)*	**M** 56	*(specify)*	C A 15	**831** 16 18	**883** 19 21	**6125** 22 25

E. STREET OR PO BOX

5 Harris Ct. Bld. D
26 55

	F. CITY OR TOWN	G. STATE	H. ZIP CODE
C B 15	**Monterey** 16 40	**CA** 42 42	**93940** 47 51

IX. INDIAN LAND

Is the facility located on Indian lands?

☐ YES ☒ NO

X. EXISTING ENVIRONMENTAL PERMITS

A. NPDES *(Discharges to Surface Water)*				D. PSD *(Air Emissions from Proposed Sources)*					
C 9 15	T N 16	I 17	**CA0048551** 18 30	C 9 15	T P 16	8 17	**See attachment to Form 2A** 18 30		
B. UIC *(Underground Injection of Fluids)*				E. OTHER *(specify)*					
C 9 15	T U 16	I 17	18 30	C 9 15	T 16	8 17	***R3-2017-0003*** 18 30	*(Specify)* **WDRs and WRRs**	
C. RCRA *(Hazardous Wastes)*				E. OTHER *(specify)*					
C 9 15	T R 16	I 17	18 30	C 9 15	T 16	8 17	***No. 1994-0082*** 18 30	*(Specify)* **WRR**	
Recycled Water Use General Order				E. OTHER *(specify)*					
			No. WQ 2016-0068-DDW	C 9 15	T 16	8 17	***No. WQ 2013-0058-EXEC*** 18 30	*(Specify)* **Collection system general order**	

XI. MAP

Attach to this application a topographic map of the area extending to at least one mile beyond property boundaries. The map must show the outline of the facility, the location of each of its existing and proposed intake and discharge structures, each of its hazardous waste treatment, storage, or disposal facilities, and each well where it injects fluids underground. Include all springs, rivers and other surface water bodies in the map area. See instructions for precise requirements.

XII. NATURE OF BUSINESS *(provide a brief description)*

Publicly owned treatment works serving the cities of Salinas, Monterey, Marina, Pacific Grove, the Boronda County Sanitation District, the Seaside County Sanitation District (including the cities of Seaside, Del Rey Oaks and Sand City), the Castroville Community Services District (including Castroville and Moss Landing) and Fort Ord.

XIII. CERTIFICATION *(see instructions)*

I certify under penalty of law that I have personally examined and am familiar with the information submitted in this application and all attachments and that, based on my inquiry of those persons immediately responsible for obtaining the information contained in the application, I believe that the information is true, accurate and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment.

A. NAME & OFFICIAL TITLE *(type or print)*	B. SIGNATURE	C. DATE SIGNED
Tamsen McNarie **Assistant General Manager**		11·21·17

COMMENTS FOR OFFICIAL USE ONLY

C C 15	16 55

V. NPDES Form 2A

1. Part A - Basic information
2. Part B - Additional information
3. Part C - Certification
4. Part D - Expanded effluent testing data summary
5. Part E - Acute and chronic toxicity testing summary
6. Part F - Industrial user discharges

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

FORM
2A
NPDES

NPDES FORM 2A APPLICATION OVERVIEW

APPLICATION OVERVIEW

Form 2A has been developed in a modular format and consists of a "Basic Application Information" packet and a "Supplemental Application Information" packet. The Basic Application Information packet is divided into two parts. All applicants must complete Parts A and C. Applicants with a design flow greater than or equal to 0.1 mgd must also complete Part B. Some applicants must also complete the Supplemental Application Information packet. The following items explain which parts of Form 2A you must complete.

BASIC APPLICATION INFORMATION:

A. **Basic Application Information for all Applicants.** All applicants must complete questions A.1 through A.8. A treatment works that discharges effluent to surface waters of the United States must also answer questions A.9 through A.12.

B. **Additional Application Information for Applicants with a Design Flow ≥ 0.1 mgd.** All treatment works that have design flows greater than or equal to 0.1 million gallons per day must complete questions B.1 through B.6.

C. **Certification.** All applicants must complete Part C (Certification).

SUPPLEMENTAL APPLICATION INFORMATION:

D. **Expanded Effluent Testing Data.** A treatment works that discharges effluent to surface waters of the United States and meets one or more of the following criteria must complete Part D (Expanded Effluent Testing Data):

1. Has a design flow rate greater than or equal to 1mgd,
2. Is required to have a pretreatment program (or has one in place), or
3. Is otherwise required by the permitting authority to provide the information.

E. **Toxicity Testing Data.** A treatment works that meets one or more of the following criteria must complete Part E (Toxicity Testing Data):

1. Has a design flow rate greater than or equal to 1 mgd,
2. Is required to have a pretreatment program (or has one in place), or
3. Is otherwise required by the permitting authority to submit results of toxicity testing.

F. **Industrial User Discharges and RCRA/CERCLA Wastes.** A treatment works that accepts process wastewater from any significant industrial users (SIUs) or receives RCRA or CERCLA wastes must complete Part F (Industrial User Discharges and RCRA/CERCLA Wastes). SIUs are defined as:

1. All industrial users subject to Categorical Pretreatment Standards under 40 Code of Federal Regulations (CFR) 403.6 and 40 CFR Chapter I, Subchapter N (see instructions); and
2. Any other industrial user that:
   a. Discharges an average of 25,000 gallons per day or more of process wastewater to the treatment works (with certain exclusions); or
   b. Contributes a process wastestream that makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the treatment plant; or
   c. Is designated as an SIU by the control authority.

G. **Combined Sewer Systems.** A treatment works that has a combined sewer system must complete Part G (Combined Sewer Systems).

ALL APPLICANTS MUST COMPLETE PART C (CERTIFICATION)

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

BASIC APPLICATION INFORMATION

PART A. BASIC APPLICATION INFORMATION FOR ALL APPLICANTS:

All treatment works must complete questions A.1 through A.8 of this Basic Application Information Packet.

A.1. Facility Information.

Facility Name **Regional Wastewater Treatment Plant and Advanced Water Purification Facility**

Mailing Address **5 Harris Ct. Building D, Monterey, CA 93940**

Contact Person **James Dix**

Title **Operations Manager**

Telephone Number **(831) 883-6183**

Facility Address (not P.O. Box) **14811 Del Monte Blvd**
Marina, CA 93933

A.2. Applicant Information. If the applicant is different from the above, provide the following:

Applicant Name **Monterey One Water**

Mailing Address **5 Harris Ct. Building D**
Monterey, CA 93940

Contact Person **Tamsen McNarie**

Title **Assistant General Manager**

Telephone Number **(831) 883-6125 or (210) 452-5194**

Is the applicant the owner or operator (or both) of the treatment works?

☒ owner ☒ operator

Indicate whether correspondence regarding this permit should be directed to the facility or the applicant.

☐ facility ☒ applicant

A.3. Existing Environmental Permits. Provide the permit number of any existing environmental permits that have been issued to the treatment works (include state-issued permits).

NPDES **CA0048551**

UIC

RCRA

PSD **See attached list**

Other **WDR/WRR Order R3-2017-0003**

Other **WRR Order No. 1994-0082**

Other **Collection System General Order No. WQ 2013-0058-EXEC**

Other **Recycled Water Use General Order No. WQ 2016-0068-DDW**

Monterey One Water CA0048551

Form 2A Part A.3. Permits from Monterey Bay Unified Air Pollution Control District

PTO #	Description	Replaced PTO #	Facility Address	Renews	Frequency
	RTP PERMITS				
4810B	Laboratory Equipment with Ventilation Systems	4810A	14811 Del Monte Blvd. Marina	27-Jun	annually
7537.1	Waste Gas Boiler	4150A prtn	14811 Del Monte Blvd. Marina	27-Jun	annually
7537.2	Waste Gas Burner Flares	4150A prtn	14811 Del Monte Blvd. Marina	27-Jun	annually
7708C	Paint Spray Area	7708B	14811 Del Monte Blvd. Marina	27-Jun	annually
7945B	Emergency Internal Combustion Engine-Generator Set (300 kw CAT 3406)	7945A	(Chlorine Facility) 14811 Del Monte Blvd. Marina	27-Jun	annually
11392A	Paint Spray Booth	11392	14811 Del Monte Blvd. Marina	27-Jun	annually
11806A	Emergency Internal Combustion Engine-Generator Set	11806	14811 Del Monte Blvd. Marina	27-Jun	annually
13597	Modification of Wastewater Treatment and Reclamation Plant	12441	14811 Del Monte Blvd. Marina	27-Jun	annually
14221	Gasoline Dispensing Facility (1)	12427	14811 Del Monte Blvd. Marina	27-Jun	annually
14406	Internal Combustion Diesel Engine-Sludge Lagoon Dredge	7994A	14811 Del Monte Blvd. Marina	12-Jun	annually
15289	Internal Combustion Engine-Generator Set #1	7936D	14811 Del Monte Blvd. Marina	27-Jun	annually
15290	Internal Combustion Engine-Generator Set #2	7937D	14811 Del Monte Blvd. Marina	27-Jun	annually
15291	Internal Combustion Engine-Generator Set #3	7938D	14811 Del Monte Blvd. Marina	27-Jun	annually
16163	Installation of New Aboveground Gasoline Storage Tank		14811 Del Monte Blvd. Marina	27-Jun	annually
	PUMP STATION PERMITS				
5801A	Castroville Pump Station Odor Control System	5801	Hwy 1 & 183, Castroville (CAPS)	27-Jun	annually
5802A	Fort Ord Pump Station Odor Control System	5802	South End of Marina Dr, Marina (FOPS)	27-Jun	annually
5803A	Seaside Pump Station Odor Control System	5803	1 Bay St, Seaside (SEPS)	27-Jun	annually
5804A	Moss Landing Pump Station Odor Control System	5804	Moss Landing Rd, Moss Landing (MLPS)	27-Jun	annually
5805A	Salinas Pump Station Odor Control System	5805	146 Hitchcock Rd, Salinas (SAPS)	27-Jun	annually
6304A	Marina Pump Station with Odor Control System	6304	180 Reservation Rd, Marina (MAPS)	27-Jun	annually
6774D	Internal Combustion Diesel Engine-Compressor Set (ID# 1394)	6774C	Various Locations in Monterey County	27-Jun	annually
7436A	Odor Scrubber Control System	7436	1951 Del Monte Ave, Monterey (MOPS)	27-Jun	annually
7437A	Portable Odor Scrubber	7437	Various Locations in Monterey County	27-Jun	annually
7567C	Portable Internal Combustion Diesel Engine-Pump Set (ID# 1380)	7567B	Various Locations in Monterey County	27-Jun	annually
7568C	Portable Internal Combustion Diesel Engine-Pump Set (ID# 1379)	7568B	Various Locations in Monterey County	27-Jun	annually
7569C	Portable Internal Combustion Diesel Engine-Generator Set (ID# 1378)	7569B	Various Locations in Monterey County	27-Jun	annually

Monterey One Water CA0048551

Form 2A Part A.3. Permits from Monterey Bay Unified Air Pollution Control District

PTO #	Description	Replaced PTO #	Facility Address	Renews	Frequency
7570C	Portable Internal Combustion Diesel Engine-Generator Set (ID# 1381)	7570B	Various Locations in Monterey County	27-Jun	annually
9066	Portable Internal Combustion Diesel Engine-Pump Set (ID #1410)		Various Locations in Monterey County	27-Jun	annually
10452	Portable Internal Combustion Diesel Engine-Water Pump Set (ID #1429)		Various Locations in Monterey County	27-Jun	annually
10986	Portable Internal Combustion Diesel Engine-Generator Set (CAT 3412)		Various Locations in Monterey County	27-Jun	annually
11524B	Emergency Internal Combustion Engine-Generator Set #1	11524A	146 Hitchcock Rd, Salinas (SAPS)	27-Jun	annually
11525B	Emergency Internal Combustion Engine-Generator Set #2	11525A	146 Hitchcock Rd, Salinas (SAPS)	27-Jun	annually
12242A	Emergency Internal Combustion Engine-Generator Set	12242	1951 Del Monte Ave, Monterey (MOPS)	27-Jun	annually
13593	Modification of Castroville Pump Station Odor Control System		Hwy 1 & 183, Castroville (CAPS)	27-Jun	annually
13594	Modification of Fort Ord Pump Station Odor Control System		South End of Marina Dr, Marina (FOPS)	27-Jun	annually
13595	Modification of Seaside Pump Station Odor Control System		1 Bay St, Seaside (SEPS)	27-Jun	annually
13596	Modification of Salinas Pump Station Odor Control System		146 Hitchcock Rd, Salinas (SAPS)	27-Jun	annually
13663	Portable Emergency Internal Combustion Engine-Generator Set (ID# 1471)		Various Locations in Monterey County	27-Jun	annually
13985	Emergency Internal Combustion Engine-Generator Set		PS 15 Oceanview & Coral PG	27-Jun	annually
14883	Portable Emergency Internal Combustion Engine-Generator Set (ID# 1485)		Various Site Locations in Monterey County	27-Jun	annually
14884	Emergency Internal Combustion Engine-Generator Set		Reeside & Cannery Row, Monterey (PS 7)	27-Jun	annually
ATC14938	Installation of 350 KW Emergency Internal Combustion Engine Generator-Set		Oceanview Blvd & Fountain Ave, PG (PS 13)	27-Jun	
15387	Emergency Internal Combustion Engine-Generator Set	15243	Hwy 1 & 183, Castroville (CAPS)	27-Jun	annually
	OWNED BY OTHER ENTITIES				
6821	Abrasive Blasting Equipment		Various Locations w/in Monterey, Santa Cruz, San Benito Counties		
12952	Emergency Internal Combustion Engine-Generator Set		Rosita Rd & Angelus Wy, DRO PS (SCSD owned)	20-Sep	annually
	Permit on a Waiver				
7898A	Emergency Internal Combustion Engine-Generator Set (CAT 3512)	7898	14811 Del Monte Blvd. Marina	27-Jun	annually

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

A.4. Collection System Information. Provide information on municipalities and areas served by the facility. Provide the name and population of each entity and, if known, provide information on the type of collection system (combined vs. separate) and its ownership (municipal, private, etc.).

Name	Population Served	Type of Collection System	Ownership
City of Salinas	**157,218**	**Separate**	**Public**
City of Monterey	**28,454**	**Separate**	**Public**
City of Marina	**21,688**	**Separate**	**Public**
City of Pacific Grove	**15,624**	**Separate**	**Public**
Boronda County Sanitation District	**12,538**	**Separate**	**Public**
Seaside County Sanitation District:			
City of Seaside	**34,312**	**Separate**	**Public**
City of Del Rey Oaks	**1,684**	**Separate**	**Public**
City of Sand City	**383**	**Separate**	**Public**
Castroville Community Services District:			
Castroville	**6,481**	**Separate**	**Public**
Moss Landing	**204**	**Separate**	**Public**
Fort Ord Community	**Varies**	**Separate**	**Public**

Total population served 278,586 **(Google 2016: United States Census Bureau)**

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

A.5. Indian Country.

a. Is the treatment works located in Indian Country?

☐ Yes ☒ No

b. Does the treatment works discharge to a receiving water that is either in Indian Country or that is upstream from (and eventually flows through) Indian Country?

☐ Yes ☒ No

A.6. Flow. Indicate the design flow rate of the treatment plant (i.e., the wastewater flow rate that the plant was built to handle). Also provide the average daily flow rate and maximum daily flow rate for each of the last three years. Each year's data must be based on a 12-month time period with the 12th month of "this year" occurring no more than three months prior to this application submittal.

a. Design flow rate **29.6** mgd ADWF and **75.6** mgd peak wet weather flow

	Two Years Ago	Last Year	This Year
b. Annual average daily flow rate, mgd	**18.53**	**18.07**	**18.28**
c. Maximum daily flow rate, mgd	**28.40**	**24.80**	**30.90**

A.7. Collection System. Indicate the type(s) of collection system(s) used by the treatment plant. Check all that apply. Also estimate the percent contribution (by miles) of each.

☒ Separate sanitary sewer	**100** %
☐ Combined storm and sanitary sewer	%

A.8. Discharges and Other Disposal Methods.

a. Does the treatment works discharge effluent to waters of the U.S.? ☒ Yes ☐ No

If yes, list how many of each of the following types of discharge points the treatment works uses:

i.	Discharges of treated effluent	**1**
ii.	Discharges of untreated or partially treated effluent	**0**
iii.	Combined sewer overflow points	**0**
iv.	Constructed emergency overflows (prior to the headworks)	**0**
v.	Other ______	**0**

b. Does the treatment works discharge effluent to basins, ponds, or other surface impoundments that do not have outlets for discharge to waters of the U.S.? ☒ Yes ☐ No

If yes, provide the following for each surface impoundment:

Location: **80 acre-foot storage pond located on Facility property**

Annual average daily volume discharge to surface impoundment(s) **Covered by WRR Order No. 94-82**

Is discharge ☐ continuous or ☒ intermittent?

c. Does the treatment works land-apply treated wastewater? ☐ Yes ☒ No

If yes, provide the following for each land application site:

Location: ______

Number of acres: ______

Annual average daily volume applied to site: ______ mgd

Is land application ☐ continuous or ☐ intermittent?

d. Does the treatment works discharge or transport treated or untreated wastewater to another treatment works? ☐ Yes ☒ No

If yes, describe the mean(s) by which the wastewater from the treatment works is discharged or transported to the other treatment works (e.g., tank truck, pipe).

____

If transport is by a party other than the applicant, provide:

Transporter Name ________________________________
Mailing Address ________________________________
____
Contact Person ________________________________
Title ________________________________
Telephone Number ( ) ____________________________

For each treatment works that receives this discharge, provide the following:

Name ________________________________
Mailing Address ________________________________
____
Contact Person ________________________________
Title ________________________________
Telephone Number ( ) ____________________________

If known, provide the NPDES permit number of the treatment works that receives this discharge:

____

Provide the average daily flow rate from the treatment works into the receiving facility. 0 mgd

e. Does the treatment works discharge or dispose of its wastewater in a manner not included in A.8. through A.8.d above (e.g., underground percolation, well injection): ☐ Yes ☒ No

If yes, provide the following for each disposal method:

Description of method (including location and size of site(s) if applicable):

____

Annual daily volume disposed by this method: 0

Is disposal through this method ☐ continuous or ☐ intermittent?

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

WASTEWATER DISCHARGES:

If you answered "yes" to question A.8.a, complete questions A.9 through A.12 **once for each outfall** (including bypass points) through which effluent is discharged. Do not include information on combined sewer overflows in this section. **If you answered "no" to question A.8.a,** go to Part B, "Additional Application Information for Applicants with a Design Flow Greater than or Equal to 0.1 mgd."

A.9. Description of Outfall.

a. Outfall number 001

b. Location

(City or town, if applicable) (Zip Code)

Monterey (County) CA (State)

36 deg 43' 40" N (Latitude) 121 deg 50' 15" W (Longitude)

c. Distance from shore (if applicable) 9,900 ft.

d. Depth below surface (if applicable) 100 ft.

e. Average daily flow rate 8.48 mgd

f. Does this outfall have either an intermittent or a periodic discharge? ☒ Yes ☐ No (go to A.9.g.)

If yes, provide the following information:

Number of times per year discharge occurs: Intermittent

Average duration of each discharge: As needed

Average flow per discharge: 0.43 Summer (May-Aug) mgd

Average flow per discharge: 12.2 Winter (Sep-Apr) mgd

Months in which discharge occurs: As needed

g. Is outfall equipped with a diffuser? ☒ Yes ☐ No

A.10. Description of Receiving Waters.

a. Name of receiving water Pacific Ocean (Monterey Bay National Marine Sanctuary, outside the zone of prohibition)

b. Name of watershed (if known) Lower Salinas Valley HA (309.10)

United States Soil Conservation Service 14-digit watershed code (if known): ______

c. Name of State Management/River Basin (if known): ______

United States Geological Survey 8-digit hydrologic cataloging unit code (if known): ______

d. Critical low flow of receiving stream (if applicable)
acute ______ cfs (1Q10) chronic ______ cfs (7Q10) ______ cfs (30Q10)

long-term ______ cfs (Harmonic mean)

e. Total hardness of receiving stream at critical low flow (if applicable): N/A mg/L

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

A.11. Description of Treatment

a. What levels of treatment are provided? Check all that apply.

☒ Primary ☒ Secondary

☐ Advanced ☒ Other. Describe: RO concentrate will receive treatment by ozonation and membrane filtration prior to discharge

b. Indicate the following removal rates (as applicable):

Design BOD5 removal or Design CBOD5 removal 85 %

Design SS removal 85 %

Design P removal ______ %

Design N removal ______ %

Other ______ ______ %

c. What type of disinfection is used for the effluent from this outfall? If disinfection varies by season, please describe:

RO concentrate will receive treatment by ozonation prior to discharge

If disinfection is by chlorination is dechlorination used for this outfall? ☐ Yes ☒ No

d. Does the treatment plant have post aeration? ☐ Yes ☒ No

A.12 Effluent Testing Information. All Applicants that discharge to waters of the US must provide effluent testing data for the following parameters. Provide the indicated effluent testing required by the permitting authority for each outfall through which effluent is discharged. Do not include information on combined sewer overflows in this section. All information reported must be based on data collected through analysis conducted using 40 CFR Part 136 methods. In addition, this data must comply with QA/QC requirements of 40 CFR Part 136 and other appropriate QA/QC requirements for standard methods for analytes not addressed by 40 CFR Part 136. At a minimum, effluent testing data must be based on at least three samples and must be no more than four and one-half years apart.

Outfall number: 001 – RTP effluent data (measured concentrations)

PARAMETER	MAXIMUM DAILY VALUE		AVERAGE DAILY VALUE		
	Value	Units	Value	Units	Number of Samples
pH (Minimum)	6.3	S.U.			
pH (Maximum)	8.2	S.U.			
Flow Rate	33.4	MGD	8.48	MGD	923
Temperature (Winter)	80	ºF	71.4	ºF	390
Temperature (Summer)	86	ºF	71.7	ºF	103

[b] The wet season is November 1 – April 30, dry season is May 1 – October 31.

POLLUTANT		MAXIMUM DAILY DISCHARGE		AVERAGE DAILY DISCHARGE			ANALYTICAL METHOD	ML/MDL
		Conc.	Units	Conc.	Units	Number of Samples		
CONVENTIONAL AND NON CONVENTIONAL COMPOUNDS								
BIOCHEMICAL OXYGEN DEMAND (Report one)	BOD5							
	CBOD5	42	mg/L	10.5	mg/L	333	SM 5210B	2
TOTAL COLIFORM						0		
TOTAL SUSPENED SOLIDS (TSS)		41	mg/L	11.0	mg/L	501	SM 2540D	1

END OF PART A.
REFER TO THE APPLICATION OVERVIEW TO DETERMINE WHICH OTHER PARTS OF FORM 2A YOU MUST COMPLETE

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

BASIC APPLICATION INFORMATION

PART B. ADDITIONAL APPLICATION INFORMATION FOR APPLICANTS WITH A DESIGN FLOW GREATER THAN OR EQUAL TO 0.1 MGD (100,000 gallons per day).

All applicants with a design flow rate ≥ 0.1 mgd must answer questions B.1 through B.6. All others go to Part C (Certification).

B.1. Inflow and Infiltration. **Estimate the average number of gallons per day that flow into the treatment works from inflow and/or infiltration.**

_______________ gpd Calculation method: The average wet weather influent flow is less than the average dry weather influent flow, therefore the average inflow/infiltration cannot be accurately estimated.

Briefly explain any steps underway or planned to minimize inflow and infiltration.

____

B.2. Topographic Map. Attach to this application a topographic map of the area extending at least one mile beyond facility property boundaries. This map must show the outline of the facility and the following information. (You may submit more than one map if one map does not show the entire area.) **See Location Maps (Section I)**

a. The area surrounding the treatment plant, including all unit processes.

b. The major pipes or other structures through which wastewater enters the treatment works and the pipes or other structures through which treated wastewater is discharged from the treatment plant. Include outfalls from bypass piping, if applicable.

c. Each well where wastewater from the treatment plant is injected underground.

d. Wells, springs, other surface water bodies, and drinking water wells that are: 1) within ¼ mile of the property boundaries of the treatment works, and 2) listed in public record or otherwise known to the applicant.

e. Any areas where the sewage sludge produced by the treatment works is stored, treated, or disposed.

f. If the treatment works receives waste that is classified as hazardous under the Resource Conservation and Recovery Act (RCRA) by truck, rail, or special pipe, show on the map where the hazardous waste enters the treatment works and where it is treated, stored, and/or disposed.

B.3. Process Flow Diagram or Schematic. Provide a diagram showing the processes of the treatment plant, including all bypass piping and all backup power sources or redundancy in the system. Also provide a water balance showing all treatment units, including disinfection (e.g., chlorination and dechlorination). The water balance must show daily average flow rates at influent and discharge points and approximate daily flow rates between treatment units. Include a brief narrative description of the diagram. **See Treatment Processes (Section II)**

B.4. Operation/Maintenance Performed by Contractor(s).

Are any operational or maintenance aspects (related to wastewater treatment and effluent quality) of the treatment works the responsibility of a contractor? ☐ Yes ☒ No

If yes, list the name, address, telephone number, and status of each contractor and describe the contractor's responsibilities (attach additional pages if necessary).

Name: _______________

Mailing Address: _______________
____

Telephone Number: (   ) _______________

Responsibilities of Contractor: _______________

B.5. Scheduled improvements and Schedules of Implementation. Provide information on any uncompleted implementation schedule or uncompleted plans for improvements that will affect the wastewater treatment, effluent quality, or design capacity of the treatment works. If the treatment works has several different implementation schedules or is planning several improvements, submit separate responses to question B.5 for each. (If none, go to question B.6.)

a. List the outfall number (assigned in question A.9) for each outfall that is covered by this implementation schedule.

001 – RTP Optimization Project

b. Indicate whether the planned improvements or implementation schedule are required by local, State, or Federal agencies.

☐ Yes ☒ No

c. If the answer to B.5.b is "Yes," briefly describe, including new maximum daily inflow rate (if applicable).

d. Provide dates imposed by any compliance schedule or any actual dates of completion for the implementation steps listed below, as applicable. For improvements planned independently of local, State, or Federal agencies, indicate planned or actual completion dates, as applicable. Indicate dates as accurately as possible.

The treatment process is being optimized. Construction may not be necessary.

Implementation Stage	Schedule MM/DD/YYYY	Actual Completion MM/DD/YYYY
- Begin Construction	08/01/2017	/ /
- End Construction	/ /	/ /
- Begin Discharge	/ /	/ /
- Attain Operational Level	/ /	/ /

e. Have appropriate permits/clearances concerning other Federal/State requirements been obtained? ☒ Yes ☐ No

Describe briefly:

a. List the outfall number (assigned in question A.9) for each outfall that is covered by this implementation schedule.

001 – Advanced Water Purification Facility

b. Indicate whether the planned improvements or implementation schedule are required by local, State, or Federal agencies.

☐ Yes ☒ No

c. If the answer to B.5.b is "Yes," briefly describe, including new maximum daily inflow rate (if applicable).

d. Provide dates imposed by any compliance schedule or any actual dates of completion for the implementation steps listed below, as applicable. For improvements planned independently of local, State, or Federal agencies, indicate planned or actual completion dates, as applicable. Indicate dates as accurately as possible.

Implementation Stage	Schedule MM/DD/YYYY	Actual Completion MM/DD/YYYY
- Begin Construction	05/01/2017	08/29/2017
- End Construction	08/03/2019	/ /
- Begin Discharge	05/05/2019	/ /
- Attain Operational Level	/ /	/ /

e. Have appropriate permits/clearances concerning other Federal/State requirements been obtained? ☒ Yes ☐ No

Describe briefly:

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

B.6. EFFLUENT TESTING DATA (GREATER THAN 0.1 MGD ONLY).

Applicants that discharge to waters of the US must provide effluent testing data for the following parameters. Provide the indicated effluent testing required by the permitting authority for each outfall through which effluent is discharged. Do not include information on combine sewer overflows in this section. All information reported must be based on data collected through analysis conducted using 40 CFR Part 136 methods. In addition, this data must comply with QA/QC requirements of 40 CFR Part 136 and other appropriate QA/QC requirements for standard methods for analytes not addressed by 40 CFR Part 136. At a minimum effluent testing data must be based on at least three pollutant scans and must be no more than four and on-half years old.

Outfall Number: **001 – RTP effluent data (measured concentrations)**

POLLUTANT	MAXIMUM DAILY DISCHARGE		AVERAGE DAILY DISCHARGE			ANALYTICAL METHOD	ML/MDL
	Conc.	Units	Conc.	Units	Number of Samples		
CONVENTIONAL AND NON CONVENTIONAL COMPOUNDS							
AMMONIA (as N)	47.9	mg/L	33.1	mg/L	64	SM 4500NH	
CHLORINE (TOTAL RESIDUAL, TRC)					0		
DISSOLVED OXYGEN					0		
TOTAL KJELDAHL NITROGEN (TKN)					0		
NITRATE PLUS NITRITE NITROGEN	81[a]	mg/L	4.3	mg/L	64	EPA 300.0	0.43
OIL and GREASE	9	mg/L	<5	mg/L	163	EPA 1664B	5
PHOSPHORUS (Total)					0		
TOTAL DISSOLVED SOLIDS (TDS)	9373[b]	mg/L	1873	mg/L	14	SM 2540C	
OTHER							

END OF PART B.
REFER TO THE APPLICATION OVERVIEW TO DETERMINE WHICH OTHER PARTS OF FORM 2A YOU MUST COMPLETE

[a] Nitrate-N: A high concentration was encountered in August 2015 and June 2017, due to increased hauled RO concentrate disposal.

[b] TDS: A high concentration was encountered in August 2015 due to increased hauled RO concentrate disposal.

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

BASIC APPLICATION INFORMATION

PART C. CERTIFICATION

All applicants must complete the Certification Section. Refer to instructions to determine who is an officer for the purposes of this certification. All applicants must complete all applicable sections of Form 2A, as explained in the Application Overview. Indicate below which parts of Form 2A you have completed and are submitting. By signing this certification statement, applicants confirm that they have reviewed Form 2A and have completed all sections that apply to the facility for which this application is submitted.

Indicate which parts of Form 2A you have completed and are submitting:

☒ Basic Application Information packet

Supplemental Application Information packet:

☒ Part D (Expanded Effluent Testing Data)

☒ Part E (Toxicity Testing: Biomonitoring Data)

☒ Part F (Industrial User Discharges and RCRA/CERCLA Wastes)

☐ Part G (Combined Sewer Systems)

ALL APPLICANTS MUST COMPLETE THE FOLLOWING CERTIFICATION.

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name and official title Tamsen McNarie, Assistant General Manager

Signature

Telephone number (831) 883-6125 or (210) 452-5194

Date signed 11.21.17

Upon request of the permitting authority, you must submit any other information necessary to assure wastewater treatment practices at the treatment works or identify appropriate permitting requirements.

SEND COMPLETED FORMS TO:

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

SUPPLEMENTAL APPLICATION INFORMATION

PART D. EXPANDED EFFLUENT TESTING DATA

Refer to the directions on the cover page to determine whether this section applies to the treatment works.

Effluent Testing: 1.0 mgd and Pretreatment Works. If the treatment works has a design flow greater than or equal to 1.0 mgd or it has (or is required to have) a pretreatment program, or is otherwise required by the permitting authority to provide the data, then provide effluent testing data for the following pollutants. Provide the indicated effluent testing information and any other information required by the permitting authority for each outfall through which effluent is discharged. Do not include information on combined sewer overflows in this section. All information reported must be based on data collected through analyses conducted using 40 CFR Part 136 methods. In addition, these data must comply with QA/QC requirements of 40 CFR Part 136 and other appropriate QA/QC requirements for standard methods for analytes not addressed by 40 CFR Part 136. Indicate in the blank rows provided below any data you may have on pollutants not specifically listed in this form. At a minimum, effluent testing data must be based on at least three pollutant scans and must be no more than four and one-half years old.

Outfall number: **001 – secondary effluent flow and dilution scenarios (table attached)**_

(Complete once for each outfall discharging effluent to waters of the United States.)

Monterey One Water Regional WWTP, CA0048551

Form 2A Part D: Projected Concentrations for Secondary Effluent Discharge Scenarios

	SE Flow Range #1: 0 - 0.40 MGD Dm #1 = 473		SE Flow Range #2: 0.41 - 1.60 MGD Dm #2 = 388		SE Flow Range #3: 1.61 - 8.0 MGD Dm #3 = 259		SE Flow Range #4: 8.01 - 29.6 MGD Dm #4 = 145				
California Ocean Plan Constituents	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Analytical Method	RDL Range[b]	Notes
Constituents with objectives for protection of marine aquatic life											
Arsenic	20.4	3.0	31.1	3.07	40.8	3.15	43.7	3.28	EPA 200.8	0.18 - 1.8	
Cadmium	6.5	0.014	5.1	0.013	3.4	0.013	1.9	0.013	EPA 200.8	0.04 - 0.8	
Chromium (Hexavalent)	13.2	0.028	10.4	0.027	7.0	0.027	3.9	0.026	EPA 218.6	0.02 - 0.4	
Copper	58.2	2.1	45.9	2.11	30.9	2.11	17.1	2.10	EPA 200.8	0.07 - 2	
Lead	14.2	0.030	11.2	0.029	7.5	0.029	4.2	0.028	EPA 200.8	0.1 - 2	
Mercury	0.51	0.0016	0.40	0.0015	0.26	0.0015	0.14	0.0014	CL 245.2	0.03 - 0.05	
Nickel	64.0	0.13	50.5	0.13	34.0	0.13	18.8	0.13	EPA 200.8	0.08 - 0.8	
Selenium	33.6	0.071	26.5	0.068	17.8	0.069	9.9	0.068	EPA 200.8	0.12 - 2.4	
Silver	4.0	0.17	3.2	0.17	2.1	0.17	1.2	0.17	EPA 200.8	0.12 - 4	
Zinc	303	8.6	239	8.59	161	8.59	88.8	8.55	EPA 200.8	5 - 20	
Cyanide	143	0.30	129	0.33	112	0.43	96.5	0.66	QuikChem 10-20	0.39 - 5	
Total Chlorine Residual	ND	ND	ND	ND	ND	ND	ND	ND	SM 4500-Cl	0.2 - 200	[c]
Ammonia (as N) - 6-mo median	225,789	476	178,331	458	119,871	461	66,209	453	4500-NH3	1000 - 1000	
Ammonia (as N) - Daily Max	257,895	544	203,688	524	136,916	527	75,624	518	4500-NH3	1000 - 1000	
Phenolic Compounds (non-chlorinated)	363	0.77	287	0.74	193	0.74	106	0.73	EPA 625	0.51 - 2	[d]
Chlorinated Phenolics	20.0	0.042	20.0	0.051	20.0	0.077	20.0	0.14	EPA 625	1 - 4.8	
Endosulfan	0.24	0.00051	0.19	0.00049	0.13	0.00049	0.071	0.00049	EPA 608	0.0019 - 0.19	[d]
Endrin	ND	ND	ND	ND	ND	ND	ND	ND	EPA 608	0.00096 - 0.095	[h]
HCH (Hexachlorocyclohexane)	0.31	0.00066	0.25	0.00063	0.17	0.00064	0.092	0.00063	EPA 608	0.00096 - 0.095	[d]

Monterey One Water Regional WWTP, CA0048551

Form 2A Part D: Projected Concentrations for Secondary Effluent Discharge Scenarios

	SE Flow Range #1: 0 - 0.40 MGD Dm #1 = 473		SE Flow Range #2: 0.41 - 1.60 MGD Dm #2 = 388		SE Flow Range #3: 1.61 - 8.0 MGD Dm #3 = 259		SE Flow Range #4: 8.01 - 29.6 MGD Dm #4 = 145				
California Ocean Plan Constituents	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Analytical Method	RDL Range[b]	Notes
Constituents with objectives for protection of human health - non-carcinogens											
Acrolein	43.6	0.092	34.5	0.089	23.2	0.089	12.8	0.088	EPA 624	2.5 - 5	
Antimony	4.1	0.0086	3.2	0.0083	2.17	0.0084	1.20	0.0082	EPA 200.8	0.1 - 5.2	
Bis (2-chloroethoxy) methane	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.29 - 2.9	
Bis (2-chloroisopropyl) ether	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.27 - 2.7	
Chlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	EPA 624	0.05 - 0.5	
Chromium (III)	36.1	0.076	28.5	0.073	19.2	0.074	10.6	0.073	EPA 200.8	0.16 - 2	
Di-n-butyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.29 - 2.9	
Dichlorobenzenes	8.4	0.018	6.7	0.017	4.5	0.017	2.5	0.017	EPA 625	0.072 - 1.9	
Diethyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.14 - 1.9	
Dimethyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.17 - 1.9	
4,6-dinitro-2-methylphenol	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.98 - 9.6	
2,4-Dinitrophenol	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.87 - 9.6	
Ethylbenzene	ND	ND	ND	ND	ND	ND	ND	ND	EPA 624	0.05 - 0.5	
Fluoranthene	0.036	0.000076	0.028	0.000073	0.019	0.000074	0.011	0.000072	EPA 610	0.002 - 4	
Hexachlorocyclopentadiene	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	1.1 - 12	
Nitrobenzene	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.31 - 3.1	
Thallium	3.6	0.0076	2.8	0.0073	1.9	0.0073	1.1	0.0072	EPA 200.8	0.04 - 0.8	
Toluene	2.5	0.0053	2.0	0.0051	1.3	0.0052	0.74	0.0051	EPA 624	0.04 - 0.5	
Tributyltin	ND	ND	ND	ND	ND	ND	ND	ND	MAI-Organic Tin	0.014 - 0.2	
1,1,1-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	EPA 624	0.05 - 0.5	

Monterey One Water Regional WWTP, CA0048551

Form 2A Part D: Projected Concentrations for Secondary Effluent Discharge Scenarios

	SE Flow Range #1: 0 - 0.40 MGD Dm #1 = 473		SE Flow Range #2: 0.41 - 1.60 MGD Dm #2 = 388		SE Flow Range #3: 1.61 - 8.0 MGD Dm #3 = 259		SE Flow Range #4: 8.01 - 29.6 MGD Dm #4 = 145				
California Ocean Plan Constituents	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Analytical Method	RDL Range[b]	Notes
Constituents with objectives for protection of human health - carcinogens											
Acrylonitrile	13.1	0.028	10.3	0.027	6.9	0.027	3.8	0.026	EPA 624	1 - 2	
Aldrin	ND	ND	ND	ND	ND	ND	ND	ND	EPA 608	0.00096 - 0.095	
Benzene	ND	ND	ND	ND	ND	ND	ND	ND	EPA 624	0.051 - 0.5	
Benzidine	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.28 - 9.6	
Beryllium	0.55	0.0012	0.61	0.0016	0.66	0.0025	0.68	0.0046	EPA 200.8	0.07 - 1.4	
Bis(2-chloroethyl)ether	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.23 - 2.3	
Bis(2-ethyl-hexyl)phthalate	411	0.87	324	0.83	218	0.84	120	0.82	EPA 625	0.32 - 3.8	
Carbon tetrachloride	2.7	0.0056	2.1	0.0054	1.4	0.0054	0.78	0.0053	EPA 624	0.069 - 0.5	
Chlordane	ND	ND	ND	ND	ND	ND	ND	ND	EPA 608	0.019 - 1.9	[d][e]
Chlorodibromomethane	11.6	0.025	9.2	0.024	6.2	0.024	3.4	0.023	EPA 624	0.08 - 0.5	
Chloroform	180	0.38	142	0.37	95.7	0.37	52.9	0.36	EPA 624	0.064 - 0.5	
DDT	ND	ND	ND	ND	ND	ND	ND	ND	EPA 608	0.0036 - 0.048	[d][f][g]
1,4-Dichlorobenzene	8.4	0.018	6.7	0.017	4.5	0.017	2.5	0.017	EPA 625	0.072 - 1.9	
3,3-Dichlorobenzidine	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.13 - 3.8	
1,2-Dichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	EPA 624	0.09 - 0.5	
1,1-Dichloroethylene	0.50	0.0011	0.50	0.0013	0.50	0.0019	0.50	0.0034	EPA 624	0.086 - 0.5	
Dichlorobromomethane	12.4	0.026	9.8	0.025	6.6	0.025	3.6	0.025	EPA 624	0.2 - 0.5	
Dichloromethane (methylene chloride)	4.6	0.010	3.7	0.0094	2.5	0.0095	1.4	0.0093	EPA 624	0.052 - 0.5	
1,3-dichloropropene	3.0	0.0062	2.3	0.0060	1.6	0.0060	0.87	0.0059	EPA 624	0.09 - 0.5	
Dieldrin	0.00049	0.0000010	0.00093	0.0000024	0.0013	0.0000052	0.0015	0.000010	EPA 608	0.00096 - 0.095	[f]
2,4-Dinitrotoluene	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.16 - 1.9	
1,2-Diphenylhydrazine (azobenzene)	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.15 - 1.9	
Halomethanes	6.9	0.015	5.5	0.014	3.7	0.014	2.0	0.014	EPA 624	0.066 - 0.5	[d]
Heptachlor	ND	ND	ND	ND	ND	ND	ND	ND	EPA 608	0.00096 - 0.095	
Heptachlor Epoxide	ND	ND	ND	ND	ND	ND	ND	ND	EPA 608	0.00096 - 0.095	[e]
Hexachlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	EPA 608	0.17 - 1.7	[e]
Hexachlorobutadiene	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.085 - 2.3	[e]

Monterey One Water Regional WWTP, CA0048551

Form 2A Part D: Projected Concentrations for Secondary Effluent Discharge Scenarios

	SE Flow Range #1: 0 - 0.40 MGD Dm #1 = 473		SE Flow Range #2: 0.41 - 1.60 MGD Dm #2 = 388		SE Flow Range #3: 1.61 - 8.0 MGD Dm #3 = 259		SE Flow Range #4: 8.01 - 29.6 MGD Dm #4 = 145				
California Ocean Plan Constituents	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Analytical Method	RDL Range[b]	Notes
Hexachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.06 - 2.8	
Isophorone	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.31 - 3.1	
N-Nitrosodimethylamine	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.71 - 9.6	[h]
N-Nitrosodi-N-Propylamine	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.33 - 3.4	[h]
N-Nitrosodiphenylamine	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.17 - 1.9	
PAHs	0.21	0.00045	0.17	0.00043	0.11	0.00044	0.063	0.00043	EPA 610	0.003 - 0.015	[d]
PCBs	ND	ND	ND	ND	ND	ND	ND	ND	EPA 608	0.014 - 1.9	[d][e]
TCDD Equivalents	0.00000073	0.0000000015	0.00000058	0.0000000015	0.00000039	0.0000000015	0.00000021	0.0000000015	EPA 1613B	1.0E-09 - 8.0E-06	[d]
1,1,2,2-Tetrachloroethane	ND	ND	ND	ND	ND	ND	ND	ND	EPA 624	0.1 - 0.5	
Tetrachloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	EPA 624	0.082 - 0.82	
Toxaphene	0.037	0.000079	0.029	0.000076	0.020	0.000076	0.011	0.000075	EPA 608	0.019 - 1.9	
Trichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	EPA 624	0.06 - 0.5	
1,1,2-Trichloroethane	ND	ND	ND	ND	ND	ND	ND	ND	EPA 624	0.08 - 0.5	
2,4,6-Trichlorophenol	ND	ND	ND	ND	ND	ND	ND	ND	EPA 625	0.23 - 2.2	
Vinyl chloride	1.2	0.0026	0.96	0.0025	0.64	0.0025	0.36	0.0024	EPA 624	0.07 - 0.5	

Definitions:

ND: Not Detected

SE: Secondary Effluent

Dm = Minimum Initial Dilution

SE Flow Range #1: 0 - 0.40 MGD, Dm #1 = 473: Predominantly reverse osmosis concentrate

SE Flow Range #2: 0.41 - 1.60 MGD, Dm #2 = 388: Low secondary effluent

SE Flow Range #3: 1.61 - 8.0 MGD, Dm #3 = 259: Moderate secondary effluent

SE Flow Range #4: 8.01 - 29.6 MGD, Dm #4 = 145: Predominantly secondary effluent

ZID: Zone of Initial Dilution

Monterey One Water Regional WWTP, CA0048551

Form 2A Part D: Projected Concentrations for Secondary Effluent Discharge Scenarios

	SE Flow Range #1: 0 - 0.40 MGD Dm #1 = 473		SE Flow Range #2: 0.41 - 1.60 MGD Dm #2 = 388		SE Flow Range #3: 1.61 - 8.0 MGD Dm #3 = 259		SE Flow Range #4: 8.01 - 29.6 MGD Dm #4 = 145				
California Ocean Plan Constituents	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Maximum In-Pipe, µg/L[a]	Maximum at Edge of ZID, µg/L	Analytical Method	RDL Range[b]	Notes

Footnotes:

[a] The Maximum In-Pipe constituent concentrations were estimated for each of the proposed Dm values and corresponding flow ranges. The values were calculated assuming no removal through AWPF treatment prior to RO, complete rejection through the RO membranes, and an 81% RO recovery, except when noted otherwise.

[b] Representative Detection Level - the average Method Detection Level (MDL) achieved by a pool of measurements using the same approach. The RDL range represents the lowest and highest RDLs reported by M1W since Order No. R3-2014-0013 (NPDES No. CA0048551) became effective.

[c] For all discharge scenarios, dechlorination will be provided when needed to ensure that total chlorine residual will be below detection.

[d] This value is listed in the Ocean Plan as 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.

[e] Conservative assessment of Ocean Plan compliance for these constituents included CCLEAN data with detected concentrations determined using analytical methods with ultra-low MDLs. Analytical results from compliance samples using analytical methods with MDLs consistent with Ocean Plan requirements were all below their respective MDLs. More detailed information on the conservative approach used for Ocean Plan compliance assessment can be found in the "*Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project Technical Memorandum"* (Trussell Tech, 2017, included as Attachment 4).

[f] The value presented represents a calculated value assuming 93% and 84% removal through primary and secondary treatment (at the RTP) for DDT and dieldrin, respectively; 36% and 44% removal through ozone for DDT and dieldrin, respectively; 92% and 97% removal through MF for DDT and dieldrin, respectively; recycling of the MF backwash to the RTP; 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. More information about the bench-scale testing can be found in Appendix K of the Pure Water Monterey Groundwater Replenishment Project Engineering Report *("Dieldrin and DDx Removal Testing for the Pure Water Monterey Groundwater Replenishment Project Final Report")* .

[g] Concentrations were measured above the RDL in the new source waters; however, this was prior to treatment through the RTP. Bench tests showed removal through the RTP, MF and Ozone as stated in Note f, such that the in-pipe concentration would be below the RDL. More detailed information on the conservative approach used for Ocean Plan compliance assessment can be found in the " *Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project Technical Memorandum"* (Trussell Tech, 2017, included as Attachment 4).

[h] This constituent was detected in the RTP secondary effluent and new source waters using an analytical method with a lower detection limit than what is currently used for compliance reporting. The detected concentration was well below the RDL required for compliance reporting. More detailed information on the conservative approach used for Ocean Plan compliance assessment can be found in the " *Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project Technical Memorandum"* (Trussell Tech, 2017, included as Attachment 4).

END OF PART D.
REFER TO THE APPLICATION OVERVIEW TO DETERMINE WHICH OTHER PARTS OF FORM 2A YOU MUST COMPLETE

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

SUPPLEMENTAL APPLICATION INFORMATION

PART E. TOXICITY TESTING DATA

POTWs meeting one or more of the following criteria must provide the results of whole effluent toxicity tests for acute or chronic toxicity for each of the facility's discharge points: 1) POTWs with a design flow rate greater than or equal to 1.0 mgd; 2) POTWs with a pretreatment program (or those that are required to have one under 40 CFR Part 403); or 3) POTWs required by the permitting authority to submit data for these parameters.

- At a minimum, these results must include quarterly testing for a 12-month period within the past 1 year using multiple species (minimum of two species), or the results from four tests performed at least annually in the four and one-half years prior to the application, provided the results show no appreciable toxicity, and testing for acute and/or chronic toxicity, depending on the range of receiving water dilution. Do not include information on combined sewer overflows in this section. All information reported must be based on data collected through analysis conducted using 40 CFR Part 136 methods. In addition, this data must comply with QA/QC requirements of 40 CFR Part 136 and other appropriate QA/QC requirements for standard methods for analytes not addressed by 40 CFR Part 136.
- In addition, submit the results of any other whole effluent toxicity tests from the past four and one-half years. If a whole effluent toxicity test conducted during the past four and one-half years revealed toxicity, provide any information on the cause of the toxicity or any results of a toxicity reduction evaluation, if one was conducted.
- If you have already submitted any of the information requested in Part E, you need not submit it again. Rather, provide the information requested in question E.4 for previously submitted information. If EPA methods were not used, report the reasons for using alternate methods. If test summaries are available that contain all of the information requested below, they may be submitted in place of Part E.

If no biomonitoring data is required, do not complete Part E. Refer to the Application Overview for directions on which other sections of the form to complete.

E.1. Required Tests.

Indicate the number of whole effluent toxicity tests conducted in the past four and one-half years.

8 chronic 7 acute

E.2. Individual Test Data. Complete the following chart for each whole effluent toxicity test conducted in the last four and one-half years. Allow one column per test (where each species constitutes a test). Copy this page if more than three tests are being reported.

See Part E.4. Test number: ______ Test number: ______ Test number: ______

E.3. Toxicity Reduction Evaluation. Is the treatment works involved in a Toxicity Reduction Evaluation?

☒ Yes ☐ No If yes, describe:

A TRE was initiated on September 8, 2016 to investigate chronic exceedances in August 2016 for the July-December semi-annual period.

E.4. Summary of Submitted Biomonitoring Test Information. If you have submitted biomonitoring test information, or information regarding the cause of toxicity, within the past four and one-half years, provide the dates the information was submitted to the permitting authority and a summary of the results.

Date submitted: ____/____/________ (MM/DD/YYYY)

Summary of results: (see instructions)

Table of testing results is attached

Monterey One Water Regional WWTP CA0048551

Form 2A Part E - Toxicity

Acute Toxicity at EFF-001

Species: Inland Silverside (*Menidia beryllina*)

Analytical Method: EPA/600/4-91/002 (1994)

Test: 96-hour survival rate

Sample Dates	% Survival	Result, TUa
August 5, 2014	95%	0.4
February 3, 2015	95%	0.4
August 18, 2015	100%	0
February 3, 2016	100%	0
August 16, 2016	100%	0
February 7, 2017	100%	0
August 15, 2017	95%	0.4

Chronic Toxicity at EFF-001

Species:	Giant Kelp (*Macrocystis pyrifera*)		Mussel (*Mytilus galloprovincialis*)	Inland Silverside (Menidia beryllina)	
Analytical Method:	EPA/600/R-95/136 (1995)		EPA/600/R-95/136 (1995)	EPA/821/R/02/014 (2002)	
Test Type:	48-hr Zoospore Germination	48-hr Gametophyte Growth	Bivalve embryo development	7-day survival	7-day growth
Sample date	Result, TUc	Result, TUc	Result, TUc	Result, TUc	Result, TUc
8/5,7,9/2014	40	80	40	40	40
2/3,5,7/2015	40	40	40	40	40
8/18,20,22/2015	40	40	40	40	40
2/23/2016	40	625	-	-	-
3/24/2016	40	40	-	-	-
8/16/2016	40	625	-	-	-
2/21/2017	37	37	-	-	-
8/21/2017	37	74.6	-	-	-

TRE initiated 9/8/16 to investigate chronic exceedances in August 2016 for the July-Dec semi-annual period.

END OF PART E.
REFER TO THE APPLICATION OVERVIEW TO DETERMINE WHICH OTHER PARTS OF FORM 2A YOU MUST COMPLETE.

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

SUPPLEMENTAL APPLICATION INFORMATION

PART F. INDUSTRIAL USER DISCHARGES AND RCRA/CERCLA WASTES

All treatment works receiving discharges from significant industrial users or which receive RCRA,CERCLA, or other remedial wastes must complete part F.

GENERAL INFORMATION:

F.1. Pretreatment program. Does the treatment works have, or is subject to, an approved pretreatment program?

☒ Yes ☐ No

F.2. Number of Significant Industrial Users (SIUs) and Categorical Industrial Users (CIUs). Provide the number of each of the following types of industrial users that discharge to the treatment works.

a. Number of non-categorical SIUs. 4

b. Number of CIUs. 0

Monterey One Water regulates six additional non-categorical industrial users which are not significant users.

SIGNIFICANT INDUSTRIAL USER INFORMATION::

Supply the following information for each SIU. If more than one SIU discharges to the treatment works, copy questions F.3 through F.8 and provide the information requested for each SIU.

F.3. Significant Industrial User Information. Provide the name and address of each SIU discharging to the treatment works. Submit additional pages as necessary.

Name: Mission Linen Supply #0300

Mailing Address: 435 W. Market St
Salinas, CA 93901

F.4. Industrial Processes. Describe all the industrial processes that affect or contribute to the SIU's discharge.

Commercial wash machines, equalization tank, pH mixing tank, water softeners, recycled water system (after 1st rinse only), boiler, starch cooker.

F.5. Principal Product(s) and Raw Material(s). Describe all of the principal processes and raw materials that affect or contribute to the SIU's discharge.

Principal product(s): Laundered uniforms (lightly soiled only), linen & towels, floor mats

Raw material(s): Lightly soiled uniforms, linen & towels, etc. Chemical products used include: laundry detergents, boiler chemicals, bleach, hydrogen peroxide, sulfuric acid for pH adjustment, hydraulic oil, and sodium or potassium chloride for water softeners.

F.6. Flow Rate.

a. Process wastewater flow rate. Indicate the average daily volume of process wastewater discharge into the collection system in gallons per day (gpd) and whether the discharge is continuous or intermittent.

50,000-100,000 gpd (____ continuous or ____ intermittent)

b. Non-process wastewater flow rate. Indicate the average daily volume of non-process wastewater flow discharged into the collection system in gallons per day (gpd) and whether the discharge is continuous or intermittent.

______ gpd (____ continuous or ____ intermittent)

F.7. Pretreatment Standards. Indicate whether the SIU is subject to the following:

a. Local limits ☒ Yes ☐ No

b. Categorical pretreatment standards ☐ Yes ☒ No

If subject to categorical pretreatment standards, which category and subcategory?

F.8. Problems at the Treatment Works Attributed to Waste Discharge by the SIU. Has the SIU caused or contributed to any problems (e.g., upsets, interference) at the treatment works in the past three years?

☐ Yes ☒ No If yes, describe each episode.

F.3. **Significant Industrial User Information.** Provide the name and address of each SIU discharging to the treatment works. Submit additional pages as necessary.

Name: **Mission Linen Supply #2100**

Mailing Address: **315 Kern St**
Salinas, CA 93905

F.4. **Industrial Processes.** Describe all the industrial processes that affect or contribute to the SIU's discharge.

Commercial wash machines, equalization tank, pH mixing tank, water softeners, sludge press, boiler, starch cooker, DAFT

F.5. Principal Product(s) and Raw Material(s). Describe all of the principal processes and raw materials that affect or contribute to the SIU's discharge.

Principal product(s): **Laundered uniforms, linen & towels, floor mats, shop towels, bar mops**

Raw material(s): **Soiled uniforms, linen, etc. Chemical products used include: laundry detergents, boiler chemicals, bleach, sulfuric acid for pH adjustment, hydraulic oil, and sodium or potassium chloride for water softeners.**

F.6. **Flow Rate.**

a. Process wastewater flow rate. Indicate the average daily volume of process wastewater discharge into the collection system in gallons per day (gpd) and whether the discharge is continuous or intermittent.

30,000-50,000 gpd(______ continuous or ______ intermittent)

b. Non-process wastewater flow rate. Indicate the average daily volume of non-process wastewater flow discharged into the collection system in gallons per day (gpd) and whether the discharge is continuous or intermittent.

__________ gpd (______ continuous or ______ intermittent)

F.7. **Pretreatment Standards.** Indicate whether the SIU is subject to the following:

a. Local limits ☒ Yes ☐ No

b. Categorical pretreatment standards ☐ Yes ☒ No

If subject to categorical pretreatment standards, which category and subcategory?

____

F.8. **Problems at the Treatment Works Attributed to Waste Discharge by the SIU.** Has the SIU caused or contributed to any problems (e.g., upsets, interference) at the treatment works in the past three years?

☐ Yes ☒ No If yes, describe each episode.

____

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

F.3. **Significant Industrial User Information.** Provide the name and address of each SIU discharging to the treatment works. Submit additional pages as necessary.

Name: **Ocean Mist Farms**

Mailing Address: **10855 Ocean Mist Pkwy**
Castroville, CA 95012

F.4. **Industrial Processes.** Describe all the industrial processes that affect or contribute to the SIU's discharge.

Cooling tower blowdown, hydrovacs, water softeners, cleaning/sanitizing of process equipment, produce wash/rinse tanks, bin washing.

F.5. Principal Product(s) and Raw Material(s). Describe all of the principal processes and raw materials that affect or contribute to the SIU's discharge.

Principal product(s): **Packaged vegetables**

Raw material(s): **Raw produce (spinach, artichokes, Brussel sprouts, etc.). Chemical products used include: Anhydrous ammonia, calcium hypochlorite, citric acid, sodium hypochlorite, and various cleaner/sanitizers.**

F.6. **Flow Rate.**

a. Process wastewater flow rate. Indicate the average daily volume of process wastewater discharge into the collection system in gallons per day (gpd) and whether the discharge is continuous or intermittent.

30,000-50,000 gpd(_____ continuous or _____ intermittent)

b. Non-process wastewater flow rate. Indicate the average daily volume of non-process wastewater flow discharged into the collection system in gallons per day (gpd) and whether the discharge is continuous or intermittent.

________ gpd (_____ continuous or _____ intermittent)

F.7. **Pretreatment Standards.** Indicate whether the SIU is subject to the following:

a. Local limits ☒ Yes ☐ No

b. Categorical pretreatment standards ☐ Yes ☒ No

If subject to categorical pretreatment standards, which category and subcategory?

____

F.8. **Problems at the Treatment Works Attributed to Waste Discharge by the SIU.** Has the SIU caused or contributed to any problems (e.g., upsets, interference) at the treatment works in the past three years?

☐ Yes ☒ No If yes, describe each episode.

____

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

F.3. **Significant Industrial User Information.** Provide the name and address of each SIU discharging to the treatment works. Submit additional pages as necessary.

Name: **Sabor Farms, LLC**

Mailing Address: **845 Vertin Ave**
Salinas, CA 93901

F.4. **Industrial Processes.** Describe all the industrial processes that affect or contribute to the SIU's discharge.

Vegetable produce packaging

F.5. Principal Product(s) and Raw Material(s). Describe all of the principal processes and raw materials that affect or contribute to the SIU's discharge.

Principal product(s): **Packaged produce**

Raw material(s): **Raw produce (leeks, turnips, radish, etc.). Chemical products used include: citric acid, sodium hypochlorite, and cleaners/sanitizers**

F.6. **Flow Rate.**

a. Process wastewater flow rate. Indicate the average daily volume of process wastewater discharge into the collection system in gallons per day (gpd) and whether the discharge is continuous or intermittent.

30,000-50,000 gpd(______ continuous or ______ intermittent)

b. Non-process wastewater flow rate. Indicate the average daily volume of non-process wastewater flow discharged into the collection system in gallons per day (gpd) and whether the discharge is continuous or intermittent.

__________ gpd (______ continuous or ______ intermittent)

F.7. **Pretreatment Standards.** Indicate whether the SIU is subject to the following:

a. Local limits ☒ Yes ☐ No

b. Categorical pretreatment standards ☐ Yes ☒ No

If subject to categorical pretreatment standards, which category and subcategory?

____

F.8. **Problems at the Treatment Works Attributed to Waste Discharge by the SIU.** Has the SIU caused or contributed to any problems (e.g., upsets, interference) at the treatment works in the past three years?

☐ Yes ☒ No If yes, describe each episode.

____

RCRA HAZARDOUS WASTE RECEIVED BY TRUCK, RAIL, OR DEDICATED PIPELINE:

F.9. **RCRA Waste.** Does the treatment works receive or has it in the past three years received RCRA hazardous waste by truck, rail or dedicated pipe?

☐ **Yes** ☒ **No (go to F.12)**

F.10 **Waste transport.** Method by which RCRA waste is received (check all that apply):

☐ Truck ☐ Rail ☐ Dedicated Pipe

F.11 **Waste Description.** Give EPA hazardous waste number and amount (volume or mass, specify units).

EPA Hazardous Waste Number	Amount	Units

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

CERCLA (SUPERFUND) WASTEWATER, RCRA REMEDIATION/CORRECTIVE ACTION WASTEWATER, AND OTHER REMEDIAL ACTIVITY WASTEWATER:

F.12 **Remediation Waste.** Does the treatment works currently (or has it been notified that it will) receive waste from remedial activities?

☒ Yes (complete F.13 through F.15.) ☐ No

F.13 **Waste Origin.** Describe the site and type of facility at which the CERCLA/RCRA/or other remedial waste originates (or is expected to originate in the next five years).

Performance Agriculture
940 Johnson Ave
Salinas, CA 93901

F.14 **Pollutants.** List the hazardous constituents that are received (or are expected to be received). Include data on volume and concentration, if known. (Attach additional sheets if necessary.)

Nitrates, diesel, TTO

F.15 **Waste Treatment.**

a. Is this waste treated (or will be treated) prior to entering the treatment works?

☐ Yes ☒ No

If yes, describe the treatment (provide information about the removal efficiency):

b. Is the discharge (or will the discharge be) continuous or intermittent?

☐ Continuous ☐ Intermittent If intermittent, describe discharge schedule.

0-10,000 gpd

F.13 **Waste Origin.** Describe the site and type of facility at which the CERCLA/RCRA/or other remedial waste originates (or is expected to originate in the next five years).

Pure Etch Company, Inc.
1031 Industrial Way
Salinas, CA 93902

F.14 **Pollutants.** List the hazardous constituents that are received (or are expected to be received). Include data on volume and concentration, if known. (Attach additional sheets if necessary.)

Nitrates, petroleum and hydrocarbons

F.15 **Waste Treatment.**

a. Is this waste treated (or will be treated) prior to entering the treatment works?

☒ Yes ☐ No

If yes, describe the treatment (provide information about the removal efficiency):

Activated carbon filtration to keep petroleum hydrocarbons and toxic organic concentrations within 1 mg/L.

b. Is the discharge (or will the discharge be) continuous or intermittent?

☐ Continuous ☐ Intermittent If intermittent, describe discharge schedule.

0-10,000 gpd

END OF PART F. REFER TO THE APPLICATION OVERVIEW TO DETERMINE WHICH OTHER PARTS OF FORM 2A YOU MUST COMPLETE
END OF FORM 2A.

VI. NPDES Form 2S - Biosolids

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

FORM
2S
NPDES

NPDES FORM 2S APPLICATION OVERVIEW

PRELIMINARY INFORMATION

This page is designed to indicate whether the applicant is to complete Part 1 or Part 2. Review each category, and then complete Part 1 or Part 2, as indicated. For purposes of this form, the term “you” refers to the applicant. “This facility” and “your facility” refer to the facility for which application information is submitted.

FACILITIES INCLUDED IN ANY OF THE FOLLOWING CATEGORIES MUST COMPLETE PART 2 (PERMIT APPLICATION INFORMATION).

1. Facilities with a currently effective NPDES permit.
2. Facilities which have been directed by the permitting authority to submit a full permit application at this time.

ALL OTHER FACILITIES MUST COMPLETE PART 1 (LIMITED BACKGROUND INFORMATION).

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

PART 2: PERMIT APPLICATION INFORMATION

Complete this part if you have an effective NPDES permit or have been directed by the permitting authority to submit a full permit application at this time. In other words, complete this part if your facility has, or is applying for, an NPDES permit.

For purposes of this form, the term "you" refers to the applicant. "This facility" and "your facility" refer to the facility for which application information is submitted.

APPLICATION OVERVIEW – SEWAGE SLUDGE USE OR DISPOSAL INFORMATION

Part 2 is divided into five sections (A-E). Section A pertains to all applicants. The applicability of Sections B, C, D, and E depends on your facility's sewage sludge use or disposal practices. The information provided on this page indicates which sections of Part 2 to fill out.

1. SECTION A: GENERAL INFORMATION.

Section A must be completed by all applicants

2. SECTION B: GENERATION OF SEWAGE SLUDGE OR PREPARATION OF A MATERIAL DERIVED FROM SEWAGE SLUDGE.

Section B must be completed by applicants who either:

1) Generate sewage sludge, or

2) Derive a material from sewage sludge.

3. SECTION C: LAND APPLICATION OF BULK SEWAGE SLUDGE.

Section C must be completed by applicants who either:

1) Apply sewage to the land, or

2) Generate sewage sludge which is applied to the land by others.

NOTE: Applicants who meet either or both of the two above criteria are exempted from this requirement if <u>all</u> sewage sludge from their facility falls into one of the following three categories:

1) The sewage sludge from this facility meets the ceiling and pollutant concentrations, Class A pathogen reduction requirements, and one of vector attraction options 1-8, as identified in the instructions, or

2) The sewage sludge from this facility is placed in a bag or other container for sale or give-away for application to the land, or

3) The sewage sludge from this facility is sent to another facility for treatment or blending.

4. SECTION D: SURFACE DISPOSAL.

Section D must be completed by applicants who own or operate a surface disposal site.

5. SECTION E: INCINERATION.

Section E must be completed by applicants who own or operate a sewage sludge incinerator.

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

A. GENERAL INFORMATION

All applicants must complete this section.

A.1. Facility Information.

a. Facility Name **Regional Wastewater Treatment Plant and Advanced Water Purification Facility**

b. Mailing Address **5 Harris Ct. Building D**
Monterey, CA 93940

c. Contact Person **James Dix**
Title **Operation Manager**
Telephone Number **(831) 883-6183**

d. Facility Address **14811 Del Monte Blvd**
(not P.O. Box) **Marina, CA 93933**

e. Is this facility a Class I sludge management facility? ☒ Yes ☐ No

f. Facility design flow rate: **29.6** mgd ADWF and **75.6** mgd peak wet weather flow

g. Total population served: **278,586**

h. Indicate the type of facility:

☒ Publicly owned treatment works (POTW)
☐ Federally owned treatment works
☐ Surface disposal site
☐ Other (describe) ______
☐ Privately owned treatment works
☐ Blending or treatment operation
☐ Sewage sludge incinerator

A.2. Applicant Information. If the applicant is different from the above, provide the following:

a. Applicant Name **Monterey One Water**

b. Mailing Address **5 Harris Ct. Building D**
Monterey, CA 93940

c. Contact Person **Tamsen McNarie**
Title **Assistant General Manager**
Telephone Number **(831) 883-6125 or (210) 452-5194**

d. Is the applicant the owner or operator (or both) of this facility?

☒ owner ☒ operator

e. Should correspondence regarding this permit be directed to the facility or the applicant?

☐ facility ☒ applicant

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

A.3. Permit Information.

a. Facility's NPDES permit number (if applicable): **CA0048551**

b. List, on this form or an attachment, all other Federal, State, and local permits or construction approvals received or applied for that regulate this facility's sewage sludge management practices:

Permit Number	Type of Permit
R3-2017-0003	**WDR/WRR**
1994-0082	**WRR**
See attachment to Form 2A	**Air permits**
WQ 2016-0068-DDW	**Recycled water use general order**

A.4. Indian Country. Does any generation, treatment, storage, application to land, or disposal of sewage sludge from this facility occur in Indian Country?

☐ Yes ☒ No

If yes, describe: ______

A.5. Topographic Map. Provide a topographic map or maps (or other appropriate map(s) if a topographic map is unavailable) that show the following information. Map(s) should include the area one mile beyond all property boundaries of the facility:

a. Location of all sewage sludge management facilities, including locations where sewage sludge is stored, treated, or disposed.

b. Location of all wells, springs, and other surface water bodies, listed in public records or otherwise known to the applicant within ¼ mile of the facility property boundaries. **See Location Maps (Section I)**

A.6. Line Drawing. Provide a line drawing and/or a narrative description that identifies all sewage sludge processes that will be employed during the term of the permit, including all processes used for collecting, dewatering, storing, or treating sewage sludge, the destination(s) of all liquids and solids leaving each unit, and all methods used for pathogen reduction and vector attraction reduction. **See Treatment Processes (Section II)**

A.7. Contractor Information.

Are there any operational or maintenance aspects of this facility related to sewage sludge generation, treatment, use, or disposal the responsibility of a contractor?

☐ Yes ☒ No

If yes, provide the following for each contractor (attach additional pages if necessary):

a. Name ______

b. Mailing Address ______

c. Telephone Number ______

d. Responsibilities of contractor ______

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

A.8. Pollution Concentrations: Using the table below or a separate attachment, provide sewage sludge monitoring data for the pollutants for which limits in sewage sludge have been established in 40 CFR Part 503 for this facility's expected use or disposal practices. All data must be based on three or more samples taken at least one month apart and must be no more than four and one-half years old.

POLLUTANT	CONCENTRATION (mg/kg dry weight)	ANALYTICAL METHOD	DETECTION LEVEL FOR ANALYSIS
ARSENIC	7.0	6020 - Metals (ICP/MS)	4.8
CADMIUM	2.6	6020 - Metals (ICP/MS)	4.8
CHROMIUM	51	6020 - Metals (ICP/MS)	9.6
COPPER	603	6020 - Metals (ICP/MS)	9.6
LEAD	16	6020 - Metals (ICP/MS)	4.8
MERCURY	1.6	7471A - Mercury (CVAA)	0.047
MOLYBDENUM	33	6020 - Metals (ICP/MS)	9.6
NICKEL	22	6020 - Metals (ICP/MS)	9.6
SELENIUM	7.9	6020 - Metals (ICP/MS)	9.6
ZINC	1133	6020 - Metals (ICP/MS)	96

A.8. Certification. Read and submit the following certification statement with this application. Refer to the instructions to determine who is an officer for purposes of this certification. Indicate which parts of Form 2S you have completed and are submitting:

☐ Part 1 Limited Background Information packet

Part 2 Permit Application Information packet:

☒ Section A (General Information)

☒ Section B (Generation of Sewage Sludge or Preparation of a Material Derived from Sewage Sludge)

☐ Section C (Land Application of Bulk Sewage Sludge)

☐ Section D (Surface Disposal)

☐ Section E (Incineration)

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system or those persons directly responsible for gathering the information, the information is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name and Official Title Tamsen McNarie, Assistant General Manager

Signature

Telephone Number (831) 883-6125 or (210) 452-5194

Date Signed 11.21.17

Upon request of the permitting authority, you must submit any other information necessary to assure wastewater treatment practices at the treatment works or identify appropriate permitting requirements.

SEND COMPLETED FORMS TO:

FACILITY NAME AND PERMIT NUMBER:

Error! Reference source not found. Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

B. GENERATION OF SEWAGE SLUDGE OR PREPARATION OF A MATERIAL DERIVED FROM SEWAGE SLUDGE

Complete this section if your facility generates sewage sludge or derives a material from sewage sludge.

B.1. Amount Generated On Site.

Total dry metric tons per 365-day period generated at your facility: **5257** dry metric tons (3 year average, 2014-2016)

B.2. Amount Received from Off Site.

If your facility receives sewage sludge from another facility for treatment, use, or disposal, provide the following information for each facility from which sewage sludge is received. If you receive sewage sludge from more than one facility, attach additional pages as necessary.

a. Facility Name ______

b. Mailing Address ______

______

c. Contact Person ______

Title ______

Telephone Number ( ) ______

d. Facility Address ______

(not P.O. Box) ______

e. Total dry metric tons per 365-day period received from this facility: 0 dry metric tons

f. Describe, on this form or another sheet of paper, any treatment processes known to occur at the off-site facility, including blending activities and treatment to reduce pathogens or vector attraction characteristics.

______

______

B.3. Treatment Provided At Your Facility.

a. Which class of pathogen reduction is achieved for the sewage at your facility?

☐ Class A ☒ Class B ☐ Neither or unknown

b. Describe, on this form or another sheet of paper, any treatment processes used at your facility to reduce pathogens in sewage sludge:

Anaerobic digestion

______

c. Which vector attraction reduction option is met for the sewage sludge at your facility?

☒ Option 1 (Minimum 38 percent reduction in volatile solids)
☐ Option 2 (Anaerobic process, with bench-scale demonstration) (If option 1 is not attained)
☐ Option 3 (Aerobic process, with bench-scale demonstration)
☐ Option 4 (Specific oxygen uptake rate for aerobically digested sludge)
☐ Option 5 (Aerobic processes plus raised temperature)
☐ Option 6 (Raise pH to 12 and retain at 11.5)
☐ Option 7 (75 percent solids with no unstabilized solids)
☐ Option 8 (90 percent solids with unstabilized solids)
☐ None or unknown

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

B.3. Treatment Provided At Your Facility. (con't)

d. Describe, on this form or another sheet of paper, any treatment processes used at your facility to reduce vector attraction properties of sewage sludge:

38% volatile solids reduction

e. Describe, on this form or another sheet of paper, any other sewage sludge treatment or blending activities not identified in (a) – (d) above:

Complete Section B.4 if sewage sludge from your facility meets the ceiling concentrations in Table 1 of 40 CFR 503.13, the pollutant concentrations in Table 3 of §503.13, the Class A pathogen reduction requirements in §503.32(a), and one of the vector attraction reduction requirements in §503.33(b)(1)-(8) and is land applied. Skip this section if sewage sludge from your facility does not meet all of these criteria

B.4. Preparation of Sewage Sludge Meeting Ceiling and Pollutant Concentrations, Class A Pathogen Requirements, and One of Vector Attraction Reduction Options 1-8.

a. Total dry metric tons per 365-day period received from this facility: 0 dry metric tons

b. Is sewage sludge subject to this section placed in bags or other containers for sale or give-away for application to the land?

☐ Yes ☐ No

Complete Section B.5 if you place sewage sludge in a bag or other container for sale or give-away for land application. Skip this section if the sewage sludge is covered in Section B.4.

B.5. Sale or Give-Away in a Bag or Other Container for Application to the Land.

a. Total dry metric tons per 365-day period of sewage sludge placed in a bag or other container at your facility for sale or give-away for application to the land: 0 dry metric tons

b. Attach, with this application, a copy of all labels or notices that accompany the sewage sludge being sold or given away in a bag or other container for application to the land.

Complete Section B.6 if sewage sludge from your facility is provided to another facility that provides treatment or blending. This section does not apply to sewage sludge sent directly to a land application or surface disposal site. Skip this section if the sewage sludge is covered in Sections B.4 or B.5. If you provide sewage sludge to more than one facility, attach additional pages as necessary.

B.6. Shipment Off Site for Treatment or Blending.

a. Receiving Facility Name

b. Mailing Address

c. Contact Person

Title

Telephone Number ( )

d. Total dry metric tons per 365-day period of sewage sludge provided to receiving facility: 0 dry metric tons

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

B.6. Shipment Off Site for Treatment or Blending. (con't)

e. Does the receiving facility provide additional treatment to reduce pathogens in sewage sludge from your facility?

☐ Yes ☐ No

Which class of pathogen reduction is achieved for the sewage sludge at the receiving facility?

☐ Class A ☐ Class B ☐ Neither or unknown

Describe, on this form or another sheet of paper, any treatment processes used at the receiving facility to reduce pathogens in sewage sludge:

f. Does the receiving facility provide additional treatment to reduce vector attraction characteristics of the sewage sludge?

☐ Yes ☐ No

Which vector attraction reduction option is met for the sewage sludge at your facility?

☐ Option 1 (Minimum 38 percent reduction in volatile solids)

☐ Option 2 (Anaerobic process, with bench-scale demonstration) (If option 1 is not attained)

☐ Option 3 (Aerobic process, with bench-scale demonstration)

☐ Option 4 (Specific oxygen uptake rate for aerobically digested sludge)

☐ Option 5 (Aerobic processes plus raised temperature)

☐ Option 6 (Raise pH to 12 and retain at 11.5)

☐ Option 7 (75 percent solids with no unstabilized solids)

☐ Option 8 (90 percent solids with unstabilized solids)

☐ None or unknown

Describe, on this form or another sheet of paper, any treatment processes used at the receiving facility to reduce vector attraction properties in sewage sludge:

g. Does the receiving facility provide additional treatment or blending activities not identified in (c) or (d) above:

☐ Yes ☐ No

If yes, describe, on this form or another sheet of paper, the treatment or blending activities not identified in (c) or (d) above:

h. If you answered yes to (e), (f), or (g), attach a copy of any information you provide the receiving facility to comply with the "notice of necessary information" requirement of 40 CFR 503.12(g).

i. Does the receiving facility place sewage sludge from your facility in a bag or other container for sale or give-away for application to the land?

☐ Yes ☐ No

If yes, provide a copy of all labels or notices that accompany the product being sold or given away.

Complete Section B.7 if sewage sludge from your facility is applied to the land, unless the sewage sludge is covered in:

- Section B.4 (it meets Table 1 ceiling concentrations, Table 3 pollutant concentrations, Class A pathogen requirements, and one of vector attraction reduction options 1-8); or
- Section B.5 (you place it in a bag or other container for sale or give-away for application to the land); or
- Section B.6 (you send it to another facility for treatment or blending).

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

B.7. Land Application of Bulk Sewage Sludge.

a. Total dry metric tons per 365-day period of sewage sludge applied to all land application sites: 0 dry metric tons

b. Do you identify all land application sites in Section C of this application?

☐ Yes ☐ No

If no, submit a copy of the land application plan with application (see instructions).

c. Are any land application sites located in States other than the State where you generate sewage sludge or derive a material from sewage sludge?

☐ Yes ☐ No

If yes, describe, on this form or another sheet of paper, how you notify the permitting authority for the States where the land application sites are located. Provide a copy of the notification.

Complete Section B.8 if sewage sludge from your facility is placed on a surface disposal site.

B.8. Surface Disposal.

a. Total dry metric tons of sewage sludge from your facility placed on all surface disposal site per 365-day period:

0 dry metric tons

b. Do you own or operate all surface disposal sites for which you send sewage sludge for disposal?

☐ Yes ☐ No

If no, answer B.8.c through B.8.f for each surface disposal site that you do not own or operate. If you send sewage sludge to more than one such surface disposal site, attach additional pages as necessary.

c. Site Name or Number

d. Contact Person

Title

Telephone Number ( )

Contact is ☐ Site owner ☐ Site operator

e. Mailing Address

f. Total dry metric tons of sewage sludge from your facility placed on this surface disposal site per 365-day:

0 dry metric tons

Complete Section B.9 if sewage sludge from your facility is fired in a sewage sludge incinerator

B.9. Incineration.

a. Total dry metric tons of sewage sludge from your facility fired in all sewage sludge incinerators per 365-day period:

0 dry metric tons

b. Do you own or operate all sewage sludge incinerators in which sewage sludge from your facility is fired?

☐ Yes ☐ No

If no, answer B.9.c through B.9.f for each sewage sludge incinerator that you do not own or operate. If you send sewage sludge to more than one such sewage sludge incinerator, attach additional pages as necessary.

c. Incinerator Name or Number

FACILITY NAME AND PERMIT NUMBER:

Monterey One Water CA0048551

Form Approved 1/14/99
OMB Number 2040-0086

B.9. Incineration. (con't)

c. Incinerator Name or Number ______

d. Contact Person ______

Title ______

Telephone Number (   ) ______

Contact is ☐ Incinerator owner ☐ Incinerator operator

e. Mailing Address ______

______

f. Total dry metric tons of sewage sludge from your facility fired in this sewage sludge incinerator per 365-day period:

0 dry metric tons

Complete Section B.10 if sewage sludge from this facility is placed on a municipal solid waste landfill.

B.10. Disposal in a Municipal Solid Waste Landfill. Provide the following information for each municipal solid waste landfill on which sewage sludge from your facility is placed. If sewage sludge is placed on more than one municipal solid waste landfill, attach additional pages as necessary.

a. Name of Landfill **Monterey Peninsula Landfill**

b. Contact Person **Tim Flanagan**

Title **General Manager, Monterey Regional Waste Management District**

Telephone Number **(831) 384-5313 main, 831-264-6915 Tim Flanagan**

Contact is ☐ Landfill owner ☒ Landfill operator

c. Mailing Address **P.O. Box 1670**
Marina, CA 93933-1670

d. Location of municipal solid waste landfill:

Street or Route # **14201 Del Monte Blvd**

County **Monterey**

City or Town **Marina**

State **CA**

Zip **93933**

e. Total dry metric tons of sewage sludge from your facility placed in this municipal solid waste landfill per 365-day period:

5257 dry metric tons

f. List, on this form or an attachment, the numbers of all other Federal, State, and local permits that regulate the operation of this municipal solid waste landfill.

Permit Number	Type of Permit
27-AA-0010	**Solid Waste Facility Permit**

g. Submit, with this application, information to determine whether the sewage sludge meets applicable requirements for disposal of sewage sludge in a municipal solid waste landfill (e.g., results of paint filter liquids test and TCLP test)

The results of 15 paint filter liquids tests performed between 2014-2017 have all been non-detected. Therefore, the sludge meets the applicable requirements for disposal on a municipal solid waste landfill.

h. Does the municipal solid waste landfill comply with applicable criteria set forth in 40 CFR Part 258?

☒ Yes ☐ No

VII. Supplemental Information

Attachment 1. Pure Water Monterey Environmental Documentation

Attachment 2. Proposed Multiple Dilution NPDES Permitting Approach for Pure Water Monterey Waste Discharge – November 2017

Attachment 3. Near-field Mixing Zone and Dilution Analysis Technical Memorandum – November 2017

Attachment 4. Ocean Plan Compliance Technical Memorandum – September 2017

Attachment 1.

Pure Water Monterey Environmental Documentation

Pure Water Monterey Environmental Documentation

(Copies available on request)

“Consolidated Final Environmental Impact Report for the Pure Water Monterey Groundwater Replenishment Project,” prepared for the Monterey Regional Water Pollution Control Agency by Denise Duffy & Associates, Inc. (January 2016).

Certified by the Monterey Regional Water Pollution Control Agency on October 8, 2015

State Clearinghouse Number 2013051094

“Addendum No. 3 to the Pure Water Monterey Groundwater Replenishment Project,” prepared for Monterey Regional Water Pollution Control Agency (Monterey One Water) by Denise Duffy & Associates (October 2017).

Certified by Monterey One Water on October 30, 2017

“Environmental Assessment, Pure Water Monterey Groundwater Replenishment Project,” prepared by the U.S. Department of Interior, Bureau of Reclamation (May 2017).

Attachment 2.

Proposed Multiple Dilution NPDES Permitting Approach for Pure Water Monterey Waste Discharge – November 2017

TECHNICAL MEMORANDUM

NPDES Permitting Approach
for Monterey One Water

Final Date: November 15, 2017

Authors: Elaine W. Howe, P.E. (Trussell Technologies, Inc.)
John D. Kenny, P.E. (Trussell Technologies, Inc.)
Brie D. Webber, P.E. (Trussell Technologies, Inc.)
Denise Conners (Larry Walker Associates)
Mitchell Mysliwiec, Ph.D. (Larry Walker Associates)

Reviewers: Rhodes Trussell, Ph.D., P.E., BCEE
Michael Trouchon (Larry Walker Associates)

Subject: Proposed Multiple Dm NPDES Permitting Approach to Address Discharges from Monterey One Water's Pure Water Monterey Project

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INTRODUCTION

Monterey One Water (M1W) is permitted to discharge secondary treated wastewater and trucked brine waste to Monterey Bay in accordance with the Waste Discharge Requirements described in their NPDES permit (Order No. R3-2014-0013, NPDES No. CA0048551). The average dry weather discharge is not to exceed 29.6 MGD, which is the average dry weather capacity of M1W's Regional Treatment Plant (RTP). Because the discharge is predominately representative of a single type of waste stream (secondary treated wastewater), only one minimum initial dilution number (D_m) is applied to this discharge. The current D_m is 145 parts seawater to 1 part effluent. This Dm and the numeric water quality objectives (WQOs) in the California Ocean Plan (Ocean Plan) were used to calculate effluent limits for the RTP secondary effluent prior to ocean discharge in order to prevent exceedance of the WQOs (SWRCB, 2015).

M1W is implementing the Pure Water Monterey (PWM) project and has begun construction of an Advanced Water Purification Facility (AWPF) to provide advanced treatment of secondary effluent. The purified recycled water will be injected into the Seaside Groundwater Basin for use as a potable water supply in response to the Cease and Desist Order issued to California American Water Company (CalAm) to stop over-pumping of the Carmel River. Once the AWPF is operational, M1W's effluent quality will be modified to include the concentrate stream from the reverse osmosis (RO) treatment process of the AWPF. The addition of the RO concentrate to the RTP secondary effluent will change the character of the effluent waste stream discharged to the Monterey Bay, and the water quality will be a function of the amount of secondary effluent commingled with the RO concentrate. Additional D_ms will be needed in the NPDES permit to represent the changed effluent quality and the impacts of the discharge to the Monterey Bay.

Secondary effluent from the RTP will be (1) treated through the AWPF to produce purified water for aquifer replenishment, (2) treated at the Salinas Valley Reclamation Project (SVRP)—as currently done—to produce tertiary recycled water for agricultural irrigation, or (3) blended with RO concentrate and discharged to the ocean. The amount of secondary effluent diverted to the outfall will vary throughout the year, with many months having no secondary effluent in the discharge flow. The RO concentrate flow, on the other hand, is anticipated to be relatively constant, ranging from 0.83 MGD to 1.17 MGD, where 1.17 MGD represents the maximum RO concentrate produced when the AWPF is operating at design capacity.

This technical memorandum (TM) discusses justification and implementation of a new NPDES permitting approach for this commingled effluent discharge, where four D_m values will apply to four different types of effluent discharge scenarios—each covering a different range of secondary effluent flows and a constant (maximum) RO concentrate flow. Additionally, this proposed NPDES permitting approach will assess compliance based on a comparison of calculated constituent concentrations at the edge of the zone of initial dilution (C_{ZID}) with each constituent's numeric Ocean Plan WQO.

MODELING APPROACH AND RESULTS

Modeling Tools

The near-field mixing zone model, Visual Plumes, was applied to represent dilution of the effluent plume. Visual Plumes is a USEPA-approved mixing zone model for environmental impact assessment of regulatory mixing zones resulting from continuous point source discharges (Larry Walker Associates, 2017). Visual Plumes version 17 was applied in this study.

The ambient currents in the vicinity of the discharge are determined either through modeling or assumptions. For the calculation of D_m, the ambient current was conservatively assumed to be zero. A zero current velocity assumption is the worst-case condition in the dilution analysis and is consistent with Ocean Plan requirements.

Near-field mixing processes include buoyant jet mixing (including ambient current effects and merging of individual port plumes) and boundary interactions (including density gradient effects). Receiving water depth and stratification, outfall configuration, and discharge flow rate and density are the most important model input parameters. For the M1W submerged, multi-port diffuser, the subprogram UM3 was used for all simulations. UM3 allows for arbitrary alignment of the diffuser structure within the ambient water body and for arbitrary orientation of the individual ports along the diffuser. The use of UM3 allows for the analysis of the current diffuser and any future diffuser modifications for port heights and angles. Using one model will provide comparable results between current and future configurations.

Model results delineate the effluent plume and define the edge of the mixing zone. Dilution calculated by UM3 (S) is the ratio of initial concentration in the effluent to concentration at a given location in the plume, which is the inverse of 'fraction of effluent.' As applied in the Ocean Plan, the dilution credit (D_m) is the parts of seawater per the parts of effluent in the plume and is equal to S - 1.

Ambient Conditions

Monterey Bay is traditionally known for three oceanic seasons: Upwelling from March to September, Oceanic from September to November, and Davidson from November to

March. Conductivity-temperature-depth (CTD) casts were performed by Applied Marine Sciences on a monthly basis from February 2014 to December 2015 at the four locations shown in Figure 1 (Roberts, 2017). The goal was to gather data representative of ocean conditions during this time period. Profiles taken from the four locations showed only slight variations, so the data were averaged and plotted in Figure 1. Seasonal density profiles were then averaged to construct one profile per season for the modeled scenarios as presented in Figure 2. Previous dilution modeling efforts relied on stratification measured at a monitoring buoy located approximately 5 miles north of the discharge. The current model results using more relevant local stratification have slightly higher dilution than previous efforts.

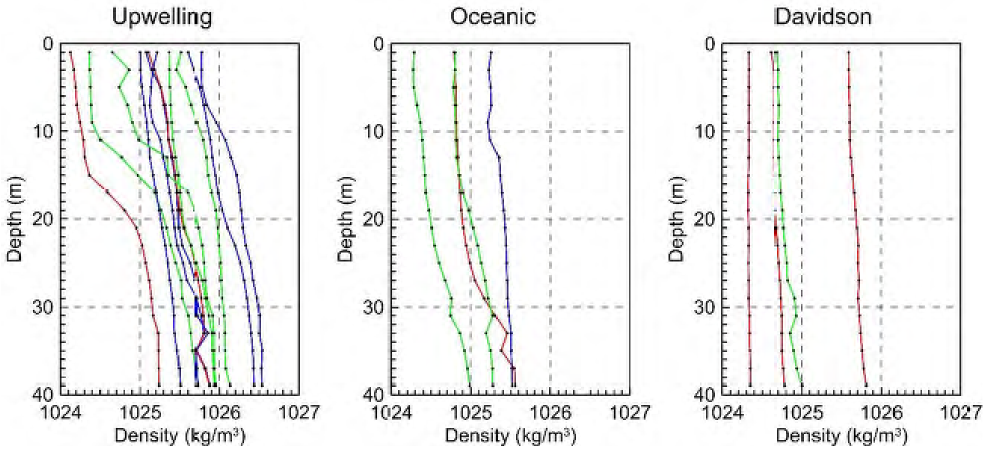

Figure 1. Seasonal density profiles drawn at different monitoring locations (Adapted from Roberts 2017).

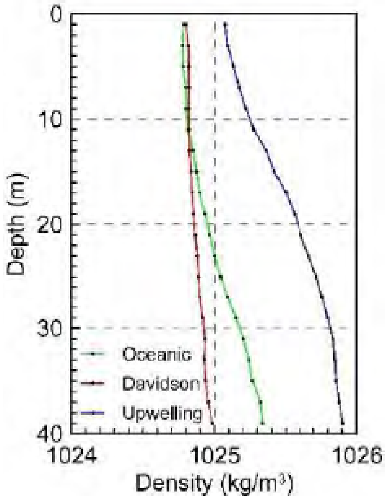

Figure 2. Average density profiles for each of the three seasons.

Ocean current velocity was conservatively assumed to be zero, as the presence of velocity enhances plume dilution. The Ocean Plan requires use of zero ambient current across the discharge structure when estimating minimum initial dilution.

Diffuser Geometry

The M1W outfall is located in Monterey Bay about 9,892 feet from shore. A typical cross-section of the diffuser design is shown in Figure 3. The diffuser design consists of 60-inch internal diameter (ID) and 48-inch ID reinforced concrete pipe with a total length of 1,272 ft. The diffuser has 65 ports in the 60-inch section and 106 ports in the 48-inch section (total of 171 ports). The ports (each 2 inches in diameter) discharge horizontally in an alternate layout on both sides of the diffuser. Currently, 42 ports closest to the shore are closed and 129 ports are open and each is fitted with 4-inch Tideflex "duckbill" check valves (4-inch is the flange size, not the valve opening). For the model, it was assumed that a 6-inch Tideflex "duckbill" check valve is installed at the end-gate. The cross-sectional area of the "duckbill" valve is a function of flowrate going through the valve. The average water depth in the diffuser area is 114.8 feet and the depth of the discharge is set to be 100.7 feet below mean sea level. The ports were modeled as round openings with areas equivalent to the effective area of the "duckbill" valves. Based on this assumption, the actual dilution will be slightly higher than the values computed in 2014 by Flow Science (Flow Science, 2014).

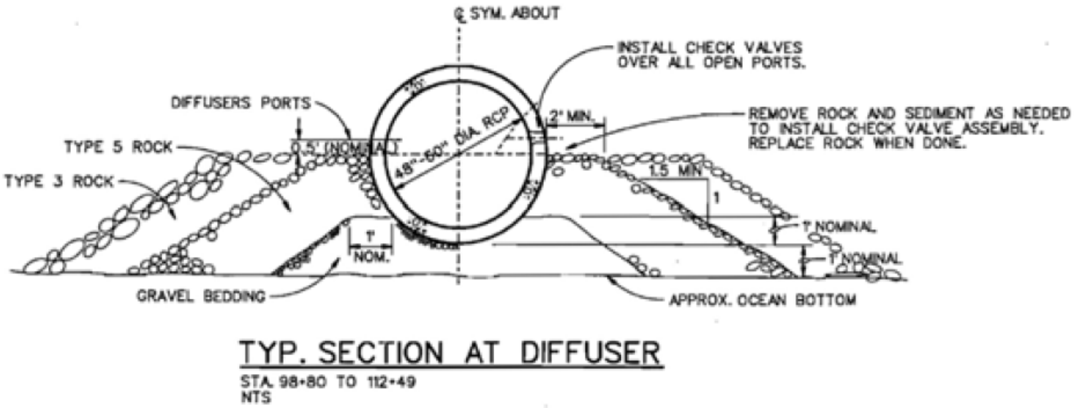

Figure 3. M1W Outfall diffuser cross-section drawing (MRWPCA, 1999).

MODEL RESULTS AND DILUTION CREDITS

The effluent density is less than the surrounding ambient density of the seawater at the discharge level. Therefore, the effluent is positively buoyant and tends to rise towards the surface. Initial dilutions estimated by the Visual Plumes UM3 model for all scenarios and oceanic conditions are presented in Table 1. Scenarios M6, M12, M23, and M34 were selected to define the proposed D_m for set ranges of secondary effluent flow (additional details about the proposed D_m values are included in Section 3). In all scenarios, the Upwelling oceanic condition resulted in the lowest available dilution. Using the Upwelling model results to set the D_m values will ensure conservative initial mixing regardless of the season. The scenarios are highlighted in Table 1 and represent conditions of predominantly RO concentrate flow (M6), low secondary effluent flow (M12), moderate secondary effluent flow (M23), and predominantly secondary effluent flow (M34). These scenarios define the proposed conditions where the D_m applied for NPDES permit limitations would change.

Table 1. Dilution Estimates and Trapped Depth for Modeled Discharge Scenarios

Scenario Number	Total Flow (mgd)	Secondary Effluent (mgd)	Upwelling		Oceanic		Davidson	
			Dm	Trapped Depth (m)	Dm	Trapped Depth (m)	Dm	Trapped Depth (m)
V11	1.17	0.0	515.8	21.6	568.1	26.0	1008.2	Surface
M1	1.20	0.0	511.4	21.6	566.9	25.9	993.7	Surface
M2	1.27	0.0	499.1	21.5	575.8	26.1	958.4	Surface
M3	1.27	0.1	505.5	21.4	557.4	26.0	965.3	Surface
M4	1.37	0.2	494.4	21.2	533.4	26.2	926.9	Surface
M5	1.47	0.3	483.7	21.3	495.3	26.1	892.4	Surface
M6	1.57	0.4	473.4	21.0	487.2	26.0	861.9	Surface
M7	1.67	0.5	463.8	20.8	482.0	21.8	834.5	Surface
M8	1.77	0.6	454.7	20.7	477.9	21.6	809.4	Surface
M9	1.87	0.7	446.2	20.6	472.2	21.6	787.3	Surface
M10	1.97	0.8	438.2	20.5	466.2	21.5	766.6	Surface
M11	2.17	1.0	423.4	20.3	454.6	21.4	730.8	Surface
M12	2.77	1.6	388.3	Surface	418.0	Surface	650.5	Surface
M13	3.17	2.0	371.5	Surface	399.9	Surface	613.8	Surface
V13	4.17	3.0	340.4	Surface	364.4	Surface	552.4	Surface
M14	4.20	3.0	339.3	Surface	363.1	Surface	550.7	Surface
M15	4.27	3.0	336.7	Surface	360.0	Surface	546.5	Surface
M16	4.67	3.5	328.1	Surface	351.0	Surface	533.5	Surface
M17	5.17	4.0	317.5	Surface	340.0	Surface	519.7	Surface
M18	5.67	4.5	308.0	Surface	331.0	Surface	510.7	Surface
M19	6.17	5.0	299.6	Surface	323.6	Surface	506.2	Surface
M20	6.67	5.5	291.3	Surface	317.6	Surface	505.7	Surface
M21	7.17	6.0	283.7	Surface	312.7	Surface	505.4	Surface
M22	8.17	7.0	270.1	Surface	304.2	Surface	498.3	Surface
M23	9.17	8.0	258.7	Surface	295.0	Surface	471.4	Surface
M24	10.17	9.0	248.5	Surface	286.5	Surface	453.8	Surface
M25	11.17	10.0	239.8	Surface	279.9	Surface	436.8	Surface
M26	13.17	12.0	225.0	Surface	265.2	Surface	404.7	Surface
M27	15.17	14.0	213.3	Surface	252.2	Surface	374.9	Surface
M28	19.17	18.0	195.8	Surface	232.7	Surface	333.5	Surface
M29	22.17	21.0	186.2	Surface	222.0	Surface	309.7	Surface
M30	23.17	22.0	183.4	Surface	219.0	Surface	299.8	Surface
M31	23.67	22.5	182.1	Surface	217.4	Surface	298.0	Surface
M32	24.17	23.0	180.8	Surface	216.1	Surface	296.3	Surface
M33	24.57	23.4	179.8	Surface	215.1	Surface	289.1	Surface
M34	29.60	29.6	169.3	Surface	204.9	Surface	263.7	Surface

RECOMMENDED DILUTION NUMBERS FOR THE NPDES PERMIT

Once M1W's AWPF comes on-line, the waste streams discharged to the Monterey Bay will be a blend of RO concentrate (1.17 MGD), trucked brine (intermittent flow, 0.03 MGD historical maximum), and secondary effluent when excess is available for discharge (0 to 9.2 MGD projected on a monthly basis). A compliance assessment found the commingled effluent to be compliant with all numeric WQOs in Table 1 of the Ocean Plan under modeled worst-case discharge conditions (Trussell Technologies, September 2017). Note that the approach used in the assessment could not be applied for some constituents (*i.e.*, acute toxicity, chronic toxicity, and radioactivity[1]). Of the constituents assessed, ammonia was estimated to reach a concentration closest to its WQO. As a result, ammonia was selected as the compliance limiting constituent and the basis for developing dilution credits for the NPDES permit. In other words, if sufficient dilution is credited for ammonia to be in compliance with its WQOs, all other constituents will also be in compliance with their WQOs.

The in-pipe concentration (*i.e.*, in the outfall pipeline) of each constituent is a function of the flow of each waste stream to the outfall. For the purpose of the Ocean Plan compliance assessment, the RO concentrate and trucked brine waste flows (where the trucked waste flows are a minimal component of the discharge) were assumed constant at their highest projected flow rates, while the secondary effluent flow to the outfall was assumed to vary over the year. The projected monthly average secondary effluent flows to the outfall are shown in Table 2. The calculated maximum average dry weather secondary effluent flow that can be discharged to the outfall, based on the permitted RTP average dry weather capacity of 29.6 MGD and the required AWPF influent flow necessary to produce 5.0 MGD of purified water, is 23.4 MGD—substantially higher than what is projected to occur on a monthly average basis.

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[1] 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 RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives (Trussell Technologies, 2017). Current discharges of the secondary effluent and hauled waste are monitored semiannually for acute toxicity, chronic toxicity, and radioactivity per the existing NPDES permit.

Table 2. Projected Monthly Average Secondary Effluent Flows (MGD) to Ocean Outfall (AWPF Down-Time Not Considered) (Schaaf and Wheeler, 2017)[2]

Type Water Year	J	F	M	A	M	J	J	A	S	O	N	D
Normal, Full Reserve	8.1	5.5	2.2	0.0	0.0	0.0	0.0	0.0	0.0	2.2	5.6	9.2
Normal, Building Drought Reserve	7.6	5.1	1.7	0.0	0.0	0.0	0.0	0.0	0.0	1.7	5.2	8.8
Drought, Starting with Full Reserve	6.5	3.7	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.4	2.6

[2] The Pure Water Monterey project will include a drought reserve of up to 1,000 acre-ft, which is projected to accumulate at a rate of 200 acre-ft per year during the "building drought reserve" water years.

The water quality of the RO concentrate and secondary effluent waste streams discharged to the outfall are also expected to change throughout the year due to variability in new source water flows diverted to the headworks of the RTP. To assess Ocean Plan compliance over the full range of potential variation in waste stream water quality, the worst-case concentrations of each constituent in the RO concentrate and secondary effluent that could occur at any time of the year were used to determine compliance. These concentrations were then combined with the projected flows in Table 2, through a flow-weighted average, to assess Ocean Plan compliance over the full range of potential variation in waste discharge composition. Considering the constituent estimated to be at a concentration closest to the Ocean Plan WQO, the range of in-pipe ammonia concentrations were then used to estimate the "minimum D_m" needed for compliance with the WQO, using a rearrangement of Equation 1 provided in the 2015 Ocean Plan as shown below.

$$C_e = C_0 + D_m(C_0 - C_s)$$ **Ocean Plan Eqn. 1**

where: C_e = effluent concentration limit - blended concentration in outfall pipe

C_0 = WQO to be met at the edge of the ZID

C_s = background seawater concentration, reported in Table 3 of the Ocean Plan (0 µg/L for ammonia)

D_m = minimum probable initial dilution number

$$D_{mR} = \frac{C_{in-pipe} - C_0}{C_0 - C_s}$$ **Rearrangement of Ocean Plan Eqn. 1**

where: D_{mR} = dilution required for compliance

$C_{in\text{-}pipe}$ = blended concentration in the outfall pipeline (same as C_e)

The minimum D_m required to comply with the Ocean Plan at all secondary effluent flow rates is plotted in Figure 4 (solid red curve). The D_m needed to be at only 80% of the objective is also plotted (solid orange curve), along with the estimated D_m values that were calculated through ocean dilution modeling. It is important to note that (1) all modeled D_m values are well above both the minimum required D_m curve and 80% minimum D_m curve, indicating compliance with WQOs over the entire range of secondary effluent flows, and (2) the proposed four D_m values are all above the 80% minimum D_m curve.

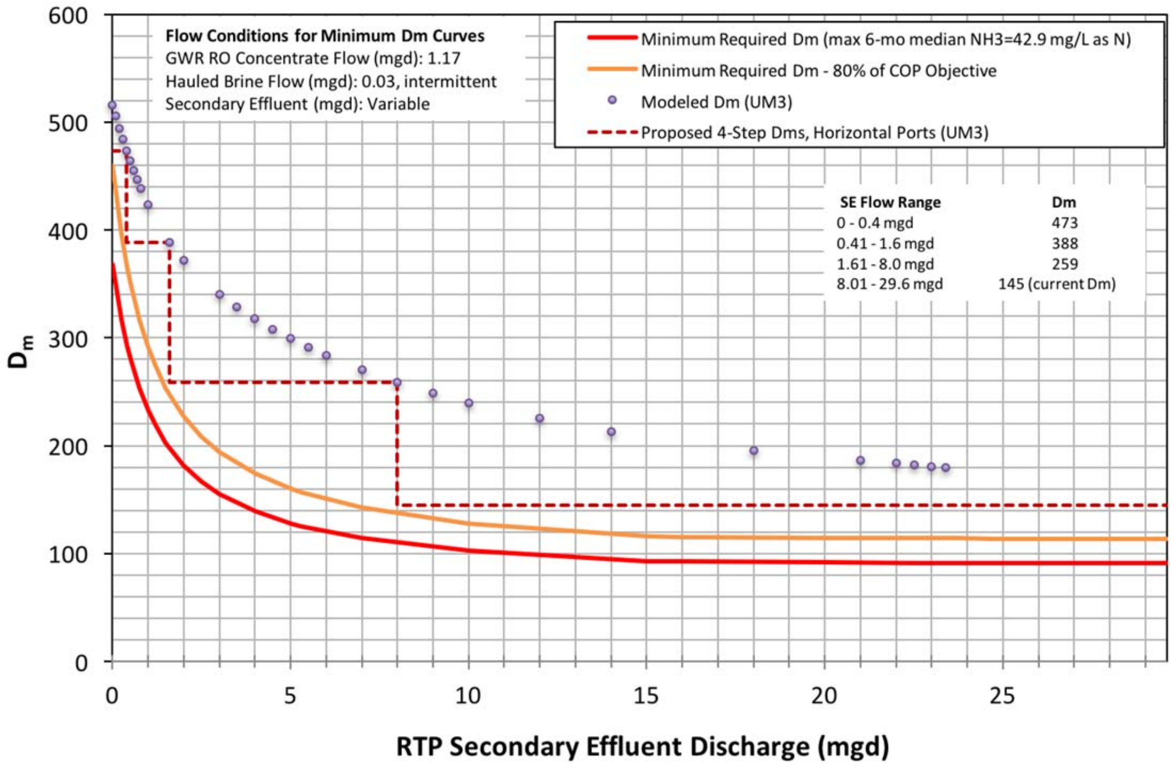

Figure 4. Proposed Four Step Dilution Numbers

Figure 4 also shows the four D_m values proposed for M1W's amended NPDES permit. These D_m values will cover four different secondary effluent flow ranges for the commingled discharge, as summarized in Table 3. The lowest D_m for the "predominately secondary effluent" flow range (i.e., 145) is the D_m in M1W's existing NPDES permit, which is associated with the maximum secondary effluent discharge (average dry weather conditions) through the ocean outfall of 29.6 MGD.

The four proposed D_m values were selected based on modeled dilution numbers for the commingled effluent discharge comprised of a constant RO concentrate flow and constant trucked brine flow. A sensitivity analysis of the relationship between D_m and flow rate was performed for the various discharge types. The greatest D_m sensitivity to flow changes was determined to be from variations in the RTP secondary effluent flow. To simplify the analysis, the flow scenarios used in the compliance analysis conservatively considered the maximum flows for the trucked waste and the RO concentrate because these flows result in the lowest D_m.

To capture the projected variation in secondary effluent flow, ranging from a monthly average of 0 to 9.2 MGD throughout the year, secondary effluent flows from 0 to 29.6 MGD were assessed. As illustrated in Figure 4, the four D_m values proposed for the NPDES permit are the minimum modeled dilutions for the four different types of commingled effluent that will be discharged (Table 3), and are all well above the minimum required D_m curve for ammonia—the compliance limiting constituent.

Table 3 - Proposed Dm Values for NPDES Permit with AWPF RO Concentrate

Secondary Effluent Flow Range (MGD)	Proposed Dm	Discharge Classification
0 – 0.4	473	Predominantly RO concentrate
0.41 – 1.6	388	Low secondary effluent
1.61 – 8.0	259	Moderate secondary effluent
8.01 – 29.6	145	Predominantly secondary effluent

JUSTIFICATION FOR A MULTIPLE D_m NPDES PERMIT

The Ocean Plan requires use of a minimum probable initial dilution "based on observed waste flow characteristics, observed receiving water density structure, and the assumption that no currents, of sufficient strength to influence the initial dilution process, flow across the discharge structure." Discharge of RO concentrate will change the waste flow characteristics significantly (in particular, the density properties that affect near-field mixing processes). In addition, the amount of secondary effluent commingled with the RO concentrate and trucked brine will influence the buoyancy of the plume and the boundary interactions with the ambient receiving water. By assigning multiple D_m values, the commingled effluent is characterized into four types of effluent waste streams that will be permitted for discharge. Representative conditions are therefore applied to each type of effluent waste stream to adequately assess the impacts of these discharges to Monterey Bay.

NPDES REPORTING STRATEGY

Electronic reporting of self-monitoring data for permitted waste discharges began in earnest in 2006. Under the following proposed approach, M1W will continue collecting and analyzing samples of the in-pipe effluent discharge. However, instead of reporting in-pipe constituent concentrations, M1W will calculate constituent concentrations at the edge of the ZID based on measured in-pipe concentrations and the D_m corresponding to the secondary effluent flow rate measured during sampling. To check for compliance, M1W will use the State Water Resources Control Board provided "Limit Tool," as is currently done. However, rather than comparing measured constituent concentrations with effluent limits, the calculated ZID concentrations will be compared with the Ocean Plan numeric WQOs.

To describe this method further, it is proposed that effluent limits in the new NPDES permit equal the Ocean Plan's numeric WQOs for each constituent that has a numeric

WQO. Calculated constituent concentrations at the edge of the ZID will be compared with the Ocean Plan's WQOs after initial dilution (i.e., at the edge of the ZID). Constituent concentrations will be calculated using a rearrangement of Equation 1 from the Ocean Plan as follows:

$$C_{ZID} = \frac{C_{in-pipe}}{(1+D_m)}$$ Eqn. 5-1, when $C_s=0$

$$C_{ZID} = \frac{(C_{in-pipe}+D_m * C_s)}{1+D_m}$$ Eqn. 5-2, when $C_s \neq 0$

where: C_{ZID} = constituent concentration at the edge of the ZID

$C_{in\text{-}pipe}$ = blended discharge concentration

C_s = background concentration in the ocean

For constituents listed in Table 3 of the Ocean Plan that have a defined background concentration (arsenic, copper, mercury, silver and zinc), equation 5-2 would be used to calculate C_{ZID}.

Sample discharge compliance calculations for ammonia—comparing calculated concentrations at the edge of the ZID with daily maximum, instantaneous maximum and 6-month median COP WQOs—are shown for a constant secondary effluent flow (Table 4) and for a variable secondary effluent flow (Table 5). The 6-month median concentration is a moving median of the C_{ZID} concentrations for the grab samples. Because the calculated concentrations at the edge of ZID are already normalized by using the applicable D_m corresponding to secondary effluent flow at sample collection, a 6-month median C_{ZID} can be calculated directly.

Table 4. Example Calculations for Ammonia Concentrations at the Edge of the ZID, Constant Secondary Effluent Flow

INPUT CELLS

A	B	C	D	E	F	G	H	I	J	K
Sampled Parameter	Date	RTP Secondary Effluent Flow (mgd)	Trucked Brine Flow (mgd)	AWTF Concentrate Flow (mgd)	Ocean Plan Limit (µg/L) (Co)	Background Conc. (µg/L) (Cs)	In-Pipe Sampled Result (µg/L)	Associated Dm	Reported C_{ZID} Result (µg/L)	In Compliance?
Ammonia (Instant Max)	1-Sep-16	0.200	0.1	1.17	6,000	0	220,000	473	464	Yes
Ammonia (Daily Max)	1-Sep-16	0.200	0.1	1.17	2,400	0	220,000	473	464	Yes
Ammonia (Instant Max)	6-Oct-16	0.200	0.1	1.17	6,000	0	190,000	473	401	Yes
Ammonia (Daily Max)	6-Oct-16	0.200	0.1	1.17	2,400	0	190,000	473	401	Yes
Ammonia (Instant Max)	3-Nov-16	0.200	0.1	1.17	6,000	0	210,000	473	443	Yes
Ammonia (Daily Max)	3-Nov-16	0.200	0.1	1.17	2,400	0	210,000	473	443	Yes
Ammonia (Instant Max)	1-Dec-16	0.200	0.1	1.17	6,000	0	200,000	473	422	Yes
Ammonia (Daily Max)	1-Dec-16	0.200	0.1	1.17	2,400	0	200,000	473	422	Yes
Ammonia (Instant Max)	5-Jan-17	0.200	0.1	1.17	6,000	0	195,000	473	411	Yes
Ammonia (Daily Max)	5-Jan-17	0.200	0.1	1.17	2,400	0	195,000	473	411	Yes
Ammonia (Instant Max)	2-Feb-17	0.200	0.1	1.17	6,000	0	200,000	473	422	Yes
Ammonia (Daily Max)	2-Feb-17	0.200	0.1	1.17	2,400	0	200,000	473	422	Yes
Ammonia (6-Mo Median)	2-Feb-17	--	--	--	600	0	--	--	422	Yes

Table 5. Example Calculations for Ammonia Concentrations at the Edge of the ZID, Variable Secondary Effluent Flow

INPUT CELLS

A	B	C	D	E	F	G	H	I	J	K
Sampled Parameter	Date	RTP Secondary Effluent Flow (mgd)	Trucked Brine Flow (mgd)	AWTF Concentrate Flow (mgd)	Ocean Plan Limit (µg/L) (Co)	Background Conc. (µg/L) (Cs)	In-Pipe Sampled Result (µg/L)	Associated Dm	Reported C_{ZID} Result (µg/L)	In Compliance?
Ammonia (Instant Max)	1-Sep-16	0.200	0.1	1.17	6,000	0	210,000	473	443	Yes
Ammonia (Daily Max)	1-Sep-16	0.200	0.1	1.17	2,400	0	210,000	473	443	Yes
Ammonia (Instant Max)	6-Oct-16	1.200	0.1	1.17	6,000	0	105,000	388	270	Yes
Ammonia (Daily Max)	6-Oct-16	1.200	0.1	1.17	2,400	0	105,000	388	270	Yes
Ammonia (Instant Max)	3-Nov-16	4.300	0.1	1.17	6,000	0	85,000	259	327	Yes
Ammonia (Daily Max)	3-Nov-16	4.300	0.1	1.17	2,400	0	85,000	259	327	Yes
Ammonia (Instant Max)	1-Dec-16	9.200	0.1	1.17	6,000	0	61,000	145	418	Yes
Ammonia (Daily Max)	1-Dec-16	9.200	0.1	1.17	2,400	0	61,000	145	418	Yes
Ammonia (Instant Max)	5-Jan-17	10.000	0.1	1.17	6,000	0	62,000	145	425	Yes
Ammonia (Daily Max)	5-Jan-17	10.000	0.1	1.17	2,400	0	62,000	145	425	Yes
Ammonia (Instant Max)	2-Feb-17	5.500	0.1	1.17	6,000	0	72,000	259	277	Yes
Ammonia (Daily Max)	2-Feb-17	5.500	0.1	1.17	2,400	0	72,000	259	277	Yes
Ammonia (6-Mo Median)	2-Feb-17	--	--	--	600	0	--	--	372	Yes

Several considerations related to the applicability of this proposed compliance reporting approach are discussed below.

Is this approach of using the Ocean Plan's water quality objectives as the permit effluent limits consistent with Ocean Plan requirements?

The Ocean Plan has the following requirements for implementing Water Quality-Based Effluent Limits (WQBELs) in permits:

1. Effluent limitations must be calculated from Ocean Plan Table 1 WQOs using Ocean Plan Equation 1.
Response: *As discussed above, the equations used to calculate constituent concentrations at the edge of the ZID are simple rearrangements of Ocean Plan Equation No. 1. The limitations on the discharge (the WQOs) are taken directly from Ocean Plan Table 1.*

2. Effluent limitations must be applied to total effluent (i.e., as discharged, in-pipe).
Response: *Effluent limitations will be applied to the total effluent. Dilution modeling considered density and velocity of total discharge. Compliance samples will be collected from the commingled effluent discharge, and both the secondary effluent flow and total discharge flow will be monitored and reported. Constituent concentrations at the edge of the ZID will be calculated from the measured "in-pipe" concentration, the secondary effluent flow, and corresponding D_m value.*

3. Effluent limitations must be prescribed for each constituent that shows reasonable potential to exceed WQOs.
Response: *The effluent limit for each constituent will be the numeric WQO set for each constituent with a WQO in the Ocean Plan. However, rather than an "in-pipe" effluent limit, each constituent will have an effluent limit at the edge of the ZID. A reasonable potential analysis will be conducted to determine which constituents have a reasonable potential to exceed their relevant WQOs.*

4. Compliance must be determined by ensuring WQOs are not exceeded at the edge of the ZID.
Response*: For each monitoring event, compliance will be based on comparing calculated constituent concentrations at the edge of the ZID with the Ocean Plan WQO. Edge of ZID concentrations will be calculated using Equation 1 from the Ocean Plan, the measured in-pipe constituent concentration, and the applicable D_m based on the flow of secondary effluent in the discharge at the time of sample collection.*

How will an average or median concentration be calculated if samples are collected during different secondary effluent discharge scenarios that have different applicable D_m values?

When the C_{ZID} is calculated, it is already normalized for the secondary effluent flow rate and applicable D_m at the time each individual sample was collected. Therefore, the average or median compliance C_{ZID} concentration is simply the average or median of the monthly (or other frequency) C_{ZID} concentrations. Compliance is still based on comparison of the average or median C_{ZID} with the numeric WQO.

How will it be decided which D_m to use when a composite sample is collected over a 24-hour period and the secondary effluent flow rate varies between the D_m flow ranges?

The composite sample is collected as a flow-weighted composite, meaning that the volume of sample collected at each specific time increment in the 24-hour period is proportioned based on the in-pipe flow rate. Thus, the average secondary effluent flow will be calculated for the 24-hour sampling period and the D_m applicable to the average secondary effluent flow will be used to calculate to C_{ZID}.

How will mass load be calculated, for comparison with the mass-based effluent limitations in the permit?

The mass-based effluent limitation for each constituent with a WQO will be the same as shown in M1W's current NPDES permit (based on the dry weather flow capacity of the RTP of 29.6 MGD).To determine compliance with the mass-based effluent limits, the mass load for each constituent in each sample will be calculated as it is currently done, where:

$$\text{Mass load }\left(\frac{\text{lbs}}{\text{day}}\right) = C_{in-pipe} * 0.00834 * Q_{discharge}$$

and: $C_{in\text{-}pipe}$ = µg/L

$Q_{discharge}$ = MGD

Will different Location IDs be required for each D_m?

No. Because the calculated C_{ZID} is already normalized for the appropriate D_m and there is only a single point of compliance assessment for each constituent—the numeric WQO at the ZID—different Location IDs will not be necessary.

Why is the proposed permitting approach based on C_{ZID} preferred over the approach using in-pipe concentration limits?

If in-pipe discharge concentration limits were to be employed, compliance monitoring and reporting would be much more complex. Instead of having one point of comparison for compliance determination (i.e., the Ocean Plan WQOs) there would be four points of comparison—a separate effluent limit associated with each of the four secondary effluent flow ranges, for each constituent. Likely, a separate Location ID would be needed for each D_m (i.e., each secondary effluent flow range), which would mean submitting four sets of data via the California Integrated Water Quality System database (CIWQS)—one for each location—versus the proposed approach which requires only one Location ID.

An additional complexity would be associated with calculating a 6-month median or 30-day average constituent concentration when each individual sample is possibly collected under a different secondary effluent flow range, each having a different applicable Dm. What effluent limit would the average or median discharge concentration be compared against if there were four effluent limits in the permit? One could calculate a flow-weighted D_m and corresponding flow-weighted effluent limit for comparison with the calculated average or median constituent concentration; however, this would increase the complexity of reporting and compliance determination on M1W's side, as well as regulatory compliance checks on the RWQCB's side. Calculating an average or median C_{ZID} concentration, on the other hand, is straight forward because the C_{ZID} concentration has already been normalized for the applicable D_m—and the compliance limit is the same over the entire secondary effluent flow range.

The Federal Standard Provisions for NPDES Permits (Attachment D, Provision V.E) requires the Regional Water Quality Control Board to be notified verbally of a noncompliant discharge event that may endanger health or the environment, within 24 hours of becoming aware of the circumstance. Will M1W be able to quickly check lab results for discharge compliance if they first must calculate the C_{ZID} concentrations for comparison with OP WQOs (i.e., compliance limits)?

Similar to the examples shown in Tables 3 and 4, M1W will have a simple Excel spreadsheet that will determine the applicable D_m, calculate the associated C_{ZID}, and compare the ZID concentration with the permit limit(s). All M1W has to enter into this Excel spreadsheet is (a) the RTP secondary effluent flow corresponding to the time of sample collection and (b) the laboratory measured result from the in-pipe sample. Except for one additional calculation (C_{ZID}), which can be done in the spreadsheet, this is no different from their current data review and reporting procedure. M1W's laboratory and compliance reporting staff will continue their commitment to a quick review of the sampled results so that they are able to adhere to all notification requirements in their NPDES Permit.

Is the proposed permitting approach conservative?

The intent of the Ocean Plan is for each constituent concentration at the edge of the ZID to be below its respective WQO. As shown in Figure 4, each of the four compliance D_m stair-steps is well below the modeled D_m values. Additionally, as shown in Figure 4, the regulatory compliance driver for M1W's waste discharge - ammonia, has estimated C_{ZID} concentrations projected to always be less than 80% of the Ocean Plan WQO. Therefore, this approach is conservative and will ensure compliance with the Ocean Plan WQO over the complete range of secondary effluent flows.

REFERENCES

State Water Resources Control Board, California Environmental Protection Agency (SWRCB), 2015. *California Ocean Plan: Water Quality Control Plan, Ocean Waters of California*.

Trussell Technologies, Inc. (Trussell Tech), 2017. "Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project." *Technical Memorandum prepared for MRWPCA and MPWMD.* September.

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Larry Walker Associates (LWA), 2017. "Near-Field Mixing Zone and Dilution Analysis Technical Memorandum." *Technical Memorandum prepared for Monterey One Water*. November.

Roberts, P. J. W, 2017. "Modeling Brine Disposal into Monterey Bay – Supplement." *CalAM EIR-EIS - App. D1: Modeling Brine Disposal into Monterey Bay*. 22 September.

Flow Science Incorporated (2014), *Technical Memorandum: MRWPCA GWR Discharge Dilution Analysis FSI 144082.*

Monterey Regional Water Pollution Agency (1999), MT17O002, *Outfall Details.*

Attachment 3.

Near-field Mixing Zone and Dilution Analysis Technical Memorandum – November 2017

Technical Memorandum

DATE:	November 15, 2017
TO:	Bob Holden, Monterey One Water Alison Imamura, Monterey One Water Elaine Howe, Trussell Technologies Brie Webber, Trussell Technologies
CC:	Denise Conners, Larry Walker Associates
SUBJECT:	Near-field Mixing Zone and Dilution Analysis for Monterey One Water

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Overview

The existing Monterey One Water (M1W) outfall and diffuser will be used to dispose of a combined discharge into the Monterey Bay (Bay). The discharge will be comprised of secondary effluent from the Regional Treatment Plant (RTP), reverse osmosis (RO) concentrate from the Advanced Water Purification Facility (AWPF) for the Pure Water Monterey Groundwater Replenishment Project (PWM Project), and truck hauled brine.

Larry Walker Associates, Inc. (LWA) conducted a near-field mixing zone analysis of the combined discharge for the PWM Project. The scenarios include combinations of secondary effluent, RO concentrate and hauled brine. The modeling used three different oceanic seasons traditionally defined in Monterey Bay: Upwelling (March to September), Oceanic (September to November), and Davidson (November to March). Density data from sampling stations in the Bay were used to build density profiles and water stratification for each season. The ambient current was set to zero for all dilution simulations.

The outfall diffuser includes 129 open ports with “duckbill” check valves installed at each port. The opening size of these valves changes upon the flow rate. It was assumed that the end-gate is also equipped with a “duckbill” valve. Simulations were conducted using both open end-gate and end-gate with “duckbill” valve and the results were essentially equivalent.

Scenarios considered for dilution analysis in each of the three different seasons are listed in **Table 1.**

Table 1: Flow scenarios for the dilution analysis.

Scenario	Flow Assumptions			
	Secondary Effluent (mgd)	RO Concentrate (mgd)	Hauled Brine (mgd)	Total (mgd)
V11	0.0	1.17	0	1.17
M1	0.0	1.17	0.03	1.2
M2	0.0	1.17	0.1	1.27
M3	0.1	1.17	0	1.27
M4	0.2	1.17	0	1.37
M5	0.3	1.17	0	1.47
M6	0.4	1.17	0	1.57
M7	0.5	1.17	0	1.67
M8	0.6	1.17	0	1.77
M9	0.7	1.17	0	1.87
M10	0.8	1.17	0	1.97
M11	1.0	1.17	0	2.17
M12	1.6	1.17	0	2.77
M13	2.0	1.17	0	3.17
V13	3.0	1.17	0	4.17
M14	3.0	1.17	0.03	4.2
M15	3.0	1.17	0.1	4.27
M16	3.5	1.17	0	4.67
M17	4.0	1.17	0	5.17
M18	4.5	1.17	0	5.67
M19	5.0	1.17	0	6.17
M20	5.5	1.17	0	6.67
M21	6.0	1.17	0	7.17
M22	7.0	1.17	0	8.17
M23	8.0	1.17	0	9.17
M24	9.0	1.17	0	10.17
M25	10.0	1.17	0	11.17
M26	12.0	1.17	0	13.17
M27	14.0	1.17	0	15.17
M28	18.0	1.17	0	19.17
M29	21.0	1.17	0	22.17
M30	22.0	1.17	0	23.17
M31	22.5	1.17	0	23.67
M32	23.0	1.17	0	24.17
M33	23.4	1.17	0	24.57
M34	29.6	0.0	0	29.6

This memo provides information and analysis to support consideration of dilution credits for discharges through the M1W outfall under different scenarios of secondary effluent flow rates and oceanic conditions.

Regulatory Guidance

The California Ocean Plan[1] (Ocean Plan) defines initial dilution[2] as the process resulting in the rapid and irreversible turbulent mixing of effluent with ocean water around the point of discharge. For water quality assessments and effluent limit derivation, the minimum probable initial dilution (Dm) is set to:

> …the lowest average initial dilution within any single month of the year. Dilution estimates shall be based on the observed waste flow characteristics, observed receiving water density structure (stratification), and the assumption that no currents, of sufficient strength to influence the initial dilution process, flow across the discharge structure.

Standard dilution models (such as CORMIX and Visual Plumes) are available to calculate dilution within plumes. However, because not all discharges fit within the constraints of the standard models, alternative methods for calculating the initial dilution may be approved by Regional Water Quality Control Boards if found to be acceptable and appropriate.

For submarine discharges, such as the M1W outfall, the momentum of the discharge and its initial buoyancy act together to produce turbulent mixing. Initial dilution in this case is completed when the diluting effluent ceases to rise in the water column and first begins to spread horizontally.

Modeling Tools

The near-field mixing zone model Visual Plumes was applied to represent dilution of the effluent plume. Visual Plumes is a USEPA-approved mixing zone model for environmental impact assessment of regulatory mixing zones resulting from continuous point source discharges. Visual Plumes version 17 was applied in this study.

The ambient currents in the vicinity of the discharge are determined either through modeling or assumptions. For the calculation of D_m, the ambient current is conservatively assumed to be zero. Zero current velocity assumption is the worst-case condition in dilution analysis and is consistent with Ocean Plan requirements.

Near-field mixing processes include buoyant jet mixing (including ambient current effects and merging of individual port's plumes) and boundary interactions (including density gradient effects). Receiving water depth and velocity, outfall configuration, and discharge flow rate are the most important input parameters. For the M1W submerged, multi-port diffuser, the subprogram UM3 was used for all simulations. UM3 allows for arbitrary alignment of the

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[1] State Water Resources Control Board (SWRCB 2012), Water Quality Control Plan Ocean Waters of California, Adopted October 16, 2012, Effective August 19, 2013

[2] Expressed as parts seawater per part wastewater.

diffuser structure within the ambient water body and for arbitrary orientation of the individual ports along the diffuser.

Model results delineate the effluent plume and define the edge of the mixing zone. Dilution calculated by UM3 (S) is the ratio of initial concentration in the effluent to concentration at a given location in the plume, which is the inverse of 'fraction of effluent.' As applied in the Ocean Plan, the dilution credit (D_m) is the parts of seawater per the parts of effluent in the plume and is equal to S - 1.

Simulation Conditions

The study area is the vicinity of M1W outfall in Monterey Bay. Water column sampling stations and the outfall are displayed in **Figure 1.** The outfall diffuser is described in this section, along with effluent and ambient receiving water conditions that affect mixing characteristics of the effluent plume.

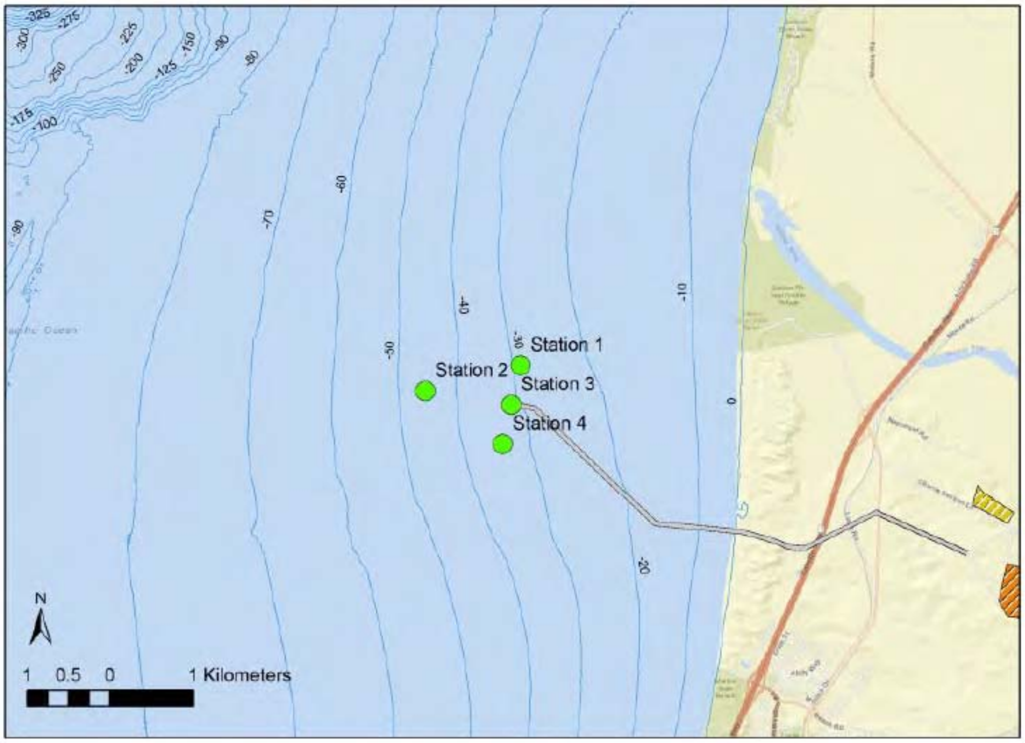

Figure 1. M1W outfall study area and nearby water column sampling stations.[3]

Discharge Scenarios

Visual Plumes requires three data entries to characterize the discharge: total flow rate or discharge velocity, the discharge density or temperature (in the case of freshwater), and discharge concentration of the material of interest. The combined effluent flowrates, temperatures, and salinities for different scenarios modeled for M1W are shown in **Table 2.**[4]

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[3] Philip J. W. Roberts (2017), CalAM EIR-EIS - *App. D1: Modeling Brine Disposal into Monterey Bay*

[4] Salinity and temperature values were provided in an email attachment from from Elaine Howe (Trussell Technologies) on 06/30/2017, "Effluent Wastestream Characteristics (For Density Determination),EWH.docx."

Table 2. Visual Plumes Input Data Summary

Scenario	Combined Flow Rate (mgd)	TDS[1] (mg/L)	Discharge Characteristics for Various Ocean Conditions					
			Upwelling		Oceanic		Davidson	
			Temp (°C)	Density (kg/m^3)	Temp (°C)	Density (kg/m^3)	Temp (°C)	Density (kg/m^3)
V11	1.17	5,800	24.4	1,001.694	24.4	1,001.694	20.2	1,002.700
M1	1.20	5,873	24.3	1,001.707	24.3	1,001.707	20.2	1,002.687
M2	1.27	6,028	24.1	1,001.875	24.1	1,001.875	20.2	1,002.805
M3	1.27	5,406	24.4	1,001.330	24.4	1,001.330	20.2	1,002.333
M4	1.37	5,070	24.3	1,001.103	24.3	1,001.103	20.2	1,002.078
M5	1.47	4,780	24.3	1,000.885	24.3	1,000.885	20.2	1,001.858
M6	1.57	4,526	24.3	1,000.694	24.3	1,000.694	20.1	1,001.687
M7	1.67	4,303	24.3	1,000.526	24.3	1,000.526	20.1	1,001.520
M8	1.77	4,105	24.3	1,000.377	24.3	1,000.377	20.1	1,001.368
M9	1.87	3,928	24.3	1,000.244	24.3	1,000.244	20.1	1,001.233
M10	1.97	3,770	24.2	1,000.151	24.2	1,000.151	20.1	1,001.113
M11	2.17	3,496	24.2	999.945	24.2	999.945	20.1	1,000.905
M12	2.77	2,985	24.1	999.575	24.1	999.575	20.1	1,000.517
M13	3.17	2,645	24.1	999.329	24.1	999.329	20.1	1,000.259
V13	4.17	2,203	24.1	998.996	24.1	998.996	20.1	999.023
M14	4.20	2,249	24.1	999.031	24.1	999.031	20.1	999.959
M15	4.27	2,355	24.0	999.136	24.0	999.136	20.1	1,000.038
M16	4.67	2,053	24.1	998.883	24.1	998.883	20.1	999.809
M17	5.17	1,932	24.1	998.792	24.1	998.792	20.0	999.738
M18	5.67	1,832	24.1	998.716	24.1	998.716	20.0	999.662
M19	6.17	1,748	24.1	998.629	24.1	998.629	20.0	999.598
M20	6.67	1,677	24.1	998.600	24.1	998.600	20.0	999.544
M21	7.17	1,616	24.1	998.554	24.1	998.554	20.0	999.497
M22	8.17	1,516	24.1	998.478	24.1	998.478	20.0	999.421
M23	9.17	1,438	24.1	998.419	24.1	998.419	20.0	999.362
M24	10.17	1,375	24.0	998.397	24.0	998.397	20.0	999.324
M25	11.17	1,324	24.0	998.358	24.0	998.358	20.0	999.275
M26	13.17	1,244	24.0	998.298	24.0	998.298	20.0	999.214
M27	15.17	1,186	24.0	998.244	24.0	998.244	20.0	999.170
M28	19.17	1,105	24.0	998.193	24.0	998.193	20.0	999.109
M29	22.17	1,064	24.0	998.162	24.0	998.162	20.0	999.077

Scenario	Combined Flow Rate (mgd)	TDS[1] (mg/L)	Discharge Characteristics for Various Ocean Conditions					
			Upwelling		Oceanic		Davidson	
			Temp (°C)	Density (kg/m^3)	Temp (°C)	Density (kg/m^3)	Temp (°C)	Density (kg/m^3)
M30	23.17	1,052	24.0	998.153	24.0	998.153	20.0	999.068
M31	23.67	1,047	24.0	998.149	24.0	998.149	20.0	999.064
M32	24.17	1,042	24.0	998.146	24.0	998.146	20.0	999.061
M33	24.57	1,038	24.0	998.143	24.0	998.143	20.0	999.058
M34	29.60	800	24.0	997.963	24.0	997.963	20.0	998.876

[1] TDS = Total Dissolved Solids

Ambient Conditions

Monterey Bay is traditionally known for three oceanic seasons: Upwelling from March to September, Oceanic from September to November, and Davidson from November to March. Conductivity-temperature-depth (CTD) casts were performed by Applied Marine Sciences[5] on a monthly basis from February 2014 to December 2015 at the four locations shown in **Figure 1**. The goal was to gather data representative of ocean conditions during this time period. Profiles taken from the four locations showed only slight variations, so the data were averaged and plotted in **Figure 2**. Seasonal density profiles were then averaged to construct one profile per oceanic season for the modeled scenarios as presented in **Figure 3**.

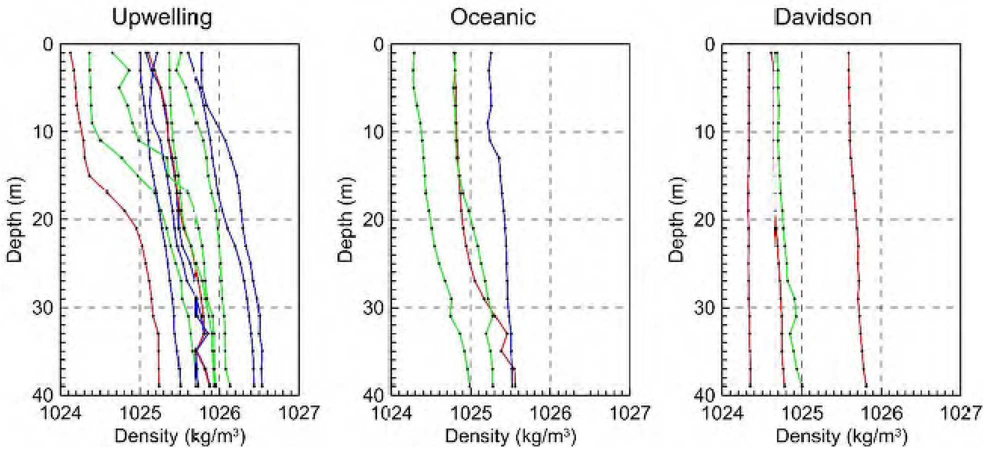

Figure 2. Seasonal density profiles drawn at different monitoring locations (Adapted from Roberts 2017).[5]

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[5] Philip J. W. Roberts (2017), CalAM EIR-EIS - *App. D1: Modeling Brine Disposal into Monterey Bay*

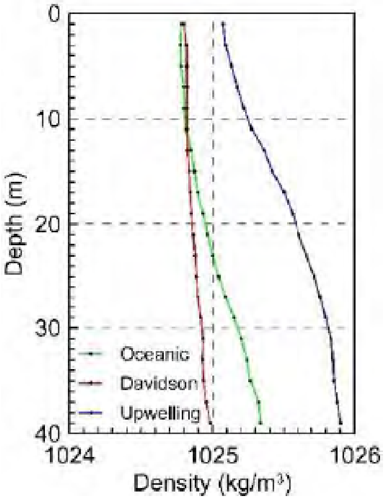

Figure 3. Seasonally averaged density profiles.

Ocean current velocity is conservatively assumed to be zero, as the presence of velocity enhances plume dilution. The Ocean Plan requires use of zero ambient current across the discharge structure when estimating minimum initial dilution.

Diffuser Geometry

The M1W outfall diffuser cross-section design is shown in **Figure 4**. The diffuser is located in the Bay about 9,892 feet from shore. The diffuser design consists of 60-inch internal diameter (ID) and 48-inch ID reinforced concrete pipe with a total length of 1,272 ft. The diffuser has 65 ports in the 60-inch section and 106 ports in the 48-inch section (total of 171 ports). The ports (each 2-inches in diameter) discharge horizontally in an alternate layout on both sides of the diffuser. Currently, 42 ports closest to the shore are closed and 129 ports are open and each are fitted with 4-inch Tideflex "duckbill" check valves (4-inch is the flange size, not the valve opening). For the model, it was assumed that a 6-inch Tideflex "duckbill" check valve is installed at the end-gate. The cross-sectional area of the "duckbill" valve is a function of flowrate going through the valve.[3] The average water depth in the diffuser area is 114.8 feet and the depth of the discharge is set to be 100.7 feet below mean sea level. The ports were modeled as round openings with areas equivalent to the effective area of the "duckbill" valves. Based on this assumption, the actual dilution will be slightly higher than the computed values.[6]

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[6] Flow Science Incorporated (2014), *Technical Memorandum: MRWPCA GWR Discharge Dilution Analysis FSI 144082*

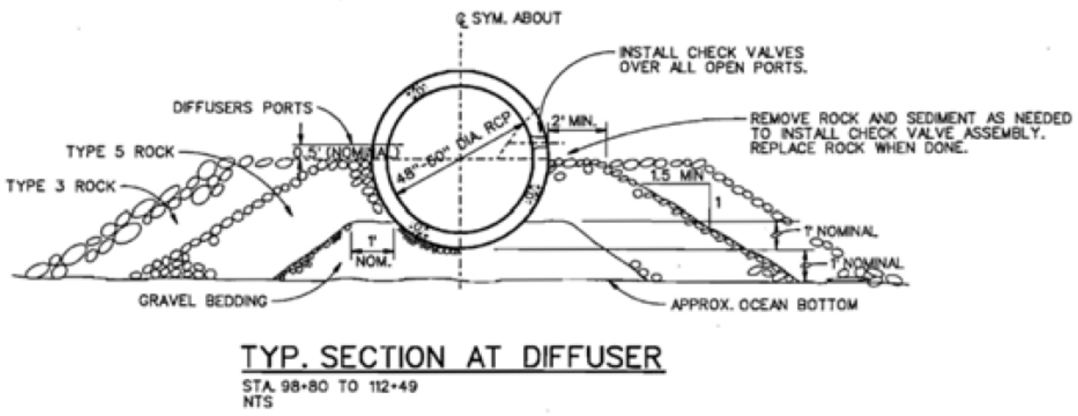

Figure 4. M1W outfall diffuser cross-section drawing.[7]

Effective open area of Tideflex valve is a function of flow rate as shown in **Figure 5**.

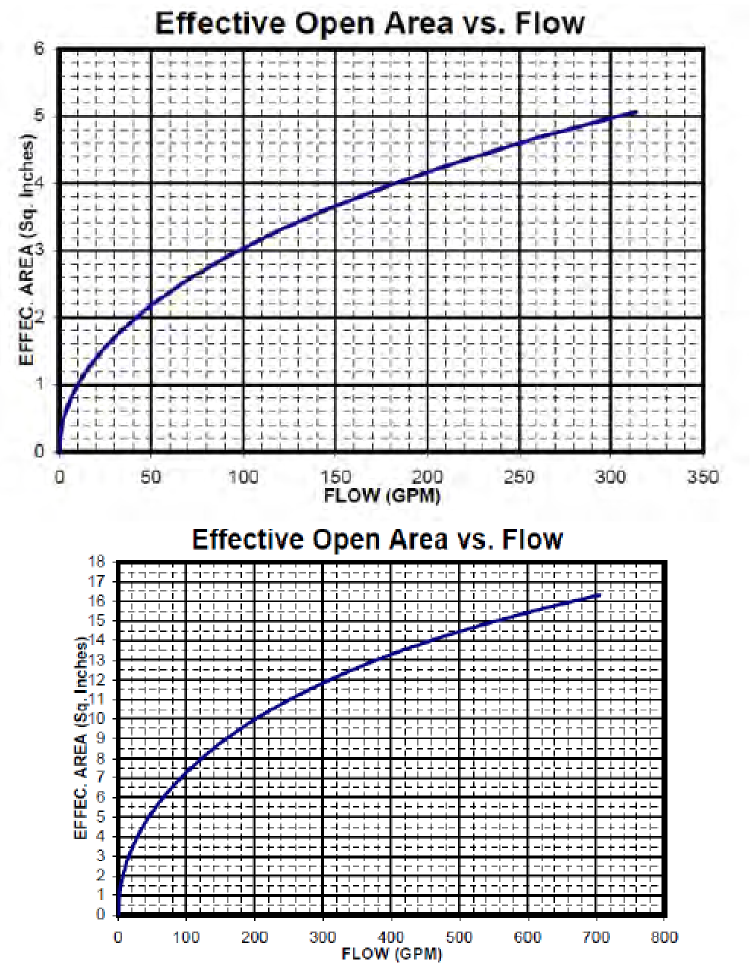

Figure 5. Effective open area for flow through 4" (top) and 6" (bottom) Tideflex "duckbill" check valves.

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[7] Monterey Regional Water Pollution Agency (1999), MT17O002, *Outfall Details*

Port diameter for each scenario was selected based on the effective area read from the 4-inch Tideflex valve plot. It was assumed that 4% of the total flow goes through the end-gate and 96% is evenly distributed among 129 ports of the diffuser. The end gate flows were calculated for all of the scenarios and the effective areas were obtained from 6-inch Tideflex valve plot. Outfall diffuser port diameters and scenario numbers are listed in **Table 3.**

Table 3. 4-Inch Tideflex Equivalent Port Diameters

Scenario Numbers	Combined Flow Rate (mgd)	Equivalent Port Diameter (in)	Effective Open Area (in^2)
V11	1.17	0.668	0.350
M1	1.20	0.679	0.362
M2	1.27	0.706	0.391
M3	1.27	0.706	0.391
M4	1.37	0.741	0.431
M5	1.47	0.774	0.471
M6	1.57	0.804	0.508
M7	1.67	0.833	0.545
M8	1.77	0.860	0.581
M9	1.87	0.886	0.617
M10	1.97	0.910	0.650
M11	2.17	0.955	0.716
M12	2.77	1.061	0.884
M13	3.17	1.131	1.005
V13	4.17	1.259	1.245
M14	4.20	1.262	1.251
M15	4.27	1.270	1.267
M16	4.67	1.312	1.352
M17	5.17	1.359	1.451
M18	5.67	1.402	1.544
M19	6.17	1.441	1.631
M20	6.67	1.478	1.716
M21	7.17	1.511	1.793
M22	8.17	1.572	1.941
M23	9.17	1.626	2.076
M24	10.17	1.674	2.201
M25	11.17	1.717	2.315
M26	13.17	1.794	2.528
M27	15.17	1.860	2.717
M28	19.17	1.969	3.045
M29	22.17	2.036	3.256
M30	23.17	2.057	3.323

Scenario Numbers	Combined Flow Rate (mgd)	Equivalent Port Diameter (in)	Effective Open Area (in^2)
M31	23.67	2.067	3.356
M32	24.17	2.077	3.388
M33	24.57	2.084	3.411
M34	29.60	2.171	3.702

Model Results and Dilution Credits

A session report for the M23 Upwelling Scenario is provided in **Appendix A**. Dilution values are highlighted in the report. The effluent density is less than the surrounding ambient water density at the discharge level. Therefore, the effluent is positively buoyant and tends to rise towards the surface. Initial dilutions estimated by the Visual Plumes UM3 model for all scenarios and oceanic conditions are presented in **Table 4**. Scenarios M6, M12, M23, and M34 are the selected scenarios to define the proposed D_m values for set ranges of secondary effluent flow. The scenarios are highlighted in gray on in Table 4 and represent conditions of predominantly RO concentrate flow, low secondary effluent flow, moderate secondary effluent flow, and predominantly secondary effluent flow. These scenarios define the proposed conditions where the D_m applied for NPDES permit limitations would change.

Table 4. Dilution Estimates and Trapped Depth for Modeled Discharge Scenarios

Scenario Number	Total Flow (mgd)	Secondary Effluent (mgd)	Upwelling		Oceanic		Davidson	
			Dm	Trapped Depth (m)	Dm	Trapped Depth (m)	Dm	Trapped Depth (m)
V11	1.17	0.0	515.8	21.6	568.1	26.0	1008.2	Surface
M1	1.20	0.0	511.4	21.6	566.9	25.9	993.7	Surface
M2	1.27	0.0	499.1	21.5	575.8	26.1	958.4	Surface
M3	1.27	0.1	505.5	21.4	557.4	26.0	965.3	Surface
M4	1.37	0.2	494.4	21.2	533.4	26.2	926.9	Surface
M5	1.47	0.3	483.7	21.3	495.3	26.1	892.4	Surface
M6	1.57	0.4	473.4	21.0	487.2	26.0	861.9	Surface
M7	1.67	0.5	463.8	20.8	482.0	21.8	834.5	Surface
M8	1.77	0.6	454.7	20.7	477.9	21.6	809.4	Surface
M9	1.87	0.7	446.2	20.6	472.2	21.6	787.3	Surface
M10	1.97	0.8	438.2	20.5	466.2	21.5	766.6	Surface
M11	2.17	1.0	423.4	20.3	454.6	21.4	730.8	Surface
M12	2.77	1.6	388.3	Surface	418.0	Surface	650.5	Surface
M13	3.17	2.0	371.5	Surface	399.9	Surface	613.8	Surface
V13	4.17	3.0	340.4	Surface	364.4	Surface	552.4	Surface
M14	4.20	3.0	339.3	Surface	363.1	Surface	550.7	Surface
M15	4.27	3.0	336.7	Surface	360.0	Surface	546.5	Surface
M16	4.67	3.5	328.1	Surface	351.0	Surface	533.5	Surface
M17	5.17	4.0	317.5	Surface	340.0	Surface	519.7	Surface
M18	5.67	4.5	308.0	Surface	331.0	Surface	510.7	Surface
M19	6.17	5.0	299.6	Surface	323.6	Surface	506.2	Surface
M20	6.67	5.5	291.3	Surface	317.6	Surface	505.7	Surface
M21	7.17	6.0	283.7	Surface	312.7	Surface	505.4	Surface
M22	8.17	7.0	270.1	Surface	304.2	Surface	498.3	Surface
M23	9.17	8.0	258.7	Surface	295.0	Surface	471.4	Surface
M24	10.17	9.0	248.5	Surface	286.5	Surface	453.8	Surface
M25	11.17	10.0	239.8	Surface	279.9	Surface	436.8	Surface
M26	13.17	12.0	225.0	Surface	265.2	Surface	404.7	Surface
M27	15.17	14.0	213.3	Surface	252.2	Surface	374.9	Surface
M28	19.17	18.0	195.8	Surface	232.7	Surface	333.5	Surface
M29	22.17	21.0	186.2	Surface	222.0	Surface	309.7	Surface
M30	23.17	22.0	183.4	Surface	219.0	Surface	299.8	Surface
M31	23.67	22.5	182.1	Surface	217.4	Surface	298.0	Surface
M32	24.17	23.0	180.8	Surface	216.1	Surface	296.3	Surface
M33	24.57	23.4	179.8	Surface	215.1	Surface	289.1	Surface
M34	29.60	29.6	169.3	Surface	204.9	Surface	263.7	Surface

D_m values for the modeled discharge scenarios are shown in **Figure 6**. The proposed D_m values for the NPDES permit corresponding to ranges of secondary effluent discharged through the outfall are listed in **Table 5**.

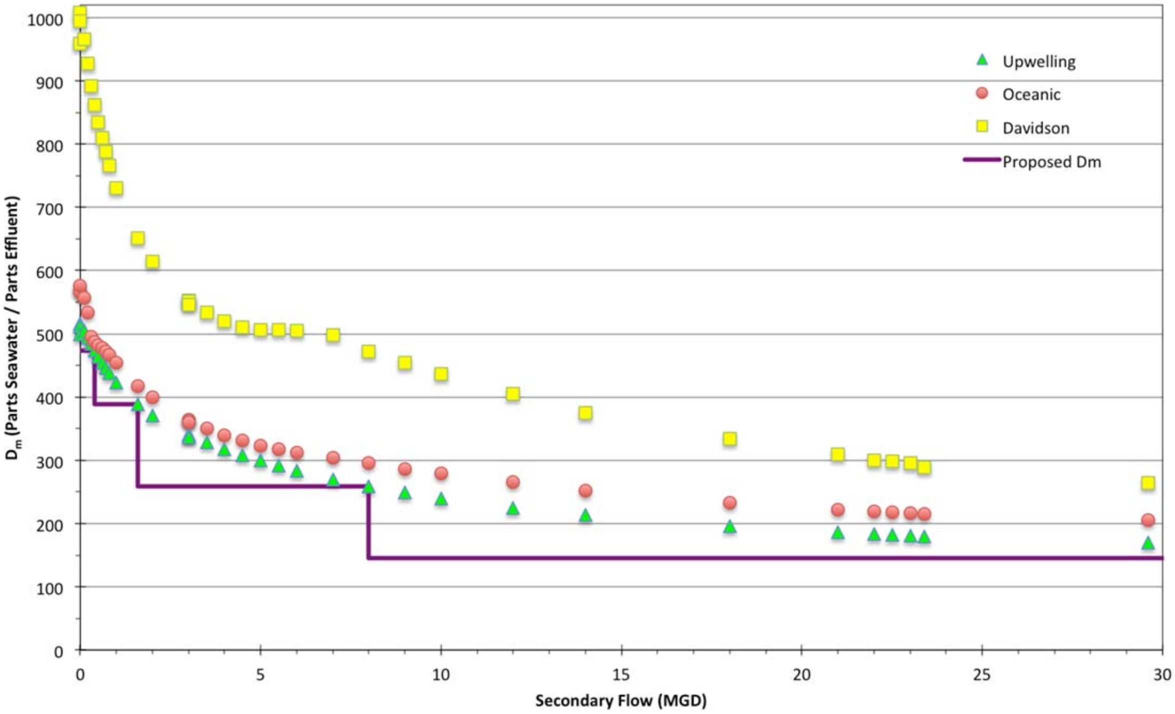


Figure 6. Minimum probable initial dilution (D_m) for different discharge scenarios and oceanic conditions

Table 5. Proposed D_m for Range of Secondary Effluent Flowrates

Secondary Effluent Flow Range (MGD)	Proposed Dm
0 – 0.4	473
0.41 – 1.6	388
1.61 – 8.0	259
8.01 – 29.6	145

Simulations for the breakpoint scenarios were also conducted for an end-gate without a Tideflex valve installed. The results are shown in **Table 6**. For those simulations, the end-gate was modeled through addition of number of ports equivalent to an area of 25.8 in^2 (i.e., the opening area of end-gate when no valves are installed).[8] The D_m values for the different cases of end-gate condition do not show a significant difference.

---

[8] Philip J. W. Roberts (2017), CalAM EIR-EIS - *App. D1: Modeling Brine Disposal into Monterey Bay*

Table 6. Comparing breakpoint scenarios modeled with and without Tideflex Valve at the end-gate

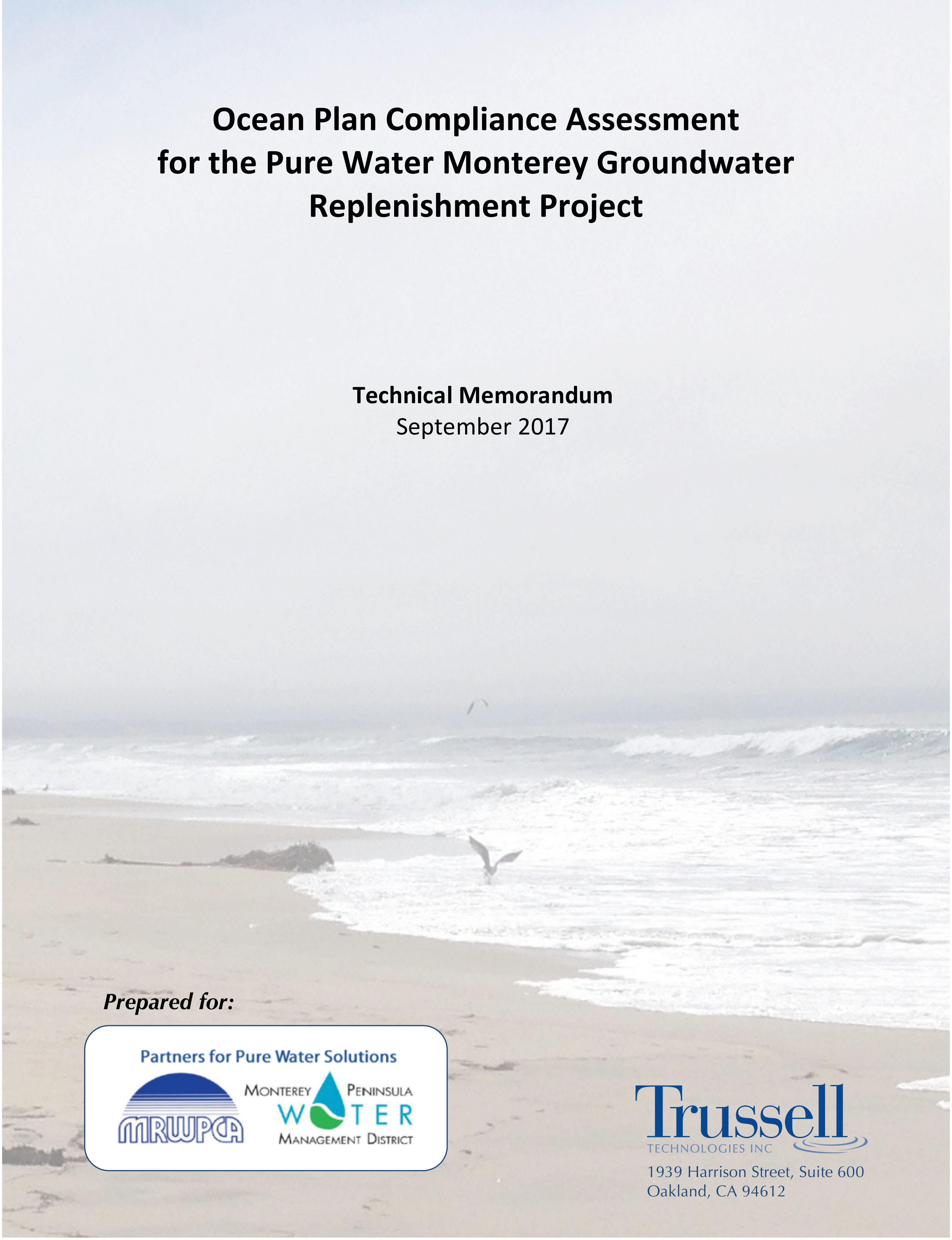
Scenario	Total Flow (mgd)	Secondary Effluent (mgd)	D_m								
			Upwelling			Oceanic			Davidson		
			Open	Tideflex	% Difference	Open	Tideflex	% Difference	Open	Tideflex	% Difference
M10	1.97	0.8	402.2	389.2	3%	467.9	455.1	3%	707.7	651.3	9%
M23	9.17	8	257.4	254.2	1%	223.7	220.8	1%	245	237.2	3%
M33	24.57	23.4	197.6	194.6	2%	157.1	155.7	1%	128.1	126.4	1%

Appendix A. Visual Plumes Model Output for Scenario M23 with Upwelling Ocean Conditions.

```
/ UM3.
Case 24; ambient file C:\Plumes17\NimaJ\Monterey\Ambient_Data\Monterey_UM3_UpwellingAmbient.db; Diffuser table
record 24: ---------------------------------

Ambient Table:
     Depth   Amb-cur   Amb-dir   Amb-den   Amb-tem   Amb-pol     Decay   Far-spd   Far-dir   Disprsn   Density
         m       m/s       deg       psu         C     kg/kg       s-1       m/s       deg  m0.67/s2   sigma-T
       0.0       0.0       0.0     32.93     11.48       0.0       0.0         -         -    0.0003  25.10000
     3.000       0.0       0.0     32.93     11.48       0.0       0.0         -         -    0.0003  25.10000
     5.000       0.0       0.0     32.93     11.48       0.0       0.0         -         -    0.0003  25.10000
     7.000       0.0       0.0     33.06     11.48       0.0       0.0         -         -    0.0003  25.20000
     9.000       0.0       0.0     33.06     11.48       0.0       0.0         -         -    0.0003  25.20000
     11.00       0.0       0.0     33.18     11.48       0.0       0.0         -         -    0.0003  25.30000
     13.00       0.0       0.0     33.31     11.48       0.0       0.0         -         -    0.0003  25.40000
     15.00       0.0       0.0     33.31     11.48       0.0       0.0         -         -    0.0003  25.40000
     17.00       0.0       0.0     33.44     11.48       0.0       0.0         -         -    0.0003  25.50000
     19.00       0.0       0.0     33.57     11.48       0.0       0.0         -         -    0.0003  25.60000
     21.00       0.0       0.0     33.57     11.48       0.0       0.0         -         -    0.0003  25.60000
     23.00       0.0       0.0     33.70     11.48       0.0       0.0         -         -    0.0003  25.70000
     25.00       0.0       0.0     33.70     11.48       0.0       0.0         -         -    0.0003  25.70000
     27.00       0.0       0.0     33.83     11.48       0.0       0.0         -         -    0.0003  25.80000
     29.00       0.0       0.0     33.83     11.48       0.0       0.0         -         -    0.0003  25.80000
     31.00       0.0       0.0     33.83     11.48       0.0       0.0         -         -    0.0003  25.80000
     33.00       0.0       0.0     33.96     11.48       0.0       0.0         -         -    0.0003  25.90000
     35.00       0.0       0.0     33.96     11.48       0.0       0.0         -         -    0.0003  25.90000

Diffuser table:
   P-dia VertAng H-Angle SourceX SourceY   Ports Spacing  MZ-dis Isoplth P-depth Ttl-flo Eff-sal    Temp
Polutnt
    (in)   (deg)   (deg)     (m)     (m)      ()    (ft)     (m)(concent)     (m)   (MGD)   (psu)     (C)
(kg/kg)
  1.6260     0.0     0.0     0.0     0.0  129.00  8.0000  500.00  0.1000  30.700  9.1700  1.4380  24.100
100.00

Simulation:
Froude No:     22.06; Strat No: 3.44E-5; Spcg No:   59.04; k: 2.32E+5; eff den (sigmaT) -1.580712; eff vel
2.325(m/s);
        Depth  Amb-cur    P-dia  Polutnt   Dilutn   x-posn   y-posn     Time  Iso dia
Step      (m)    (m/s)     (in)  (kg/kg)      (S)      (m)      (m)      (s)      (m)
   0     30.70 1.000E-5    1.626    100.0    1.000      0.0      0.0      0.0  0.03738;
 100     30.67      0.0    12.02    13.51    7.404    0.658      0.0    1.227   0.3046;
 200     30.28      0.0    26.46    5.575    17.94    1.624      0.0    6.531   0.6690;
 300     28.91      0.0    42.62    2.524    39.62    2.643      0.0    18.75   1.0718;
 376     23.51      0.0    96.82    0.656    152.6    3.955      0.0    66.49   2.3637; merging;
 391     20.61      0.0    129.0    0.487    205.3    4.341      0.0    97.49   3.0867; trap level;
 400     17.55      0.0    183.4    0.408    245.4    4.737      0.0    137.4   4.2729;
 412     16.16      0.0    321.3    0.387    258.7    4.963      0.0    162.8   7.4244; begin overlap;
 500     15.63      0.0   1000.7    0.385    259.7    5.137      0.0    182.8   23.114;
 594     15.60      0.0   1491.7    0.385    259.7    5.175      0.0    187.2   34.454; surface;
Horiz plane projections in effluent direction: radius(m):      0.0; CL(m):   5.1753
Lmz(m):   5.1753
forced entrain     24     0.0   15.10   37.89   0.904
Rate sec-1          0.0 dy-1          0.0  kt:          0.0 Amb Sal      33.3517
```

Attachment 4.

Ocean Plan Compliance Technical Memorandum – September 2017



Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project

Technical Memorandum
September 2017

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

September 2017

Prepared By:

Trussell Technologies, Inc.
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John Kenny, P.E.
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Table of Contents

1 Executive Summary

Monterey Regional Water Pollution Control Agency (MRWPCA) and the Monterey Peninsula Water Management District ("Project Partners") are implementing the Pure Water Monterey Groundwater Replenishment Project ("Project"). The Project involves treating secondary effluent from MRWPCA's Regional Treatment Plant (RTP) through the proposed Advanced Water Purification Facility (AWPF) and then injecting this highly purified recycled water into the Seaside Groundwater Basin, with subsequent withdrawal for use as a municipal water supply. The Project will also provide additional tertiary recycled water for agricultural irrigation in the northern Salinas Valley as part of the Castroville Seawater Intrusion Project (CSIP). A waste stream, the reverse osmosis concentrate ("RO concentrate"), will be generated by the AWPF and discharged through the existing MRWPCA ocean outfall, which currently discharges secondary effluent from the RTP. The goal of this technical memorandum is to analyze whether discharge of the Project's RO concentrate to the Pacific Ocean (Monterey Bay) through the existing outfall would comply with numeric water quality objectives in the California Ocean Plan to protect marine aquatic life and human health.

The California Ocean Plan sets forth numeric and narrative water quality objectives for ocean waters with the intent of protecting the ocean's beneficial uses, which include recreation, aesthetics, navigation, fishing, mariculture, areas of special biological significance, rare and endangered species, habitat, fish migration, fish spawning, and shellfish harvesting (SWRCB, 2015). 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. The mixing that occurs in the rising plume is affected by the buoyancy and momentum of the discharge, a process referred to as initial dilution (NRC, 1993). The numeric 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), and the Ocean Plan objectives are to be met at the edge of the 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 NPDES permit limits that are applied to a wastewater discharge prior to ocean dilution.

Trussell Technologies, Inc. (Trussell Tech) estimated worst-case in-pipe discharge water quality (*i.e.*, prior to being discharged through the outfall and diluted in the ocean) for the Project and used the dilution modeling results determined by Dr. Philip Roberts to provide an assessment of whether the Project would consistently meet Ocean Plan water quality objectives. The resulting concentrations for each constituent in each scenario were compared to its minimum Ocean Plan objective to assess compliance. The estimated concentrations for eight different flow scenarios are presented in the following technical memorandum (TM) (Tables 3 and 4). None of the constituents are expected to exceed their Ocean Plan objective[1]. Ammonia is estimated to reach a concentration closest to its minimum objective, with the highest estimated concentration at the edge of the ZID at 71% of the objective.

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[1] 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 common occurrence for ocean discharges since the MRL is higher than the Ocean Plan objective for some constituents.

The purpose of the analysis documented in this TM was to assess the ability of the 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 waste (blended with secondary effluent) for the 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 discharge scenario. Compliance assessments could not be made for selected constituents due to analytical limitations, but this is a common occurrence for these Ocean Plan constituents. Based on the data, assumptions, modeling, and analytical methodology presented in this technical memorandum, the Project will comply with all numeric Ocean Plan objectives.

2 Introduction

Monterey Regional Water Pollution Control Agency (MRWPCA) and the Monterey Peninsula Water Management District ("Project Partners") are in the process of implementing the Pure Water Monterey Groundwater Replenishment Project ("Project"). The Project involves treating secondary effluent from MRWPCA's Regional Treatment Plant (RTP) through the proposed Advanced Water Purification Facility (AWPF) and then injecting this highly purified recycled water into the Seaside Groundwater Basin, with subsequent withdrawal for use as a municipal water supply. The Project will also provide additional tertiary recycled water for agricultural irrigation in the northern Salinas Valley as part of the Castroville Seawater Intrusion Project (CSIP). A waste stream, the reverse osmosis concentrate ("RO concentrate"), will be generated by the AWPF and discharged through the existing MRWPCA ocean outfall, which currently discharges secondary effluent from the RTP. The goal of this technical memorandum is to analyze whether discharge of the Project's RO concentrate to the Pacific Ocean (Monterey Bay) through the existing outfall would comply with numeric water quality objectives in the California Ocean Plan to protect marine aquatic life and human health.

The original version of this document (Trussell Technologies, 2015b) and an addendum report to that document (Trussell Technologies, 2015c) was included in the Project's Consolidated Final Environmental Impact Report (CFEIR). This version has been updated to reflect an increase in capacity of the AWPF to produce more product water and thus more RO concentrate. In addition, new water quality data have been included since the original analysis (including years 2012 – 2017), and the ocean dilution modeling has correspondingly been revised. Further details regarding these updates are included in the following sections.

2.1 Treatment through the RTP and AWPF

The existing 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 (coagulation, flocculation, granular media filtration and disinfection) to produce recycled water used for agricultural irrigation. The unused secondary effluent is discharged to the Monterey Bay through an existing ocean outfall. The RTP also accepts trucked brine waste ("hauled waste") for ocean disposal, which is stored in a pond and mixed with secondary effluent prior to being discharged.

The AWPF will include several advanced treatment technologies for purifying the secondary effluent water: ozone (O_3), membrane filtration (MF), reverse osmosis (RO), an advanced oxidation process (AOP) using ultraviolet light (UV) and hydrogen peroxide, and finished water stabilization. The Project Partners conducted a pilot-scale study of the ozone, MF, and RO processes of the AWPF 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 Water Recycling Criteria for Indirect Potable Reuse: Groundwater Replenishment – Subsurface Application (Groundwater Replenishment Regulations) (SWRCB, 2014) and Central Coast Water Quality Control Plan (Basin Plan) standards, objectives and guidelines for groundwater (CCWQCB, 2011). After the pilot-scale study, an advanced water purification demonstration facility was built to gain additional experience operating ozone, MF, and RO processes; the new facility also includes a UV/hydrogen peroxide AOP and stabilization treatment. The demonstration facility is operated and maintained by MRWPCA.

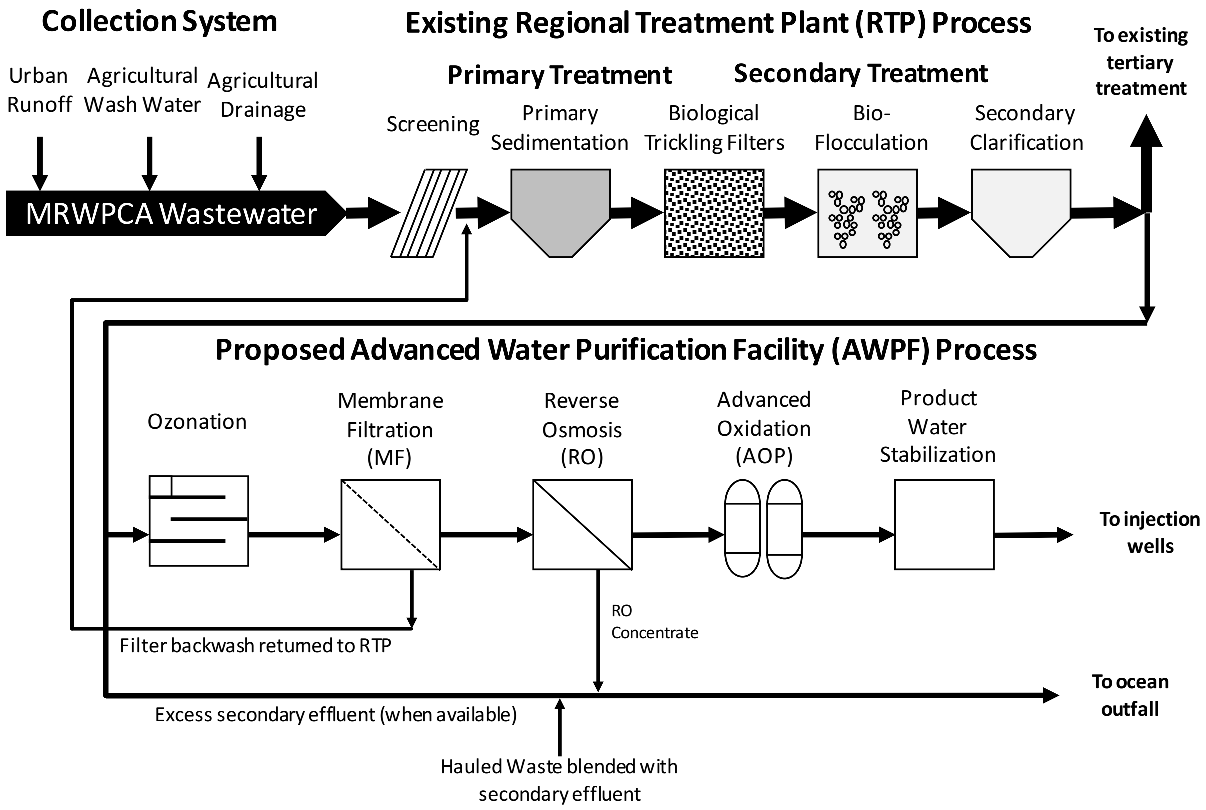

Figure 1 – Simplified diagram of existing MRWPCA RTP and Future AWPF treatment processes

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 from the MF, the RO concentrate cannot be recycled back to the RTP headworks and would be discharged through the existing ocean outfall. Discharges through the outfall are subject to National Pollution Discharge Elimination System (NPDES) permitting based on requirements specified in the California State Water Resources Control Board 2015 Ocean Plan ("Ocean Plan") (SWRCB, 2015). Monitoring of the RO concentrate was conducted during the Project's pilot-scale study.

2.2 California Ocean Plan

The California Ocean Plan sets forth numeric and narrative water quality objectives for ocean waters with the intent of protecting the ocean's beneficial uses, which include recreation, aesthetics, navigation, fishing, mariculture, areas of special biological significance, rare and endangered species, habitat, fish migration, fish spawning, and shellfish harvesting (SWRCB, 2015). 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.[2] The mixing that occurs in the rising plume is affected by the buoyancy and momentum of the discharge, a process referred to as initial dilution (NRC, 1993). The numeric 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), and the Ocean Plan objectives are to be met at the edge of the 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 NPDES permit limits that are applied to a wastewater discharge prior to ocean dilution.

The current RTP wastewater discharge is governed by Order No. R3-2014-0013 (NPDES permit No. CA0048551) issued by the Central Coast Regional Water Quality Control Board (RWQCB). Because the current NPDES permit for the existing ocean outfall must be amended to include RO concentrate in the waste discharge, comparing future discharge concentrations to current NPDES permit limits would not be an appropriate metric or threshold for determining whether the 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 the Project would result in a significant impact requiring mitigation. Dilution modeling of the Project's ocean discharge was conducted by Dr. Philip Roberts
, a Professor in the School of Civil and Environmental Engineering at the Georgia Institute of Technology, to determine D_m values for the various discharge scenarios at different ambient ocean conditions. The dilution modeling results were combined with projected discharge water quality to assess compliance with the Ocean Plan.

2.3 Objective of Technical Memorandum

Trussell Technologies, Inc. (Trussell Tech) estimated worst-case in-pipe discharge water quality (*i.e.*, prior to being discharged through the outfall and diluted in the ocean) for the Project and used the dilution modeling results determined by Dr. Roberts to provide an assessment of whether the Project would consistently meet Ocean Plan water quality objectives. The purpose of this technical memorandum (TM) is to summarize the assumptions, methodology, results and conclusions of the Ocean Plan compliance assessment.

3 Methodology for Ocean Plan Compliance Assessment

To analyze impacts due to ocean discharge of RO concentrate, the Project technical team (Trussell Tech with MRWPCA staff) conducted a thorough water quality and flow characterization of the current secondary effluent and the new sources of water to be diverted

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[2] Municipal wastewater effluent, being low in salinity, is less dense than seawater and thus rises (due to buoyancy) while it mixes with ocean water.

into the wastewater collection system. After primary and secondary treatment, this effluent will be used as influent to the AWPF. The team collected all available water quality data for secondary effluent and water quality monitoring results for the Project's new source waters through a one-year monitoring program conducted from July 2013 to June 2014. The new source waters included in the monitoring program were agricultural wash water, and waters from the Blanco Drain, Lake El Estero, and Tembladero Slough. 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. Additional data from routine monitoring of the Reclamation Ditch and Salinas Urban Stormwater Runoff was also incorporated into the analysis (for years 2012 to 2017).

Lake El Estero and the Tembladero Slough are no longer included as new source waters for the Project, and so the monitoring data for those source waters were not included in this analysis. For the Reclamation Ditch, water quality data related to the Ocean Plan were only available for ammonia, copper, zinc, arsenic, cadmium, lead, nickel, and total phenols. For the remaining constituents identified in the Ocean Plan, the concentrations in the Reclamation Ditch waters were conservatively assumed to be the higher of either the Blanco Drain or Tembladero Slough concentrations.

Using the full suite of data, the team estimated the future worst-case water quality of the combined ocean discharge. With the results of dilution modeling, concentrations at the edge of the ZID were estimated to determine the ability of the Project to comply with the Ocean Plan objectives. 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.

3.1 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 Project conditions: (1) the RTP secondary effluent, (2) hauled waste (discussed in Section 3.1.3), and (3) the Project RO concentrate. First, Trussell Tech estimated the potential influence of the new source waters (*e.g.*, agricultural wash water, stormwater 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 will change under the different flow scenarios that can occur under the Project. MRWPCA staff worked with Schaaf and Wheeler consultants to estimate the available volume of source waters for each month of the different types of operational years for the Project (Andrew Sterbenz, Schaaf and Wheeler, June 05, 2017). The monthly flows for each source water were estimated 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. All 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[3].

Cyanide has been detected in the RTP effluent and other new source waters (Agricultural Wash Water and the Blanco Drain) at relatively high levels compared to the discharge requirements. The maximum detected value in the RTP effluent was 81 µg/L; the maximum seen in the Agricultural Wash Water and the Blanco Drain was 89 µg/L and 127 µg/L, respectively.

Several investigations have been conducted into the accuracy of sampling, preservation, and analytical methods for cyanide. These have shown that sample holding time and preservation have a significant impact on measured cyanide concentrations. Pandit et al. (2006) demonstrated that when sodium hydroxide was added to adjust the pH higher than 12, as specified in accepted methods for cyanide measurement in order to preserve the sample, the measured cyanide concentrations were consistently higher than those for samples preserved at pH 10 to 11. Pandit et al. also showed that cyanide levels increased within the recommended holding times of the approved cyanide methods (at pH 12).

In addition, the 2015 California Ocean Plan specifies the following:

If a discharger can demonstrate to the satisfaction of the Regional Water Board (subject to EPA approval) that an analytical method is available to reliably distinguish between strongly and weakly complexed cyanide, effluent limitations for cyanide may be met by the combined measurement of free cyanide, simple alkali metal cyanides, and weakly complexed organometallic cyanide complexes. In order for the analytical method to be acceptable, the recovery of free cyanide from metal complexes must be comparable to that achieved by the approved method in 40 CFR PART 136, as revised May 14, 1999.

Based on the above information, it is recommended that additional cyanide sampling be conducted using different methods (*e.g.,* analysis within 15 minutes with no preservation) to determine if the current laboratory method leads to inaccurately high cyanide values. It is also recommended to determine if a method can be performed that distinguishes between weakly and strongly complexed cyanide. Until this evaluation is completed, all cyanide concentrations presently available are used in this Ocean Plan compliance assessment.

It was also assumed that no constituent removal occurred through the RTP when considering the new source waters, and so the concentration detected through the source water monitoring program was used to calculate the concentration in the RTP secondary effluent. The exceptions to this statement are dieldrin and DDT. RTP sampling and bench-scale testing were conducted for these constituents to determine removal through the RTP, ozone and MF processes. The minimum removal through the RTP and ozone process was observed to be 91% and 96% for dieldrin and DDT, respectively (Trussell Tech, 2016b). The MF process was observed to remove

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[3] The exception to this statement is copper. The median copper concentration was used to estimate the water quality impact of the additional source waters, as the maximum values detected appear to be outliers. Additionally, the minimum Ocean Plan objective for copper is a 6-month median value, and so it is reasonable to use the median value detected from the new source waters to estimate compliance.

a minimum of 97% and 92% for dieldrin and DDT, respectively (Trussell Tech, 2016b). However, the MF system only removes the constituents from the RO concentrate, as the MF backwash water is returned to the RTP headworks.

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 waste and the RO concentrate, as appropriate. The methodology for each type of water is further described in the following sections.

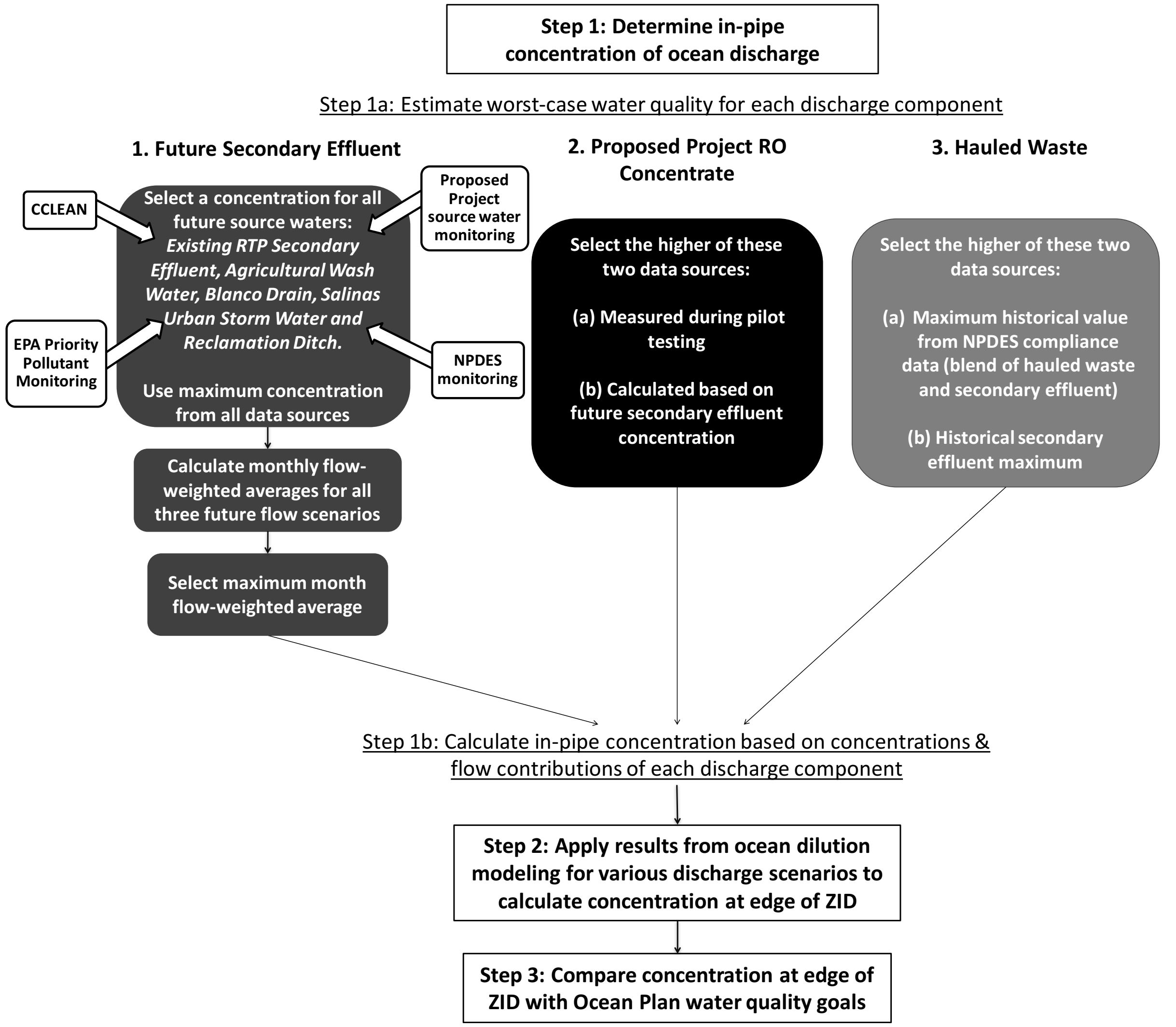

Figure 2 – Logic flow-chart for determination of project compliance with the Ocean Plan objectives

3.1.1 Future Secondary Effluent

The Project involves bringing new source waters into the RTP, and so the water quality of those source waters, as well as the existing secondary effluent, was taken into account to estimate the water quality of the future secondary effluent. Although the new source waters will be brought into the RTP influent, it was assumed that no removal of constituents occurred through the RTP when calculating the secondary effluent concentration (except dieldrin and DDT, as described in the previous section). 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 Project from July 2013 through June 2014
- NPDES storm water discharge monitoring for the City of Salinas (2012 – 2017) and the Salinas Industrial Ponds (2017)
- RTP historical NPDES compliance data collected semi-annually by MRWPCA (2005-Spring 2017)
- Historical NPDES RTP Priority Pollutant data collected annually by MRWPCA (2004-2016)
- Data collected semi-annually by the Central Coast Long-Term Environmental Assessment Network (CCLEAN) (2008-2016)

The existing secondary effluent concentration for each constituent selected for the analysis was the maximum reported value from the above sources.

Limited data sources were available for several of the new source waters (*i.e.*, agricultural wash water, Blanco Drain, and the Reclamation Ditch). Agricultural wash water and Blanco Drain water quality data was collected during the source water monitoring conducted for the Project. NPDES storm water discharge monitoring for the City of Salinas (2012 – 2017) and Salinas Industrial Ponds monitoring (2017) provided additional data for the Reclamation Ditch and the agricultural wash water. For these new source waters, the maximum observed concentration was selected for Ocean Plan compliance analysis.[4]

Source water flows used for calculation of blended future secondary effluent concentrations were taken from the three projected operational conditions prepared by MRWPCA: (a) normal/wet year, building reserve, (b) normal/wet year, full reserve, and (c) drought year. For each constituent, a total of 36 future concentrations were calculated – 12 months of the year for the three projected future source water flow contributions. Of these concentrations, the maximum monthly flow-weighted concentration was selected for each constituent to be used for the Ocean Plan compliance analysis.

When a constituent could not be quantified or was not detected, it was reported as less than the Method Reporting Limit (<MRL).[5] 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-

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[4] Except for copper, where instead the median was calculated from the data for each new source water because the maximum values detected seemed to be outliers, and the Ocean Plan objective for copper considered in this assessment is the 6-month median concentration.

[5] 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).

weighting calculations. In some cases, constituents were not detected above the MRL in any of the source waters, so the concentrations for these constituents were reported as ND (<MRL) in this TM. In cases where the analysis of a constituent was detected but was not quantifiable, the results were also reported in this TM as less than the Method Reporting Limit, ND (<MRL). For some non-detected constituents, the MRL exceeds the Ocean Plan objective, and thus no compliance determination could be made.[6]

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, among others). 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 was used for both combining different source waters (*i.e.*, estimating future secondary effluent concentrations based on a flow-weighted average of source water contributions) and for combining the different discharge components (*i.e.*, RTP secondary effluent, hauled waste, 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 waters had values reported above the MRL.
    - ***When some or all waters had maximum values reported as less than the MRL*:**
        - When the MRL was at least two orders of magnitude greater (*i.e.*, at least 100 times greater) than the highest detected value from the other waters, the waters with maximum concentrations below the MRL were ignored. This case is exclusive to times when CCLEAN data were reported as detections for the RTP secondary effluent, and all the other source waters were below the MRL[7] (*i.e.*, hexachlorobutadiene was detected at a concentration of $9.0\text{x}10^{-6}$ µg/L in the secondary effluent via CCLEAN, and the MRL of all other source waters was 0.5 µg/L). The analytical methods used for CCLEAN can detect concentrations many orders of magnitude below the detection limits for traditional methods, and thus to include the MRL value 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.

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[6] 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.

[7] Specifically, this case applies to endrin, fluoranthene, chlordane, heptachlor epoxide, hexachlorobenzene, hexachlorobutadiene, PCBs, and toxaphene.

- When the MRL was less than two orders of magnitude greater (*i.e.*, less than 100 times greater) than the highest detected value from the other waters, the constituents were reported as less than the MRL and were assumed to have a concentration equal to the MRL for the purposes of calculating a flow-weighted average (*i.e.*, mercury was detected in the secondary effluent at a concentration of 0.019 µg/L, but was not detected in any other source waters, where the MRL was 0.2 µg/L).

3.1.2 GWR RO Concentrate

Two potential worst-case estimates of constituent concentrations were available for assessing the Project's RO concentrate:

- Measured in the concentrate during pilot testing
- Calculated from the blended future secondary effluent concentration, using the following treatment assumptions[8]:
  - No removal prior to the RO process (*i.e.,* no removal through the RTP or AWPF ozone or MF), except for dieldrin and DDT
  - 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 (i.e., 100% of the constituent is in the RO concentrate)

The higher of these two values was selected as the final concentration of the RO concentrate for all constituents, except as noted in the Table 1 footnotes.

3.1.3 Hauled Waste

Currently, small volumes of brine are trucked to the RTP and blended with secondary effluent in a brine pond. The blended waste from this pond ("hauled waste") is then discharged along with the secondary effluent bound for ocean discharge (when there is excess secondary effluent to discharge). For the Project, the hauled waste will be discharged with both secondary effluent and RO concentrate (see Figure 1). The point where the hauled waste is added to the ocean discharge water is downstream of the AWPF intake, and thus will not impact the quality of the Project product water or the RO concentrate. Currently, all sampling of the hauled waste takes place after dilution by secondary effluent in the brine pond, so the data represent a mix of secondary effluent and brine water. It is appropriate to use these data for the hauled waste quality since the practice of diluting with secondary effluent will continue in the future. Two potential values were available for the hauled waste constituent concentrations:

- Historical NPDES compliance data collected semi-annually by MRWPCA (2005-Spring 2017) of hauled waste water diluted with existing secondary effluent
- Calculated future secondary effluent constituent concentrations, as previously described.

The higher of these two values was selected for all constituents; because the hauled waste is diluted by secondary effluent prior to discharge, it is also appropriate to use future secondary effluent concentrations to represent the concentration within the hauled waste. Even if a

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[8] Based on the treatment assumptions, the RO concentrate would equal 5.3 times the AWPF influent (*i.e.*, blended future secondary effluent) concentration.

constituent was not present in the hauled waste, if it was present in the secondary effluent it would be present in the combined discharge.

3.1.4 Combined Ocean Discharge Concentrations

Having calculated the worst-case future concentrations for each of the three discharge components (i.e., secondary effluent, RO concentrate, blended hauled waste), the combined concentration prior to discharge was determined as a flow-weighted average of the contributions of each of these three discharge components. Depending on drought conditions and water usage for agricultural irrigation, the amount of secondary effluent discharged to the ocean will vary. A range of potential discharge scenarios was considered to encompass the worst-case water quality conditions of the combined discharge, as described in Section 4.2.

3.2 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 concentration (*i.e.*, pre-ocean dilution) of a constituent ($C_{\text{in-pipe}}$) that was calculated as discussed in the previous section, (2) the minimum probable dilution for ocean mixing (D_m) for the relevant discharge flow scenarios that was modeled by Dr. Roberts[9] (Roberts, P. J. W, 2017), and (3) the background concentration of the constituent in the ocean ($C_{\text{Background}}$) 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:

$$C_{\text{ZID}} = \frac{C_{\text{In-pipe}} + D_m * C_{\text{Background}}}{1 + D_m} \tag{1}$$

The C_{ZID} was then compared to the Ocean Plan objectives[10] in the Ocean Plan's "Table 1" (SWRCB, 2015). As described previously, the in-pipe concentration was estimated as a flow-weighted average of the future secondary effluent, Project RO concentrate, and hauled waste with the concentrations determined as discussed above. The D_m values for various flow scenarios were determined by modeling. Note that this approach could not be applied for some constituents (*e.g.*, acute toxicity, chronic toxicity, and radioactivity[11]).

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[9] The Ocean Plan defines D_m differently than Dr. Roberts. Dr. Roberts provided results defined as S = [total volume of a sample]/[volume of effluent contained in the sample]. The D_m referenced in Equation 1 of the California Ocean Plan is defined as $D_m = S - 1$. A value of 1 was subtracted from the dilution estimates provided by Dr. Roberts prior to using Equation 1.

[10] 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. 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; the current AWPF design does not include to ability to change the RO concentrate pH because pilot testing and RO performance modeling indicated it was not necessary. Oil and grease, suspended solids, settable solids, and turbidity in the RO concentrate would be significantly lower than the secondary effluent. 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.

[11] 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 RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives (Trussell

Two methods were used when modeling the ocean mixing: (1) the mathematical model UM_3 in the United States Environmental Protection Agency's (EPA's) Visual Plume suite, and (2) the NRFIELD model (for positively buoyant plumes only), also from the EPA's Visual Plume suite (Roberts, P. J. W., 2017). When results were provided from both methods, the D_m value estimated with the UM_3 model was selected for consistency, such that all dilution results used for this analysis were determined using the same model.

Dr. Roberts documented the dilution modeling assumptions and results in a technical memorandum (Roberts, P. J. W., 2017, Appendix A). Additional analysis assumptions were made as follows:

- **Flow**: A sensitivity analysis of the relationship between D_m and flow rate was performed for the various discharge types. The greatest D_m sensitivity to flow changes was determined to be from 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 waste 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).
    - ***Project RO concentrate***: 1.17 million gallons per day (mgd), which would be the resulting RO concentrate flow when the AWPF is producing 5.0 mgd of highly-purified recycled water (corresponding AWPF influent is 6.86 mgd of RTP secondary effluent). Although the AWPF will not be operated at this influent flowrate year-round, this is the highest potential RO concentrate flow and therefore the most conservative assessment.
    - ***Hauled waste:*** A sensitivity analysis was conducted to determine the impacts of hauled waste on the modeled D_m results. It was concluded that neither the flow nor TDS from the addition of hauled waste had a significant impact on the modeled D_m result, and was therefore excluded when determining the D_m value. However, the impact of hauled waste on assumed in-pipe water quality was still assessed. A hauled waste flow of 0.03 mgd blended with secondary effluent for a total flow of 0.1 mgd was used for calculating the in-pipe concentrations of each constituent.
- **Total Dissolved Solids (TDS)**: the greatest dilution is achieved when the salinity of the discharge water is lower and the most different from the ambient ocean 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

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Technologies, 2015c and 2016a). Current discharges of the secondary effluent and hauled waste are monitored semiannually for acute toxicity, chronic toxicity, and radioactivity per the existing NPDES permit. See section 4.4.

  - ***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).
- **Ocean salinity**: 33,340 mg/L – 33,890 mg/L, depending on the ocean condition
- **Temperature**:
  - ***Secondary effluent*:** 20˚C
  - ***Project RO concentrate***: 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 (December to February), Upwelling (March to September), and Oceanic (October to November)[12]. 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 the range of potential operating conditions, 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. To select the representative flow scenarios for compliance assessment, the balance between in-pipe dilution and dilution through the outfall was considered. In general, higher secondary effluent flows discharged to the ocean would provide dilution of the 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 eight representative discharge conditions that are described in Section 4.2 for the Project.

4 Ocean Plan Compliance Results

4.1 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, Project RO concentrate, and blended hauled 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 waste streams that would be discharged through the ocean outfall

Constituent	Units	Secondary Effluent	Hauled Waste	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	6.5	2,11
Chromium (Hexavalent)	µg/L	2.5	130	13	2,11

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[12] Note that these ranges assign the transitional months (March, September, and November) to the ocean condition that is typically more restrictive at relevant discharge flows.

Constituent	Units	Secondary Effluent	Hauled Waste	RO Concentrate	Notes
Copper	µg/L	11	39	58	2,11,17
Lead	µg/L	2.69	2.69	14.2	2,11
Mercury	µg/L	0.085	0.085	0.510	5,12
Nickel	µg/L	12.2	12.2	64	2,11
Selenium	µg/L	6.4	75	34	2,11
Silver	µg/L	0.77	0.77	4.05	5,11
Zinc	µg/L	57.5	170	303	2,11
Cyanide	µg/L	89.7	89.7	143	2,12,13
Total Chlorine Residual	µg/L	ND(<200)	ND(<200)	ND(<200)	10
Ammonia (as N), 6-month median	µg/L	42,900	42,900	225,789	1,11,18
Ammonia (as N), daily maximum	µg/L	49,000	49,000	257,895	1,11,18
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	0.046	0.046	0.24	5,9,11
Endrin	µg/L	0.000112	0.000112	0.00059	3,11
HCH (Hexachlorocyclohexane)	µg/L	0.059	0.059	0.312	5,9,11
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	8.3	8.3	44	2,11
Antimony	µg/L	0.78	0.78	4.1	2 ,11
Bis (2-chloroethoxy) methane	µg/L	ND(<4.0)	ND(<4.0)	ND(<1)	4,14
Bis (2-chloroisopropyl) ether	µg/L	ND(<4.0)	ND(<4.0)	ND(<1)	4,14
Chlorobenzene	µg/L	ND(<0.5)	ND(<0.5)	ND(<0.5)	4,14
Chromium (III)	µg/L	6.9	87	36	2,11
Di-n-butyl phthalate	µg/L	ND(<7)	ND(<7)	ND(<1)	4,14
Dichlorobenzenes	µg/L	1.6	1.6	8	5,11
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(<19)	ND(<19)	ND(<5)	4,14
2,4-dinitrophenol	µg/L	ND(<9)	ND(<9)	ND(<5)	4,14
Ethylbenzene	µg/L	ND(<0.5)	ND(<0.5)	ND(<0.5)	4,14
Fluoranthene	µg/L	0.00684	0.00684	0.0360	3,11
Hexachlorocyclopentadiene	µg/L	ND(<0.5)	ND(<0.5)	ND(<0.05)	4,14
Nitrobenzene	µg/L	ND(<2.1)	ND(<2.1)	ND(<1)	4,14
Thallium	µg/L	0.68	0.68	3.6	2,11
Toluene	µg/L	0.48	0.48	2.5	5,11
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(<18.6)	ND(<18.6)	ND(<0.05)	4,14
Beryllium	µg/L	ND(<0.68)	0.0052	ND(<0.5)	4,14
Bis(2-chloroethyl)ether	µg/L	ND(<4.0)	ND(<4.0)	ND(<1)	4,14
Bis(2-ethyl-hexyl)phthalate	µg/L	78	78	411	1,11
Carbon tetrachloride	µg/L	0.50	0.50	2.66	2,11
Chlordane	µg/L	0.00122	0.00122	0.0064	3,9,11
Chlorodibromomethane	µg/L	2.2	2.2	12	2,11

Constituent	Units	Secondary Effluent	Hauled Waste	RO Concentrate	Notes
Chloroform	µg/L	34	34	180	2,11
DDT	µg/L	0.001	0.001	0.0003	2,9,11,15
1,4-dichlorobenzene	µg/L	1.6	1.6	8.4	1,11
3,3-dichlorobenzidine	µg/L	ND(<18)	ND(<18)	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)	0.5	ND(<0.5)	4,14
Dichlorobromomethane	µg/L	2.4	2.4	12	2,11
Dichloromethane (methylenechloride)	µg/L	0.88	0.88	4.6	2,11
1,3-dichloropropene	µg/L	0.56	0.56	3.0	2,11
Dieldrin	µg/L	0.0015	0.0015	0.0001	2,11,15
2,4-dinitrotoluene	µg/L	ND(<2)	ND(<2)	ND(<0.1)	4,14
1,2-diphenylhydrazine (azobenzene)	µg/L	ND(<4)	ND(<4)	ND(<1)	4,14
Halomethanes	µg/L	1.3	1.3	6.9	2,9,11
Heptachlor	µg/L	ND(<0.01)	ND(<0.01)	ND(<0.01)	4,14
Heptachlor epoxide	µg/L	0.000088	0.000088	0.000463	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(<2.1)	ND(<2.1)	ND(<0.5)	4,14
Isophorone	µg/L	ND(<0.5)	ND(<0.5)	ND(<0.5)	4,14
N-Nitrosodimethylamine	µg/L	0.086	0.086	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(<2.1)	ND(<2.1)	ND(<1)	4,14
PAHs	µg/L	0.04	0.04	0.21	2,9,11
PCBs	µg/L	0.00068	0.00068	0.00357	3,9,11
TCDD Equivalents	µg/L	1.39E-7	1.39E-7	7.29E-7	2,8,9,11
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	0.0071	0.0071	0.0373	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(<2.1)	ND(<2.1)	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 Waste 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 estimated 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 the constituent, and so the maximum observed value is 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.

[10] For all waters, 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 AWPF (*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 93% and 84% removal through primary and secondary treatment for DDT and dieldrin, respectively, 36% and 44% removal through ozone for DDT and dieldrin, respectively, 92% and 97% removal through MF for DDT and dieldrin, respectively, recycling of the MF backwash to the RTP, 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.

General

[16] Footnote not used

[17] The value reported for the 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 estimated source water blends. The median value was used because the maximum values detected in new source waters 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.

[18] Ammonia (as N) represents the total ammonia concentration, *i.e.* the sum of unionized ammonia (NH_3) and ionized ammonia (NH_4).

4.2 Ocean Modeling Results

Dr. Roberts performed dilution modeling of various discharge scenarios that included combinations of RTP secondary effluent, hauled waste, and Project RO concentrate (Appendix A, Table C3). Year-round compliance with the Ocean Plan objectives was assessed through the evaluation of eight representative discharge scenarios covering the expected range of secondary effluent discharge flows. All scenarios assume the maximum flow rates for the RO concentrate and hauled waste, which is a conservative assumption in terms of constituent loading and minimum dilution.

To assess potential future discharge compositions, various secondary effluent flow rates were included in this analysis. These scenarios encompass the range of operating conditions that is expected to occur for the Project, as well as the best- and worse-case ocean dilution conditions. The eight scenarios used for the compliance assessment, in terms of secondary effluent flow rates to be discharged with the other waste streams, are shown in Table 2, and include:

- **Minimum Wastewater Flow (Upwelling) – Scenario 1:** the maximum influence of the Project RO concentrate on the ocean discharge (*i.e.*, no secondary effluent discharged). The Upwelling ocean condition was used since it represents the worst-case dilution for this flow scenario.
- **Low Wastewater Flow (Upwelling) – Scenarios 2-3:** significant influence of the Project RO concentrate on the ocean discharge (*i.e.*, minimal secondary effluent discharged). The

Upwelling ocean condition was used as it represents the worst-case dilution for this flow scenario.

- **Moderate Wastewater Flow (Upwelling) – Scenarios 4-7:** conditions with a moderate wastewater flow when the Project RO concentrate has a greater influence on the in-pipe water quality than in Scenario 8, but where the ocean dilution (D_m) is reduced due to the higher overall discharge flow (*i.e.*, compared to Scenarios 1-3). The Upwelling ocean condition was used as it represents the worst-case dilution for these scenarios.
- **High Wastewater Flow (Upwelling) – Scenario 8:** the highest expected flow that will be discharged. The Upwelling ocean condition was used as it represents the worst-case dilution for this flow scenario.

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	Blended Hauled Waste[1]	
1	Minimum wastewater flow (Upwelling)	0	1.17	0	498
2	Low wastewater flow (Upwelling)	0.4	1.17	0	460
3	Low Wastewater Flow (Upwelling)	0.6	1.17	0	442
4	Moderate wastewater flow (Upwelling)	2	1.17	0	358
5	Moderate wastewater flow (Upwelling)	4	1.17	0	299
6	Moderate wastewater flow (Upwelling)	4.5	1.17	0	289
7	Moderate wastewater flow (Upwelling)	5	1.17	0	281
8	High wastewater flow (Upwelling)	23.4	1.17	0	174

[1] A sensitivity analysis was conducted to determine the impacts of hauled waste on the modeled D_m results. It was concluded that neither the flow nor TDS from the addition of hauled waste had a significant impact on the modeled D_m result, and was therefore excluded from the D_m calculation.

4.3 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 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[13]. The resulting concentrations for each constituent in each scenario were compared to the Ocean Plan objective to assess compliance. The estimated concentrations for all eight flow scenarios are presented as concentrations at the edge of the ZID

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[13] The Ocean Plan defines D_m differently than Dr. Roberts. Dr. Roberts provided dilution results defined as S = [total volume of a sample]/[volume of effluent contained in the sample]. The D_m referenced in Equation 1 of the California Ocean Plan is defined as $D_m = S - 1$. A value of 1 was subtracted from the dilution estimates provided by Dr. Roberts prior to using Equation 1.

(Table 3) and as a percentage of the Ocean Plan objective (Table 4). As shown, none of the constituents are expected to exceed their Ocean Plan objective[14]. Ammonia is estimated to reach a concentration closest to its objective, where it is 71% of the objective in Scenario 1.

Table 3 – Estimated 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	6	7	8
Objectives for protection of marine aquatic life										
Arsenic	μg/L	8	3.0	3.0	3.0	3.1	3.1	3.1	3.1	3.2
Cadmium	μg/L	1	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Chromium (Hexavalent)	μg/L	2	0.04	0.04	0.04	0.03	0.02	0.02	0.02	0.02
Copper	μg/L	3	2.1	2.1	2.1	2.1	2.1	2.1	2.1	2.1
Lead	μg/L	2	0.03	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Mercury	μg/L	0.04	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Nickel	μg/L	5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Selenium	μg/L	15	0.1	0.1	0.1	0.05	0.05	0.05	0.04	0.05
Silver	μg/L	0.7	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
Zinc	μg/L	20	8.6	8.5	8.5	8.4	8.4	8.3	8.3	8.4
Cyanide	μg/L	1	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.5
Total Chlorine Residual	μg/L	2	--	--	--	--	--	--	--	--
Ammonia (as N) - 6-mo median	μg/L	600	424	371	355	302	278	276	273	295
Ammonia (as N) - Daily Max	μg/L	2,400	484	424	406	345	318	315	312	337
Acute Toxicity[a]	TUa	0.3								
Chronic Toxicity[a]	TUc	1								
Phenolic Compounds (non-chlorinated)	μg/L	30	0.7	0.6	0.6	0.5	0.4	0.4	0.4	0.5
Chlorinated Phenolics	μg/L	1	0.04	0.04	0.05	0.1	0.1	0.1	0.1	0.1
Endosulfan	μg/L	0.009	4.5E-04	4.0E-04	3.8E-04	3.2E-04	3.0E-04	3.0E-04	2.9E-04	3.2E-04
Endrin	μg/L	0.002	1.1E-06	9.7E-07	9.3E-07	7.9E-07	7.3E-07	7.2E-07	7.1E-07	7.7E-07
HCH (Hexachlorocyclohexane)	μg/L	0.004	5.9E-04	5.1E-04	4.9E-04	4.2E-04	3.9E-04	3.8E-04	3.8E-04	4.1E-04
Radioactivity (Gross Beta)[a]	pci/L	–								
Radioactivity (Gross Alpha)[a]	pci/L	–								
Objectives for protection of human health - noncarcinogens										
Acrolein	μg/L	220	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Antimony	μg/L	1200	0.01	0.01	0.01	0.01	0.01	0.005	0.005	0.01
Bis (2-chloroethoxy) methane	μg/L	4.4	<0.002	<0.004	<0.005	<0.01	<0.01	<0.01	<0.01	<0.02
Bis (2-chloroisopropyl) ether	μg/L	1200	<0.002	<0.004	<0.005	<0.01	<0.01	<0.01	<0.01	<0.02
Chlorobenzene	μg/L	570	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.003
Chromium (III)	μg/L	190000	0.1	0.1	0.1	0.06	0.05	0.05	0.05	0.05
Di-n-butyl phthalate	μg/L	3500	<0.003	<0.01	<0.01	<0.01	<0.02	<0.02	<0.02	<0.04
Dichlorobenzenes	μg/L	5100	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Diethyl phthalate	μg/L	33000	<0.003	<0.005	<0.01	<0.01	<0.01	<0.01	<0.02	<0.03

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[14] 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 common 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	6	7	8
Dimethyl phthalate	μg/L	820000	<0.001	<0.002	<0.002	<0.00	<0.01	<0.01	<0.01	<0.01
4,6-dinitro-2-methylphenol	μg/L	220	<0.01	<0.02	<0.02	<0.04	<0.1	<0.1	<0.1	<0.1
2,4-Dinitrophenol	μg/L	4.0	<0.01	<0.01	<0.01	<0.02	<0.03	<0.03	<0.03	<0.05
Ethylbenzene	μg/L	4100	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.003
Fluoranthene	μg/L	15	6.8E-05	5.9E-05	5.7E-05	4.8E-05	4.4E-05	4.4E-05	4.4E-05	4.7E-05
Hexachlorocyclopentadiene	μg/L	58	<0.0002	<0.0004	<0.0005	<0.001	<0.001	<0.001	<0.001	<0.003
Nitrobenzene	μg/L	4.9	<0.002	<0.003	<0.003	<0.005	<0.01	<0.01	<0.01	<0.01
Thallium	μg/L	2	0.01	0.01	0.01	0.005	0.004	0.004	0.004	0.005
Toluene	μg/L	85000	0.005	0.004	0.004	0.003	0.003	0.003	0.003	0.003
Tributyltin	μg/L	0.0014	<4.5E-05	<6.3E-05	<7.0E-05	<1.1E-04	<1.4E-04	<1.5E-04	<1.6E-04	<2.8E-04
1,1,1-Trichloroethane	μg/L	540000	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.003
Objectives for protection of human health - carcinogens										
Acrylonitrile	μg/L	0.10	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Aldrin[b]	μg/L	0.000022	<2.0E-05	<2.0E-05	<2.0E-05	<2.2E-05	<2.6E-05	<2.6E-05	<2.7E-05	<4.1E-05
Benzene	μg/L	5.9	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.003
Benzidine[b]	μg/L	0.000069	<0.003	<0.01	<0.02	<0.03	<0.0	<0.1	<0.1	<0.1
Beryllium	μg/L	0.033	0.0009	0.0011	0.0012	0.0017	0.0021	0.0022	0.0023	0.0038
Bis(2-chloroethyl)ether	μg/L	0.045	<0.002	<0.004	<0.005	<0.01	<0.01	<0.01	<0.01	<0.02
Bis(2-ethyl-hexyl)phthalate	μg/L	3.5	0.8	0.7	0.6	0.5	0.5	0.5	0.5	0.5
Carbon tetrachloride	μg/L	0.90	0.00	0.004	0.004	0.004	0.003	0.003	0.003	0.003
Chlordane	μg/L	0.000023	1.2E-05	1.1E-05	1.0E-05	8.5E-06	7.9E-06	7.8E-06	7.7E-06	8.3E-06
Chlorodibromomethane	μg/L	8.6	0.02	0.02	0.02	0.02	0.01	0.01	0.01	0.02
Chloroform	μg/L	130	0.3	0.3	0.3	0.2	0.2	0.2	0.2	0.2
DDT	μg/L	0.00017	6.3E-07	1.0E-06	1.2E-06	2.0E-06	2.7E-06	2.8E-06	3.0E-06	5.3E-06
1,4-Dichlorobenzene	μg/L	18	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01
3,3-Dichlorobenzidine[b]	μg/L	0.0081	<0.01	<0.01	<0.02	<0.03	<0.05	<0.1	<0.1	<0.1
1,2-Dichloroethane	μg/L	28	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.003
1,1-Dichloroethylene	μg/L	0.9	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.003
Dichlorobromomethane	μg/L	6.2	0.02	0.02	0.02	0.02	0.02	0.02	0.02	0.02
Dichloromethane (methylenechloride)	μg/L	450	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
1,3-dichloropropene	μg/L	8.9	0.01	0.005	0.005	0.004	0.004	0.004	0.004	0.004
Dieldrin	μg/L	0.00004	4.9E-07	1.2E-06	1.5E-06	2.8E-06	4.0E-06	4.3E-06	4.5E-06	8.3E-06
2,4-Dinitrotoluene	μg/L	2.6	<0.001	<0.001	<0.002	<0.004	<0.01	<0.01	<0.01	<0.01
1,2-Diphenylhydrazine (azobenzene)	μg/L	0.16	<0.002	<0.004	<0.005	<0.01	<0.01	<0.01	<0.01	<0.02
Halomethanes	μg/L	130	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Heptachlor[b]	μg/L	0.00005	<2.0E-05	<2.2E-05	<2.3E-05	<2.8E-05	<3.3E-05	<3.4E-05	<3.5E-05	<5.7E-05
Heptachlor Epoxide	μg/L	0.00002	8.7E-07	7.6E-07	7.3E-07	6.2E-07	5.7E-07	5.7E-07	5.6E-07	6.0E-07
Hexachlorobenzene	μg/L	0.00021	7.7E-07	6.7E-07	6.5E-07	5.5E-07	5.1E-07	5.0E-07	5.0E-07	5.4E-07
Hexachlorobutadiene	μg/L	14	8.9E-08	7.8E-08	7.5E-08	6.3E-08	5.8E-08	5.8E-08	5.7E-08	6.2E-08
Hexachloroethane	μg/L	2.5	<0.001	<0.002	<0.003	<0.004	<0.01	<0.01	<0.01	<0.01
Isophorone	μg/L	730	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.003
N-Nitrosodimethylamine	μg/L	7.3	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003	0.0005
N-Nitrosodi-N-Propylamine	μg/L	0.38	0.00005	0.0001	0.0001	0.0002	0.0002	0.0002	0.0002	0.0004
N-Nitrosodiphenylamine	μg/L	2.5	<0.002	<0.003	<0.003	<0.005	<0.01	<0.01	<0.01	<0.01
PAHs	μg/L	0.0088	0.0004	0.0004	0.0003	0.0003	0.0003	0.0003	0.0003	0.0003
PCBs	μg/L	0.000019	6.7E-06	5.9E-06	5.6E-06	4.8E-06	4.4E-06	4.4E-06	4.3E-06	4.7E-06
TCDD Equivalents	μg/L	3.9E-09	1.4E-09	1.2E-09	1.1E-09	9.7E-10	9.0E-10	8.9E-10	8.8E-10	9.5E-10
1,1,2,2-Tetrachloroethane	μg/L	2.3	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.003
Tetrachloroethylene	μg/L	2.0	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.003
Toxaphene	μg/L	2.1E-04	7.0E-05	6.1E-05	5.9E-05	5.0E-05	4.6E-05	4.6E-05	4.5E-05	4.9E-05
Trichloroethylene	μg/L	27	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.003
1,1,2-Trichloroethane	μg/L	9.4	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<0.003
2,4,6-Trichlorophenol	μg/L	0.29	<0.002	<0.003	<0.003	<0.005	<0.01	<0.01	<0.01	<0.01
Vinyl chloride	μg/L	36	<0.001	<0.001	<0.001	<0.001	<0.002	<0.002	<0.002	<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 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.

Table 4 – Estimated 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	6	7	8
Objectives for protection of marine aquatic life										
Arsenic	µg/L	8	38%	38%	38%	39%	39%	39%	39%	40%
Cadmium	µg/L	1	1%	1%	1%	1%	1%	1%	1%	1%
Chromium (Hexavalent)	µg/L	2	2%	2%	2%	1%	1%	1%	1%	1%
Copper	µg/L	3	70%	70%	70%	69%	69%	69%	69%	69%
Lead	µg/L	2	1%	1%	1%	1%	1%	1%	1%	1%
Mercury	µg/L	0.04	4%	3%	3%	3%	3%	3%	3%	3%
Nickel	µg/L	5	2%	2%	2%	2%	2%	2%	2%	2%
Selenium	µg/L	15	0.5%	0.4%	0.4%	0.3%	0.3%	0.3%	0.3%	0.3%
Silver	µg/L	0.7	24%	24%	24%	24%	23%	23%	23%	23%
Zinc	µg/L	20	43%	42%	42%	42%	42%	42%	42%	42%
Cyanide	µg/L	1	28%	28%	28%	30%	34%	35%	35%	53%
Total Chlorine Residual	µg/L	2	--	--	--	--	--	--	--	--
Ammonia (as N) - 6-mo median	µg/L	600	71%	62%	59%	50%	46%	46%	46%	49%
Ammonia (as N) - Daily Max	µg/L	2,400	20%	18%	17%	14%	13%	13%	13%	14%
Acute Toxicity[a]	TUa	0.3								
Chronic Toxicity[a]	TUc	1								
Phenolic Compounds (non-chlorinated)	µg/L	30	2%	2%	2%	2%	1%	1%	1%	2%
Chlorinated Phenolics	µg/L	1	4%	4%	5%	6%	7%	7%	7%	11%
Endosulfan	µg/L	0.009	5%	4%	4%	4%	3%	3%	3%	4%
Endrin	µg/L	0.002	0.1%	0.05%	0.05%	0.04%	0.04%	0.04%	0.04%	0.04%
HCH (Hexachlorocyclohexane)	µg/L	0.004	15%	13%	12%	10%	10%	10%	9%	10%
Radioactivity (Gross Beta)[a]	pci/L	–								
Radioactivity (Gross Alpha)[a]	pci/L	–								
Objectives for protection of human health - noncarcinogens										
Acrolein	µg/L	220	0.04%	0.03%	0.03%	0.03%	0.02%	0.02%	0.02%	0.03%
Antimony	µg/L	1200	0.001%	0.001%	0.001%	0.0005%	0.0004%	0.0004%	0.000%	0.000%
Bis (2-chloroethoxy) methane	µg/L	4.4	<0.1%	<0.1%	<0.1%	<0.2%	<0.3%	<0.3%	<0.3%	<0.5%
Bis (2-chloroisopropyl) ether	µg/L	1200	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Chlorobenzene	µg/L	570	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Chromium (III)	µg/L	190000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Di-n-butyl phthalate	µg/L	3500	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Dichlorobenzenes	µg/L	5100	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Diethyl phthalate	µg/L	33000	<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%
4,6-dinitro-2-methylphenol	µg/L	220	<0.01%	<0.01%	<0.01%	<0.02%	<0.02%	<0.02%	<0.03%	<0.0%
2,4-Dinitrophenol	µg/L	4.0	<0.3%	<0.3%	<0.4%	<1%	<1%	<1%	<1%	<1%
Ethylbenzene	µg/L	4100	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Fluoranthene	µg/L	15	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Hexachlorocyclopentadiene	µg/L	58	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Nitrobenzene	µg/L	4.9	<0.04%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.2%
Thallium	µg/L	2	0.3%	0.3%	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%
Toluene	µg/L	85000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Tributyltin	µg/L	0.0014	<3%	<4%	<5%	<8%	<10%	<11%	<11%	<20%
1,1,1-Trichloroethane	µg/L	540000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Objectives for protection of human health - carcinogens										

Constituent	Units	Ocean Plan Objective	Estimated Percentage of Ocean Plan Objective at Edge of ZID by Discharge Scenario[c]							
			1	2	3	4	5	6	7	8
Acrylonitrile	µg/L	0.10	25%	21%	21%	17%	16%	16%	16%	17%
Aldrin[b]	µg/L	0.000022	--	--	--	--	--	--	--	--
Benzene	µg/L	5.9	<0.02%	<0.02%	<0.02%	<0.02%	<0.03%	<0.03%	<0.03%	<0.0%
Benzidine[b]	µg/L	0.000069	--	--	--	--	--	--	--	--
Beryllium	µg/L	0.033	3%	3%	4%	5%	6%	7%	7%	12%
Bis(2-chloroethyl)ether	µg/L	0.045	<5%	<9%	<11%	<18%	<24%	<26%	<27%	<49%
Bis(2-ethyl-hexyl)phthalate	µg/L	3.5	22%	19%	18%	16%	14%	14%	14%	15%
Carbon tetrachloride	µg/L	0.90	1%	0.5%	0.5%	0.4%	0.4%	0.4%	0.4%	0.4%
Chlordane	µg/L	0.000023	52%	46%	44%	37%	34%	34%	34%	36%
Chlorodibromomethane	µg/L	8.6	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Chloroform	µg/L	130	0.3%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
DDT	µg/L	0.00017	0.4%	1%	1%	1%	2%	2%	2%	3%
1,4-Dichlorobenzene	µg/L	18	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%	0.1%
3,3-Dichlorobenzidine[b]	µg/L	0.0081	--	--	--	--	--	--	--	--
1,2-Dichloroethane	µg/L	28	<0.01%	<0.01%	<0.01%	<0.01%	0.01%	0.01%	0.01%	0.01%
1,1-Dichloroethylene	µg/L	0.9	0.1%	0.1%	0.1%	0.2%	0.2%	0.2%	0.2%	0.3%
Dichlorobromomethane	µg/L	6.2	0.4%	0.3%	0.3%	0.3%	0.2%	0.2%	0.2%	0.3%
Dichloromethane (methylenechloride)	µg/L	450	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
1,3-dichloropropene	µg/L	8.9	0.1%	0.1%	0.1%	0.04%	0.04%	0.04%	0.04%	0.04%
Dieldrin	µg/L	0.00004	1%	3%	4%	7%	10%	11%	11%	21%
2,4-Dinitrotoluene	µg/L	2.6	<0.02%	<0.1%	<0.1%	<0.1%	<0.2%	<0.2%	<0.2%	<0.4%
1,2-Diphenylhydrazine (azobenzene)	µg/L	0.16	<2%	<3%	<3%	<5%	<7%	<7%	<8%	<14%
Halomethanes	µg/L	130	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%	0.01%
Heptachlor[b]	µg/L	0.00005	<40%	<43%	<45%	<56%	<67%	<69%	<71%	--
Heptachlor Epoxide	µg/L	0.00002	4%	4%	4%	3%	3%	3%	3%	3%
Hexachlorobenzene	µg/L	0.00021	0.4%	0.3%	0.3%	0.3%	0.2%	0.2%	0.2%	0.3%
Hexachlorobutadiene	µg/L	14	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Hexachloroethane	µg/L	2.5	<0.05%	<0.1%	<0.1%	<0.2%	<0.2%	<0.2%	<0.3%	<0.5%
Isophorone	µg/L	730	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
N-Nitrosodimethylamine	µg/L	7.3	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	0.01%
N-Nitrosodi-N-Propylamine	µg/L	0.38	0.01%	0.02%	0.02%	0.0%	0.1%	0.1%	0.1%	0.1%
N-Nitrosodiphenylamine	µg/L	2.5	<0.1%	<0.1%	<0.1%	<0.2%	<0.3%	<0.3%	<0.3%	<0%
PAHs	µg/L	0.0088	5%	4%	4%	3%	3%	3%	3%	3%
PCBs	µg/L	0.000019	35%	31%	30%	25%	23%	23%	23%	25%
TCDD Equivalents	µg/L	3.9E-09	35%	31%	29%	25%	23%	23%	23%	24%
1,1,2,2-Tetrachloroethane	µg/L	2.3	<0.04%	<0.05%	<0.05%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Tetrachloroethylene	µg/L	2.0	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%	<0.1%
Toxaphene	µg/L	2.1E-04	33%	29%	28%	24%	22%	22%	21%	23%
Trichloroethylene	µg/L	27	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
1,1,2-Trichloroethane	µg/L	9.4	<0.01%	<0.01%	<0.01%	<0.01%	<0.02%	<0.02%	<0.02%	<0.03%
2,4,6-Trichlorophenol	µg/L	0.29	<1%	<1%	<1%	<2%	<2%	<2%	<2%	<4%
Vinyl chloride	µg/L	36	<0.01%	<0.01%	<0.01%	<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 constituents. 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 4.4).

[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 was determined to be less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the constituent was estimated to be 0.000001% of the objective, 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.

4.4 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 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 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 estimated D_m values for the discharge of RO concentrate only from the Project's full-scale AWPF and the discharge of RO concentrate combined with secondary effluent from the RTP. The minimum dilution modeled for the various Project discharge scenarios was 174:1, which is when the secondary effluent discharge is at the highest expected flow for future discharges. Given that the lowest expected D_m value for the various 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.

5 Conclusions

The purpose of the analysis documented in this technical memorandum was to assess the ability of the Project to comply with the numeric Ocean Plan water quality objectives. Trussell Tech used a conservative approach to estimate the water qualities of the RTP secondary effluent, RO concentrate, and hauled waste (blended with secondary effluent) for the 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 select constituents, as noted, due to analytical limitations, but this is a common occurrence for these Ocean Plan constituents. Based on the data, assumptions, modeling, and analytical methodology presented in this technical memorandum, the Project would comply with all Ocean Plan objectives.

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Appendix A

Modeling Brine Disposal into Monterey Bay – Supplement

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Final Report

Prepared for
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September 22, 2017

CONTENTS

EXECUTIVE SUMMARY

Additional dilution simulations are presented for the disposal of brine concentrate resulting from reverse osmosis (RO) seawater desalination into Monterey Bay, California. The report is a supplement to Roberts (2016) and addresses new flow scenarios and other issues that have been raised.

It has been suggested to replace the opening in the end gate of the diffuser with a check valve. A 6-inch valve was proposed, and analyses of the internal hydraulics of the diffuser and outfall were conducted. The check valve had minimal effect on the flow distribution between the diffuser ports and minimal effect on head loss. The flow from the end gate was reduced slightly and the exit velocity considerably increased. The effect of the valve orientation on dilution of brine discharges was investigated. It was found that any upward angle greater than about 20° would result in dilutions that meet the BMZ salinity requirements. The optimum angle to maximize dilution is 60°.

Dilutions were computed for all new flow scenarios assuming the 6-inch check valve was installed in the end gate.

The effect of currents on the brine jets was addressed. Dilutions were predicted using the mathematical model UM3 for the pure brine discharges for various anticipated current speeds. Jets discharging into the currents were bent back and dilutions were increased by the current. Jets discharging with the current were swept downstream and impacted the seabed farther from the diffuser. All dilutions with currents were greater than those with zero current, and all impact points were well within the BMZ.

It has been suggested to orient the nozzles along the diffuser upwards (from their present horizontal angles) to increase the dilution of dense effluents. This would decrease the dilution of buoyant effluents, however. Dilutions were predicted for dense and buoyant effluents. For dense effluents, increasing the nozzle angle increased dilution considerably; for buoyant effluents, the dilutions reduced slightly.

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

It is proposed to dispose of the brine concentrate resulting from reverse osmosis (RO) seawater desalination into Monterey Bay, California. Discharge will be through an existing outfall and diffuser usually used for domestic wastewater disposal. Because of varying flow scenarios, the effluent and its composition vary from pure secondary effluent to pure brine. Sixteen scenarios, with flows ranging from 9.0 to 33.8 mgd (million gallons per day) and densities from 998.8 to 1045.2 kg/m^3, were previously analyzed in Roberts (2016). The internal hydraulics of the outfall and diffuser were computed and dilutions predicted for flow scenarios resulting in buoyant and dense effluents. It was found that, for all dense discharge conditions, the salinity requirements in the new California Ocean Plan were met within the BMZ (Brine Mixing Zone).

Since that report was completed, new flow scenarios have been proposed that include higher volumes of brine and GWR effluent, the inclusion of hauled brine, and situations where the desalination plant is offline. It has been requested to analyze dilutions for many more flow combinations for typical and variant cases. And it is proposed to replace the opening in the diffuser's end gate, which allows some brine to be released at a low velocity and therefore low dilution, with a check valve that would increase the exit velocity and therefore increase dilution. The check valve would be angled upwards, further increasing dilution. Finally, it has been suggested to replace the horizontal 4-inch check valves along the diffuser with upwardly oriented valves that would increase the dilution of dense effluents.

The specific tasks addressed in this report are:

- Analyze internal hydraulics accounting for the effect of the new proposed end gate check valve;
- Compute dilutions for new scenarios with dense and buoyant flow effluents accounting for the effect of the valve;
- Assess the effects of currents on dense discharges;
- Compute the dilution of dense discharges from the end gate;
- Analyze the effect of varying the nozzle angle on the dilution of dense and buoyant effluents.

2. MODELING SCENARIOS

2.1 Introduction

To address the additional concerns and issues that have been raised, the revised dilution analyses will include the following:

- **End-Gate**: The outfall hydraulics will be revised assuming the end-gate has been replaced with one Tideflex valve. The assumed end-gate configuration may be modified depending on the California Ocean Plan (COP) compliance analysis results.
- **Effluent Water Quality:** The salinity and temperature of the secondary effluent and GWR effluent shall remain unchanged from prior analyses presented in the 2017 Draft EIR/EIS.
- **Ocean Conditions**: Dilution analyses shall incorporate conditions related to the ocean seasons consistent with previous analyses. Worst-case conditions shall be assessed and presented.
- **Mitigation:** Preliminary assessments of the impact of diffuser nozzle orientation on dilution of dense and buoyant effluents will be made.
- **Currents:** The effects of currents on the advection and dispersion of dense effluents will be assessed.

All revised discharge scenarios will incorporate consideration of a modified end-gate on outfall diffuser hydraulics and dilution.

Model analyses will be done for typical and high brine discharge scenarios with a range of secondary and GWR effluent flows. Modeling the highest RO concentrate flow expected follows the conservative approach previously used on COP compliance evaluations for this project. Also, scenarios involving high flows of secondary effluent will be assessed for typical operations of the Variant both with and without GWR effluent. In addition, it has been requested that discharge scenarios where brine is absent be included in dilution model analyses to cover times when the desalination plant is offline.

2.2 Environmental and Discharge Conditions

In the previous report, Roberts (2016), oceanographic measurements obtained near the diffuser were discussed. Traditionally, three oceanic seasons have been defined in Monterey Bay: Upwelling (March-September), Oceanic (September-November), and Davidson (November-March). Density profiles were averaged by season to obtain representative profiles for the dilution simulations. The profiles are shown in Figure 1 and are tabulated in Appendix A. The salinities and temperatures near the depth of the diffuser were averaged seasonally as summarized in Table 1.

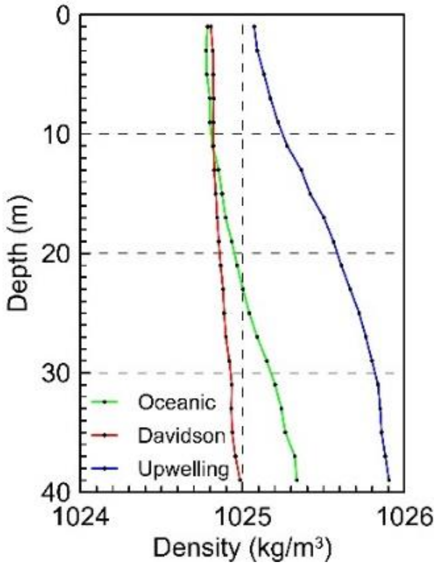


Figure 1. Seasonally averaged density profiles used for dilution simulations.

Table 1. Seasonally Averaged Properties at Diffuser Depth

Season	Temperature (°C)	Salinity (ppt)	Density (kg/m^3)
Davidson	14.46	33.34	1024.8
Upwelling	11.48	33.89	1025.8
Oceanic	13.68	33.57	1025.1

The assumed constituent properties are summarized in Table 2.

Table 2. Assumed Properties of Effluent Constituents

Constituent	Temperature (°C)	Salinity (ppt)	Density (kg/m^3)
Secondary effluent	20.0	0.80	998.8
Brine	9.9	58.23	1045.2
GWR	20.0	5.80	1002.6
Hauled brine	20.0	40.00	1028.6

2.3 Discharge Scenarios

Following publication of the 2017 MPWSP Draft EIR/EIS, the MRWPCA commented on several concerns related to the impact analysis regarding Ocean Plan and NPDES compliance. Specifically, discharge scenarios involving higher volumes of desalination brine (following a shut down for repair or routine maintenance) had not been assessed. Also, it was requested that higher resolution model analysis be conducted for scenarios involving low and moderate flows of secondary effluent for all project alternatives. Additionally, the MRWPCA requested that increased GWR effluent flows be assessed as part of planning for an increased capacity PWM project. Finally, it was requested that hauled brine be included in the dilution analysis for the Proposed Project.

It is proposed that revised model analysis be completed for typical and high brine discharge scenarios with secondary effluent flows ranging from 0 to 10 mgd and with the inclusion of hauled brine. Additionally, scenarios involving high flows of secondary effluent (15 and 19.78 mgd) will be assessed for typical operations. In addition, MPWPCA has requested that discharge scenarios where brine is absent be included in dilution model analyses to cover times when the desal plant is offline and to revise dilution model estimates based on the modified end-gate which may alter the outfall diffuser hydraulics.

Table 3 details the revised discharge scenarios for dilution model analysis of the Proposed Project (full size desalination facility and no implementation of GWR/PWM).

Table 4 details revised discharge scenarios for dilution model analysis of the Variant (MPWSP Alternative, reduced capacity desalination facility with PWM/GWR).

Table 3. Modeled Discharge Scenarios – Project (no GWR)

Case ID	Scenario	Constituent flows (mgd)				Combined effluent		
		Brine	Secondary effluent	GWR	Hauled brine	Flow (mgd)	Salinity (ppt)	Density (kg/m^3)
T1	SE Only	0.00	19.78	0	0.1	19.88	1.00	999.0
T2	Brine only	13.98	0.00	0	0.1	14.08	58.10	1045.1
T3	Brine + Low SE	13.98	1.00	0	0.1	15.08	54.30	1042.0
T4	Brine + Low SE	13.98	2.00	0	0.1	16.08	50.97	1039.4
T5	Brine + Low SE	13.98	3.00	0	0.1	17.08	48.04	1037.0
T6	Brine + Low SE	13.98	4.00	0	0.1	18.08	45.42	1034.9
T7	Brine + Moderate SE	13.98	5.00	0	0.1	19.08	43.08	1033.0
T8	Brine + Moderate SE	13.98	6.00	0	0.1	20.08	40.98	1031.3
T9	Brine + Moderate SE	13.98	7.00	0	0.1	21.08	39.07	1029.7
T10	Brine + Moderate SE	13.98	8.00	0	0.1	22.08	37.34	1028.3
T11	Brine + Moderate SE	13.98	9.00	0	0.1	23.08	35.76	1027.1
T12	Brine + High SE	13.98	10.00	0	0.1	24.08	34.30	1025.9
T13	Brine + High SE	13.98	15.00	0	0.1	29.08	28.54	1021.2
T14	Brine + High SE	13.98	19.78	0	0.1	33.86	24.63	1018.1
T15	High Brine only	16.31	0.00	0	0.1	16.41	58.12	1045.1
T16	High Brine + Low SE	16.31	1.00	0	0.1	17.41	54.83	1042.5
T17	High Brine + Low SE	16.31	2.00	0	0.1	18.41	51.89	1040.1
T18	High Brine + Low SE	16.31	3.00	0	0.1	19.41	49.26	1038.0
T19	High Brine + Low SE	16.31	4.00	0	0.1	20.41	46.89	1036.1
T20	High Brine + Moderate SE	16.31	5.00	0	0.1	21.41	44.73	1034.3

Table 4. Modeled Discharge Scenarios – Variant

Case ID	Scenario	Constituent Flows (mgd)				Combined effluent		
		Brine	Secondary effluent	GWR	Hauled brine	Flow (mgd)	Salinity (ppt)	Density (kg/m^3)
V1	Brine only	8.99	0.00	0	0.0	8.99	58.23	1045.2
V2	Brine + Low SE	8.99	1.00	0	0.0	9.99	52.48	1040.6
V3	Brine + Low SE	8.99	2.00	0	0.0	10.99	47.78	1036.8
V4	Brine + Low SE	8.99	3.00	0	0.0	11.99	43.86	1033.6
V5	Brine + Low SE	8.99	4.00	0	0.0	12.99	40.55	1030.9
V6	Brine + Moderate SE	8.99	5.00	0	0.0	13.99	37.70	1028.6
V7	Brine + Moderate SE	8.99	5.80	0	0.0	14.79	35.71	1027.0
V8	Brine + Moderate SE	8.99	7.00	0	0.0	15.99	33.09	1024.9
V9	Brine + High SE	8.99	14.00	0	0.0	22.99	23.26	1017.0
V10	Brine + High SE	8.99	19.78	0	0.0	28.77	18.75	1013.3
V11	GWR Only	0.00	0.00	1.17	0.0	1.17	5.80	1002.6
V12	Low SE + GWR	0.00	0.40	1.17	0.0	1.57	4.53	1001.6
V13	Low SE + GWR	0.00	3.00	1.17	0.0	4.17	2.20	999.9
V14	High SE + GWR	0.00	23.70	1.17	0.0	24.87	1.04	999.0
V15	High SE + GWR	0.00	24.70	1.17	0.0	25.87	1.03	999.0
V16	Brine + High GWR only	8.99	0.00	1.17	0.0	10.16	52.19	1040.3
V17	Brine + High GWR + Low SE	8.99	1.00	1.17	0.0	11.16	47.59	1036.6
V18	Brine + High GWR + Low SE	8.99	2.00	1.17	0.0	12.16	43.74	1033.5
V19	Brine + High GWR + Low SE	8.99	3.00	1.17	0.0	13.16	40.48	1030.9
V20	Brine + High GWR + Low SE	8.99	4.00	1.17	0.0	14.16	37.67	1028.6
V21	Brine + High GWR + Moderate SE	8.99	5.00	1.17	0.0	15.16	35.24	1026.6
V22	Brine + High GWR + Moderate SE	8.99	5.30	1.17	0.0	15.46	34.57	1026.1
V23	Brine + High GWR + Moderate SE	8.99	6.00	1.17	0.0	16.16	33.11	1024.9
V24	Brine + High GWR + Moderate SE	8.99	7.00	1.17	0.0	17.16	31.23	1023.4
V25	Brine + High GWR + High SE	8.99	11.00	1.17	0.0	21.16	25.48	1018.7
V26	Brine + High GWR + High SE	8.99	15.92	1.17	0.0	26.08	20.82	1015.0
V27	Brine + Low GWR only	8.99	0.00	0.94	0.0	9.93	53.27	1041.2
V28	Brine + Low GWR + Low SE	8.99	1.00	0.94	0.0	10.93	48.47	1037.3
V29	Brine + Low GWR + Low SE	8.99	3.00	0.94	0.0	12.93	41.09	1031.4
V30	Brine + Low GWR + Moderate SE	8.99	5.30	0.94	0.0	15.23	35.01	1026.4
V31	Brine + Low GWR + High SE	8.99	15.92	0.94	0.0	25.85	20.95	1015.1
V32	High Brine only	11.24	0.00	0.00	0.0	11.24	58.23	1045.2
V33	High Brine + Low SE	11.24	0.50	0.00	0.0	11.74	55.78	1043.3
V34	High Brine + Low SE	11.24	1.00	0.00	0.0	12.24	53.54	1041.4
V35	High Brine + Low SE	11.24	2.00	0.00	0.0	13.24	49.55	1038.2
V36	High Brine + Low SE	11.24	3.00	0.00	0.0	14.24	46.13	1035.5
V37	High Brine + Low SE	11.24	4.00	0.00	0.0	15.24	43.16	1033.0
V38	High Brine + Moderate (5) SE	11.24	5.00	0.00	0.0	16.24	40.55	1030.9
V39	High Brine + GWR only	11.24	0.00	1.17	0.0	12.41	53.29	1041.2
V40	High Brine + GWR + Low SE	11.24	0.50	1.17	0.0	12.91	51.25	1039.6
V41	High Brine + GWR + Low SE	11.24	1.00	1.17	0.0	13.41	49.37	1038.0
V42	High Brine + GWR + Low SE	11.24	2.00	1.17	0.0	14.41	46.00	1035.3
V43	High Brine + GWR + Low SE	11.24	3.00	1.17	0.0	15.41	43.07	1033.0
V44	High Brine + GWR + Low SE	11.24	4.00	1.17	0.0	16.41	40.49	1030.9
V45	High Brine + GWR + Moderate SE	11.24	5.00	1.17	0.0	17.41	38.21	1029.0

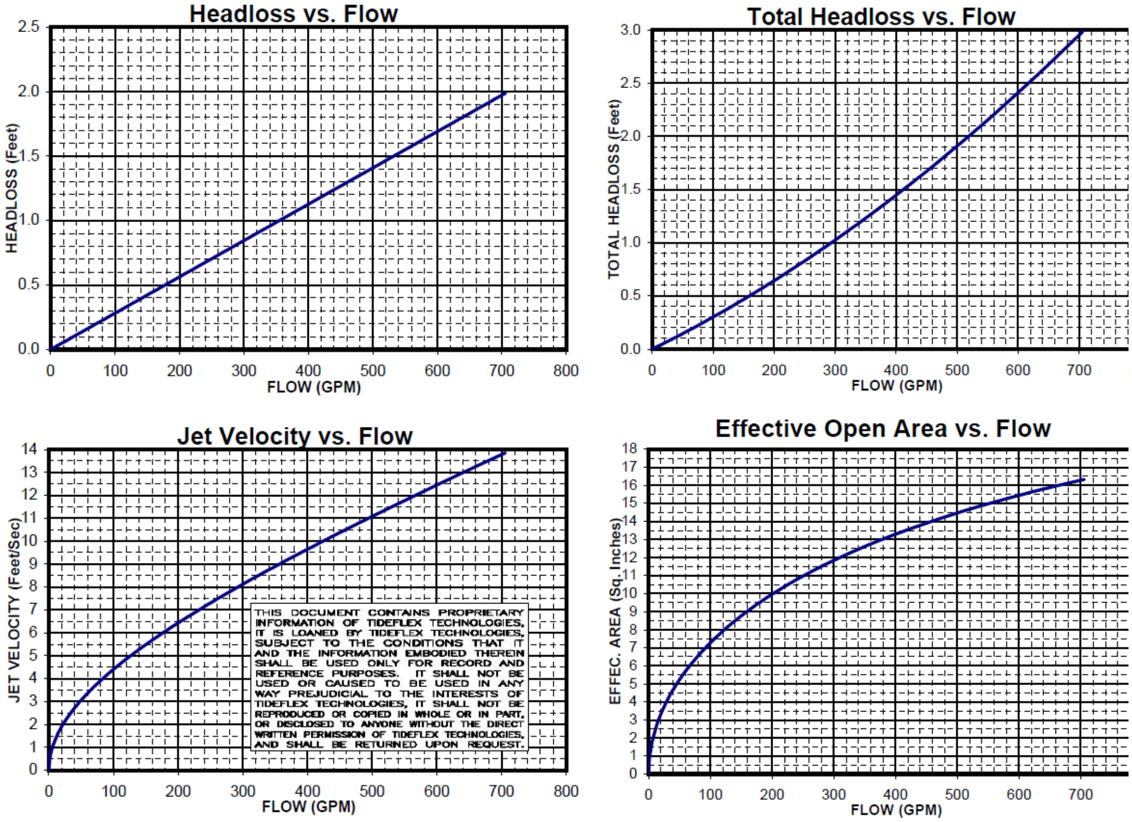
3. OUTFALL HYDRAULICS

3.1 Introduction

The outfall and diffuser is described in Roberts (2016) (see Figure 1 in that report) as follows:

The Monterey Regional Water Pollution Control Agency (MRWPCA) outfall at Marina 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 hydraulic characteristics of the four-inch valves and the procedure to compute the flow distribution in the diffuser with the end gate opening was detailed in Roberts (2016) Appendix A.

It is proposed to replace the end gate opening with a Tideflex check valve. A suitable valve is a 6 inch Tideflex check valve, Hydraulic Code 355. The hydraulic characteristics of this valve are shown in Figure 2.



THIS DOCUMENT CONTAINS PROPRIETARY INFORMATION OF TIDEFLEX TECHNOLOGIES, IT IS LOANED BY TIDEFLEX TECHNOLOGIES, SUBJECT TO THE CONDITIONS THAT IT AND THE INFORMATION EMBODIED THEREIN SHALL BE USED ONLY FOR RECORD AND REFERENCE PURPOSES. IT SHALL NOT BE USED OR CAUSED TO BE USED IN ANY WAY PREJUDICIAL TO THE INTERESTS OF TIDEFLEX TECHNOLOGIES, IT SHALL NOT BE REPRODUCED OR COPIED IN WHOLE OR IN PART, OR DISCLOSED TO ANYONE WITHOUT THE DIRECT WRITTEN PERMISSION OF TIDEFLEX TECHNOLOGIES, AND SHALL BE RETURNED UPON REQUEST.

Figure 2. Characteristics of 6-inch TideFlex check valve Hydraulic Code 355.

The same methodology to compute the internal hydraulics as outlined in Roberts (2016) was used. For the purposes of the hydraulic computations, the relationship between the total head loss across the valve, E' and the flow Q of Figure 2 was approximated by:

$$Q = -28.24E'^2 + 319.8E' \tag{1}$$

The calculation procedure followed that in Roberts (2016) except that the open end gate relationship was replaced by Eq. 1.

Typical flow variations with and without the end gate valve are shown in Figure 3. This shows Case T1, mostly secondary effluent with a total flow of 19.88 mgd, density 999.0 kg/m3, and case T2, almost pure brine with a flow of 14.08 mgd, density 1045.1 kg/m3. The flow distributions with and without the Tideflex valve are virtually indistinguishable. The flow exiting from the end gate is reduced slightly from 4% to 3% of the total for T1 and from 5% to 4% for T2. The velocity from the end gate is increased significantly by the check valve, from 6.7 to 10.7 ft/s for T1 and from 6.1 to 9.7 ft/s for T2. The additional total head loss through the outfall due to the check valve is negligible, about 0.01 ft.

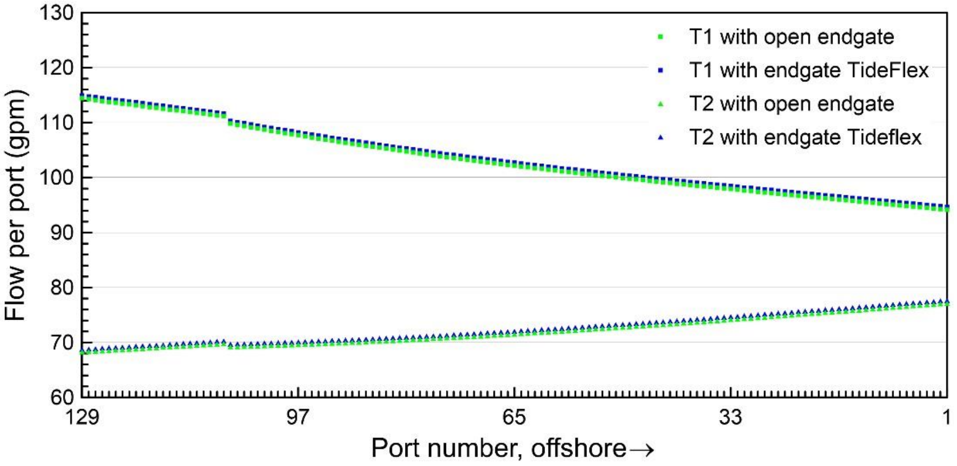


Figure 3. Typical port flow distributions with and without the endgate check valve for cases T1 and T2.

3.2 Effect of End Gate Valve on Dilution

The end gate check valve decreases the flow from the end gate and increases the flow from the two-inch ports. The dilution calculations later in this report assume the check valve is in place. To assess the effect of the valve on dilution from the main diffuser, dilutions were calculated for cases T1 and T2.

For T1, the total flow through the two-inch ports increased from 19.1 to 19.2 mgd (0.5%) and the port diameter increased from 2.00 to 2.01 inches. This had no effect on dilution (when rounded to a whole number).

For T2, the total flow through the two-inch ports increased from 13.4 to 13.5 mgd (0.8%) and the port diameter was unchanged at 1.84 inches. This had no effect on dilution (when rounded to a whole number).

4. DENSE DISCHARGE DILUTION

4.1 Introduction

The calculation procedure was similar to that in Roberts (2016), where dilutions were predicted by two methods. First was the semi-empirical equation due to Cederwall (1968) (Eq. 3 in Roberts, 2016):

$$\frac{S_i}{F_j} = 0.54\left(0.66 + 0.38\frac{z}{dF_j}\right)^{5/3} \tag{2}$$

where S_i is the impact dilution, F_j the jet densimetric Froude number, and z the height of the nozzle above the seabed. Second, the dilution and trajectories of the jets were predicted by UM3, a Lagrangian entrainment model in the mathematical modeling suite Visual Plumes (Frick et al. 2003, Frick 2004, and Frick and Roberts 2016).

First, the internal hydraulics program was run to determine the flow variation along the diffuser. Dilutions were then computed for the flow and equivalent nozzle diameter for the innermost and outermost nozzles and the lowest dilution chosen. Worst-case oceanic conditions were assumed, which corresponds to the lowest oceanic density, the “Davidson” condition (Table 1), i.e. salinity = 33.34 ppt, density = 1024.8 kg/m^3.

4.2 Results

The results for the Project scenarios (Table 3) are summarized in Table 5, and for the Variant (Table 4) in Table 6. For large density differences, the Cederwall equation gives the lowest dilutions but as the effluent density approaches the ambient density, UM3 gives lower dilutions. To be conservative, the lowest of the two model predictions was chosen, as shown in last columns of Tables 5 and 6. The increase in dilution from the impact point to the edge of the BMZ was assumed to be 20% as discussed in Roberts (2016).

All dense discharges meet the Ocean Plan requirement of a 2 ppt increment in salinity at the edge of the BMZ.

Table 5. Summary of Dilution Simulations for Dense Effluent Scenarios – Project (no GWR)

Case ID	Effluent conditions			Port conditions				Predictions						
								Cederwall	UM3		At impact (ZID)		At BMZ	
	Flow (mgd)	Salinity (ppt)	Density (kg/m^3)	Flow (gpm)	Diam. (inch)	Velocity (ft/s)	Froude no.	Dilution	Dilution	Distance (ft)	Dilution	Salinity increment (ppt)	Dilution	Salinity increment (ppt
T2	14.08	58.10	1045.1	77.8	1.88	9.0	28.5	15.4	16.2	10.2	15.4	1.61	18.5	1.34
T3	15.08	54.30	1042.0	82.8	1.91	9.3	31.6	16.0	16.1	10.4	16.0	1.31	19.2	1.09
T4	16.08	50.97	1039.4	80.8	1.89	9.2	34.5	16.8	17.6	11.6	16.8	1.05	20.1	0.88
T5	17.08	48.04	1037.0	86.2	1.92	9.6	38.6	17.7	18.5	12.7	17.7	0.83	21.2	0.69
T6	18.08	45.42	1034.9	91.6	1.95	9.8	43.4	18.8	19.5	13.8	18.8	0.64	22.5	0.54
T7	19.08	43.08	1033.0	97.1	1.98	10.1	49.2	20.1	20.9	15.3	20.1	0.48	24.2	0.40
T8	20.08	40.98	1031.3	103.1	2.01	10.4	56.5	21.9	22.2	16.8	21.9	0.35	26.3	0.29
T9	21.08	39.07	1029.7	108.7	2.02	10.9	67.4	24.8	24.9	19.2	24.8	0.23	29.7	0.19
T10	22.08	37.34	1028.3	114.2	2.05	11.1	80.6	28.2	27.5	21.9	27.5	0.15	33.0	0.12
T11	23.08	35.76	1027.1	119.8	2.07	11.4	103.3	34.2	27.7	22.3	27.7	0.09	33.2	0.07
T12	24.08	34.30	1025.9	125.3	2.10	11.6	150.4	46.7	39.2	33.0	39.2	0.02	47.0	0.02
T15	16.41	58.12	1045.1	82.4	1.90	9.3	29.3	15.5	16.3	10.5	15.5	1.60	18.6	1.33
T16	17.41	54.83	1042.5	87.8	1.93	9.6	32.3	16.1	16.9	11.3	16.1	1.34	19.3	1.11
T17	18.41	51.89	1040.1	93.3	1.96	9.9	35.4	16.7	17.5	12.1	16.7	1.11	20.1	0.92
T18	19.41	49.26	1038.0	98.7	1.99	10.2	38.9	17.5	18.4	13.1	17.5	0.91	21.0	0.76
T19	20.41	46.89	1036.1	104.8	2.01	10.6	43.6	18.6	19.3	14.2	18.6	0.73	22.3	0.61
T20	21.41	44.73	1034.3	110.3	2.04	10.8	48.1	19.6	20.4	15.4	19.6	0.58	23.6	0.48

Table 6. Summary of Dilution Simulations for Dense Effluent Scenarios – Variant

Case	Effluent conditions			Port conditions				Predictions						
ID								Cederwall	UM3		At impact (ZID)		At BMZ	
	Flow (mgd)	Salinity (ppt)	Density (kg/m^3)	Flow (gpm)	Diam. (inch)	Velocity (ft/s)	Froude no.	Dilution	Dilution	Distance (ft)	Dilution	Salinity increment (ppt)	Dilution	Salinity increment (ppt)
V1	9.0	58.23	1045.2	51.6	1.68	7.5	23.9	15.7	16.0	8.6	15.7	1.59	18.8	1.32
V2	10.0	52.48	1040.6	55.8	1.72	7.7	28.9	16.3	16.9	9.6	16.3	1.17	19.6	0.98
V3	11.0	47.78	1036.8	54.9	1.71	7.7	33.1	17.4	18.1	10.5	17.4	0.83	20.8	0.69
V4	12.0	43.86	1033.6	61.5	1.76	8.1	40.3	18.8	19.8	12.4	18.8	0.56	22.6	0.47
V5	13.0	40.55	1030.9	67.3	1.81	8.4	49.2	20.9	21.6	14.4	20.9	0.35	25.0	0.29
V6	14.0	37.70	1028.6	73.4	1.85	8.8	64.3	24.6	24.9	17.5	24.6	0.18	29.5	0.15
V7	14.8	35.71	1027.0	76.8	1.87	9.0	86.0	30.3	29.4	21.4	29.4	0.08	35.3	0.07
V8	16.0	33.09	1024.9	76.3	1.87	8.9	382.9	110.2	67.6	51.4	67.6	0.00	81.1	0.00
V16	10.2	52.19	1040.3	56.8	1.72	7.8	29.7	16.5	17.3	9.9	16.5	1.14	19.8	0.95
V17	11.2	47.59	1036.6	56.1	1.72	7.8	33.6	17.4	18.3	10.8	17.4	0.82	20.9	0.68
V18	12.2	43.74	1033.5	63.5	1.79	8.1	40.1	18.7	19.3	12.3	18.7	0.56	22.4	0.46
V19	13.2	40.48	1030.9	68.3	1.81	8.5	50.3	21.1	21.8	14.5	21.1	0.34	25.4	0.28
V20	14.2	37.67	1028.6	73.8	1.85	8.8	65.0	24.8	24.9	17.5	24.8	0.17	29.8	0.15
V21	15.2	35.24	1026.6	80.9	1.89	9.3	97.2	33.2	31.7	23.5	31.7	0.06	38.0	0.05
V22	15.5	34.57	1026.1	79.8	1.89	9.1	114.2	37.7	34.3	25.6	34.3	0.04	41.2	0.03
V23	16.2	33.11	1024.9	83.3	1.91	9.3	395.8	113.5	68.5	53.5	68.5	0.00	82.2	0.00
V27	9.9	53.27	1041.2	55.3	1.71	7.7	28.5	16.3	16.9	9.5	16.3	1.22	19.6	1.02

Table 6. Summary of Dilution Simulations for Dense Effluent Scenarios – Variant

Case ID	Effluent conditions			Port conditions				Predictions						
								Cederwall	UM3		At impact (ZID)		At BMZ	
	Flow (mgd)	Salinity (ppt)	Density (kg/m^3)	Flow (gpm)	Diam. (inch)	Velocity (ft/s)	Froude no.	Dilution	Dilution	Distance (ft)	Dilution	Salinity increment (ppt)	Dilution	Salinity increment (ppt)
V28	10.9	48.47	1037.3	59.3	1.75	7.9	33.1	17.1	17.8	10.7	17.1	0.88	20.6	0.74
V29	12.9	41.09	1031.4	67.0	1.80	8.5	48.1	20.6	21.1	13.9	20.6	0.38	24.7	0.31
V30	15.2	35.01	1026.4	78.3	1.88	9.1	100.6	34.1	32.6	24.1	32.6	0.05	39.1	0.04
V32	11.2	58.23	1045.2	63.3	1.78	8.2	26.5	15.4	16.1	9.3	15.4	1.61	18.5	1.34
V33	11.7	55.78	1043.3	57.1	1.73	7.8	27.0	15.8	16.5	9.2	15.8	1.42	19.0	1.18
V34	12.2	53.54	1041.4	67.3	1.81	8.4	29.9	16.1	16.8	10.3	16.1	1.26	19.3	1.05
V35	13.2	49.55	1038.2	66.4	1.80	8.4	33.3	16.9	17.8	11.0	16.9	0.96	20.3	0.80
V36	14.2	46.13	1035.5	72.7	1.84	8.8	38.8	18.1	19.0	12.4	18.1	0.71	21.7	0.59
V37	15.2	43.16	1033.0	78.9	1.88	9.1	45.3	19.6	20.3	13.9	19.6	0.50	23.5	0.42
V38	16.2	40.55	1030.9	85.0	1.92	9.4	53.7	21.5	22.0	15.8	21.5	0.33	25.9	0.28
V39	12.4	53.29	1041.2	61.5	1.76	8.1	29.5	16.2	17.0	10.0	16.2	1.23	19.5	1.02
V40	12.9	51.25	1039.6	64.5	1.79	8.2	31.3	16.5	17.3	10.5	16.5	1.09	19.8	0.91
V41	13.4	49.37	1038.0	67.6	1.81	8.4	33.7	17.0	17.8	11.1	17.0	0.95	20.4	0.79
V42	14.4	46.00	1035.3	73.9	1.85	8.8	39.1	18.1	18.8	12.4	18.1	0.70	21.7	0.58
V43	15.4	43.07	1033.0	80.0	1.89	9.2	45.6	19.6	20.2	14.0	19.6	0.50	23.5	0.41
V44	16.4	40.49	1030.9	85.8	1.92	9.5	54.4	21.7	22.3	16.0	21.8	0.33	26.1	0.27
V45	17.4	38.21	1029.0	90.3	1.95	9.7	66.0	24.7	24.7	18.4	24.7	0.20	29.6	0.16

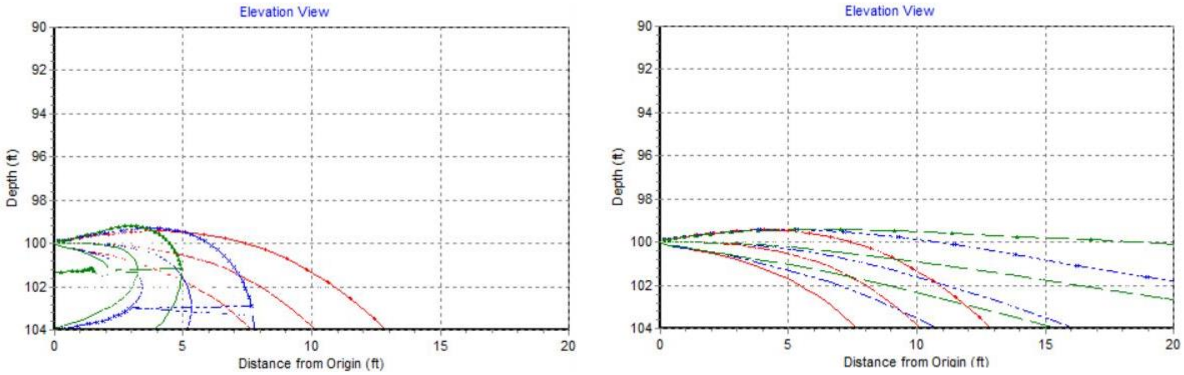
4.3 Effect of Currents

The effect of currents on the dynamics of dense jets has been questioned. All simulations have been done with zero current speed, as this is usually the worst case that results in lowest dilutions. According to the Research Activity Panel of the Monterey Bay National Marine Sanctuary, currents in the vicinity of the diffuser are commonly 5 to 10 cm/s and can reach 20 cm/s.

The effect of currents on dense jets is determined by the dimensionless parameter u_rF_j (Gungor and Roberts 2009) where $u_r = u_a/u$ is the ratio of the ambient current speed, u_a, to the jet velocity, u. If $u_rF_j \ll 1$ the current does not significantly affect the jet; if $u_rF_j \gg 1$ the jet will be significantly deflected by the current and dilution increases significantly. Gungor and Roberts (2009) investigated the effects of currents on vertical dense jets; experiments on multiport diffusers with 60° nozzles were reported by Abessi and Roberts (2017).

There are no known experiments on horizontal dense jets in flowing currents so we investigated the phenomenon using the UM3 model in Visual Plumes. We simulated the pure brine case, T2 (Table 3) at current speeds of zero, 5, 10, and 20 cm/s. Because of the orientation of the MRWPCA diffuser (see Figure 1 of Roberts 2016) the predominant current direction is expected to be perpendicular to the diffuser axis. The nozzles are perpendicular to the diffuser, so the current direction relative to the individual jets is either counter-flow (jets directly opposing the current), or co-flow (jets in the same direction as the currents.

UM3 was run for all cases. Screen shots of the jet trajectories for counter- and co-flowing jets are shown in Figure 4.



a) Counter-flow **b) Co-flow**

Figure 4. Screen shots of UM3 simulations of dense jet trajectories (Case T2) in counter- and co-flowing currents. Red: zero current; Blue: 10 cm/s; Green: 20 cm/s.

In counter flowing currents, the jets are bent backwards and impact the seabed closer to the diffuser. In co-flowing currents, the jets are advected downstream and impact the seabed farther from the diffuser. The numerical results are summarized in Table 7.

Table 7. UM3 Simulations of Case T2 with Current

Current	Counter-flow		Co-flow	
Speed (cm/s)	Dilution	Impact distance (ft)	Dilution	Impact distance (ft)
0	16.2	10	16.2	10
5	17.3	8	22.6	13
10	18.9	5	38.4	16
20	32.6	0	78.0	27

It can be seen that the effect of the currents is to increase dilution compared to the zero current case. The maximum impact distance from the diffuser occurs with co-flowing currents and increases as the current speed increases. In this case, the maximum impact distance (for u_a = 20 cm/s) is 27 ft (8.2 m). Clearly, this is much less than the distance to the edge of the BMZ (100 m) so we conclude that neglecting the effect of currents is indeed conservative, and the Ocean Plan regulations will be met for all anticipated currents.

4.4 Dilution of End Gate Check Valve

As discussed in Section 3, it has been proposed to replace the opening in the end gate with a 6-inch Tideflex check valve. We simulated the dilution of this valve for various nozzle angles for the worst case of pure brine, T2 (Table 3). The flow distributions along the diffuser for this case were shown in Figure 3. The exit velocity from the end gate check valve is 9.7 ft/s and the equivalent round diameter is 4.1 inches, yielding a densimetric Froude number, F_j = 20.7.

The effect of nozzle angle on the dilution of dense jets is discussed in Section 6.2. Using Figure 6, the impact dilutions for various angles were calculated. The results are summarized in Table 8.

The corresponding dilution for the main diffuser nozzles is 15.4 (Table 5). It is therefore apparent that any nozzle angle greater than about 20° will result in dilutions greater than the main diffuser and will meet the BMZ requirements. Dilution is maximized for a 60° nozzle.

Table 8. Effect of Nozzle Angle on Impact Dilution for Flow from End Gate Check Valve for Case T2 (14.08 mgd, 1045.1 kg/m^3).

Nozzle angle (Degrees)	Impact dilution
0	8.9
10	12.3
20	18.9
30	25.6
40	31.6
50	35.7
60	36.9

5. BUOYANT DISCHARGE DILUTION

5.1 Introduction

The same procedures and models discussed in Roberts (2016) were used except that all three seasonal profiles were used for each flow scenario to determine the worst-case condition. Inspection of Tables 3 and 4 show that there are 14 cases of buoyant discharges, i.e., the effluent density is less than the receiving water density. Three are for the Project and 11 for the Variant. Two models in the US EPA modeling suite Visual Plumes were used: NRFIELD and UM3. Zero current speed was assumed in all cases.

5.2 Results

The following procedure was used: The internal hydraulics program was first run for each scenario and the average diameter and flow for each nozzle was obtained. UM3 and NRFIELD were then run for each oceanic season.

As was observed in Roberts (2016), for very buoyant cases, the average dilution predicted by UM3 is close to the minimum (centerline) dilution predicted by NRFIELD. They diverge as the effluent becomes only slightly buoyant (i.e. the effluent density approaches the ambient density), with UM3 dilutions being considerably higher.

NRFIELD is based on experiments conducted for parameters typical of domestic wastewater discharges into coastal waters and estuaries. For this situation, dilution and mixing are mainly dependent on the source buoyancy flux with momentum flux playing a minor role. As the effluent density approaches the background density, buoyancy becomes less important and the mixing becomes dominated by momentum. In that situation, NRFIELD continues to give predictions but issues a warning that “The results are extrapolated” when the parameters are outside the range of the original experiments. Table 9 summarizes the results; NRFIELD predictions are only given when they fall within the experimental range on which it is based.

The plume behavior depends strongly on the shape of the density profile (Figure 1) but dilutions are generally very high. The Upwelling profile always gives deepest submergence and lowest dilutions. The plumes are always submerged with the Upwelling and Oceanic profiles but some plumes surface with the weak Davidson stratification. Dilutions are very high for surfacing plumes, up to 842 (Case V12) when the flow is very low.

Table 9. Summary of Dilution Simulations for Buoyant Effluent Scenarios – Project and Variant

Case ID	Season	Effluent conditions			Port conditions				UM3 simulations		NRFIELD simulations		
		Flow (mgd)	Salinity (ppt)	Density (kg/m^3)	Flow (gpm)	Diam. (inch)	Velocity (ft/s)	Froude no.	Average dilution	Rise height (centerline) (ft)	Minimum dilution	Rise height (centerline) (ft)	Rise height (top) (ft)
T1	Upwelling	19.88	1.00	999.0	103.7	2.01	10.5	27.9	188	57	179	41	57
	Davidson								327	100	349	100	100
	Oceanic								239	80	238	50	72
T13	Upwelling	29.08	28.54	1021.2	151.6	2.18	13.0	80.6	93	28			
	Davidson								127	57			
	Oceanic								94	27			
T14	Upwelling	33.86	24.63	1018.1	176.4	2.25	14.2	66.7	99	36			
	Davidson								147	76			
	Oceanic								104	41			
V9	Upwelling	22.99	23.26	1017.0	119.6	2.10	11.1	50.3	110	37			
	Davidson								172	75			
	Oceanic								116	42			
V10	Upwelling	28.77	18.75	1013.3	149.9	2.18	12.9	48.3	118	44	100	39	41
	Davidson								202	96	215	97	100
	Oceanic								132	58	134	57	59
V11	Upwelling	1.17	5.80	1002.6	6.5	0.71	5.3	25.4	495	30			
	Davidson								974	48			
	Oceanic								549	35			
V12	Upwelling	1.57	4.53	1001.6	8.4	0.81	5.2	23.1	457	31	385	25	32
	Davidson								842	50	652	33	45
	Oceanic								520	37	460	28	36

Table 9. Summary of Dilution Simulations for Buoyant Effluent Scenarios – Project and Variant

Case ID	Season	Effluent conditions			Port conditions				UM3 simulations		NRFIELD simulations		
		Flow (mgd)	Salinity (ppt)	Density (kg/m^3)	Flow (gpm)	Diam. (inch)	Velocity (ft/s)	Froude no.	Average dilution	Rise height (centerline) (ft)	Minimum dilution	Rise height (centerline) (ft)	Rise height (top) (ft)
V13	Upwelling	4.17	2.20	999.9	21.7	1.24	5.8	19.9	324	39	301	30	40
	Davidson								547	66	687	51	74
	Oceanic								376	47	378	35	47
V14	Upwelling	24.87	1.04	999.0	129.6	2.11	11.9	30.9	174	60	165	56	59
	Davidson								290	100	301	67	100
	Oceanic								223	86	235	55	81
V15	Upwelling	25.87	1.03	999.0	134.8	2.13	12.1	31.4	172	60	163	57	59
	Davidson								281	100	293	67	100
	Oceanic								221	87	232	56	82
V24	Upwelling	17.16	31.23	1023.4	89.3	1.94	9.7	87.3	91	20			
	Davidson								131	46			
	Oceanic								91	18			
V25	Upwelling	21.16	25.48	1018.7	109.8	2.03	10.9	56.2	107	33			
	Davidson								159	65			
	Oceanic								111	37			
V26	Upwelling	26.08	20.82	1015.0	135.6	2.13	12.2	49.7	115	41			
	Davidson								191	89			
	Oceanic								124	49			
V31	Upwelling	25.85	20.95	1015.1	134.4	2.13	12.1	49.5	115	41			
	Davidson								191	89			
	Oceanic								124	49			

6. Dilution Mitigation – Effect of Nozzle Angle

6.1 Introduction

Orienting the nozzles upwards from horizontal will increase the dilution of brine mixtures that are more dense than the receiving water. For buoyant effluents, it will decrease dilution slightly. In this section, we investigate the effect on dilution of varying nozzle orientations for dense and buoyant effluents.

6.2 Dense Effluents

The effect of nozzle angle on dense jets has been recently investigated by Abessi and Roberts (2015). Figure 5 shows central plane tracer concentrations (inverse of dilution) obtained by laser-induced fluorescence for dense jets with angles ranging from 15° to 85°. For very shallow angles, e.g. 15°, the jet impacts the bed quickly, reducing dilution. For steep angles, e.g. 85°, the trajectory is also truncated and the jet falls back on itself, which also reduces dilution.

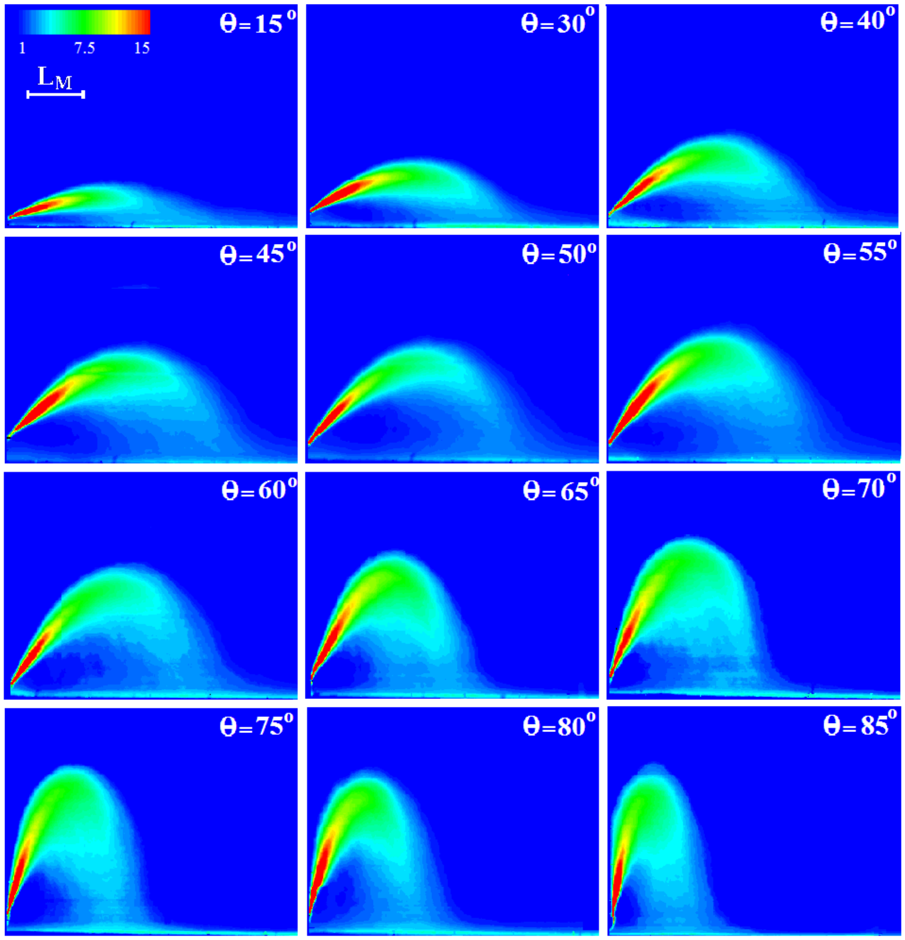


Figure 5. Central plane tracer concentrations for dense jets at various nozzle angles from 15° to 85°. After Abessi and Roberts (2015).

The optimum angle for dilution is 60°. This is illustrated by Figure 6, which shows the variation with nozzle angle on normalized impact dilution (S_i/F_j) and near field dilution (S_n/F_j) for single jets.

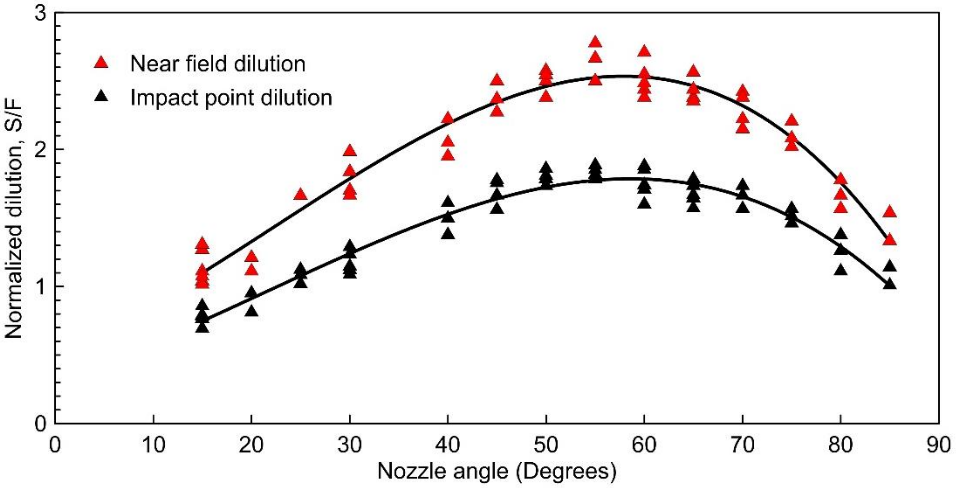


Figure 6. Effect of nozzle angle on normalized dilution of dense jets. After Abessi and Roberts (2015).

Impact dilutions were computed for the "worst-case" of brine only (T2, for conditions, see Table 3) using Figure 6. The results are tabulated in Table 10 and plotted in Figure 7. The effect of the height of the nozzle above the seabed, z, is determined by the dimensionless parameter z/dF_j, where d is the nozzle diameter. For Monterey, the nozzles are four feet above the seabed, so for case T2 we have $z/dF_j \approx 0.93$. The experiments of Abessi and Roberts were done with nozzles closer to the bed, with h/dF_j ranging from 0.12 to 0.39, so actual dilutions are expected to be higher than predicted in Table 10.

Dilution calculations with UM3 are also shown for completeness with other simulations. However, it is known that UM3 considerably underestimates dilutions for inclined jets (Palomar et al. 2012), therefore only the Abessi and Roberts results are used.

Table 10. Effect of Nozzle Angle on Dense Jets Case T2.
(for conditions, see Table 3)

Case ID	Nozzle angle	Dilution predictions			UM3	At impact		At BMZ	
		Cederwall	Abessi and Roberts (2015a)			Dilution	Salinity increment	Dilution	Salinity increment
	(deg)	Impact	Impact	Near field	Impact		(ppt)		(ppt)
T2	0	15.4	-	-	16.1	15.4	1.61	18.5	1.34
	10	-	16.9	25.2	18.7	16.9	1.47	20.3	1.22
	20	-	25.9	37.8	20.9	25.9	0.95	31.1	0.80
	30	-	35.3	50.8	22.8	35.3	0.70	42.3	0.59
	40	-	43.4	62.3	24.3	43.4	0.57	52.1	0.48
	50	-	49.0	70.0	24.5	49.0	0.50	58.9	0.42
	60	-	50.7	71.9	24.4	50.7	0.49	60.9	0.41

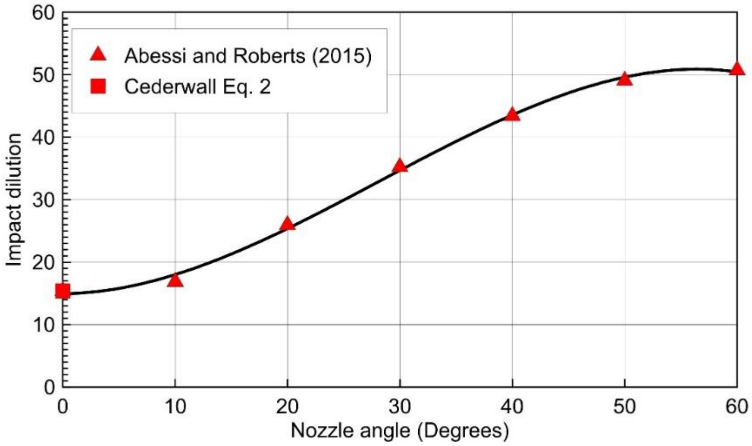


Figure 7. Effect of nozzle angle on dilution of dense jets, case T2.

Increasing the angle from horizontal (0°) to 60° increases dilution considerably, from 15 to 51. A 30° angle more than doubles the dilution compared to the horizontal jets.

The dilution at the BMZ is computed as 120% of the impact dilution. Note that in Table 10 the increase in dilution from the impact point to the end of the near field is more than 20%. This result, however, is for a single jet, and the increase for merged jets is less than this, and is conservatively assumed to be 20%, as explained in Roberts (2016).

6.3 Buoyant Effluents

Diffusers for buoyant effluents are usually designed with horizontal nozzles to maximize the length of the jet trajectory up to the terminal rise height, and therefore maximize dilution. Inclining the nozzles upwards will usually reduce dilution, although for very buoyant discharges in deep water the effect may be minimal. This is because the dynamics are then buoyancy dominated and the effect of momentum flux and therefore nozzle orientation is unimportant.

For very buoyant discharges, NRFIELD is the preferred model. NRFIELD, however, assumes the nozzles to be horizontal, so UM3 was used to assess the effect of nozzle orientation.

Simulations were run with UM3 for selected cases to bracket the expected results. The chosen cases were for the project scenarios (Table 3): T1 (mainly pure secondary effluent) and T13 (brine plus high secondary effluent). The latter case is only slightly buoyant and resulted in the lowest dilution of the buoyant cases. The simulations were run only for the oceanic conditions that gave the highest dilutions (Upwelling) and lowest dilutions (Davidson).

The results are summarized in Table 11 and plotted in Figure 8.

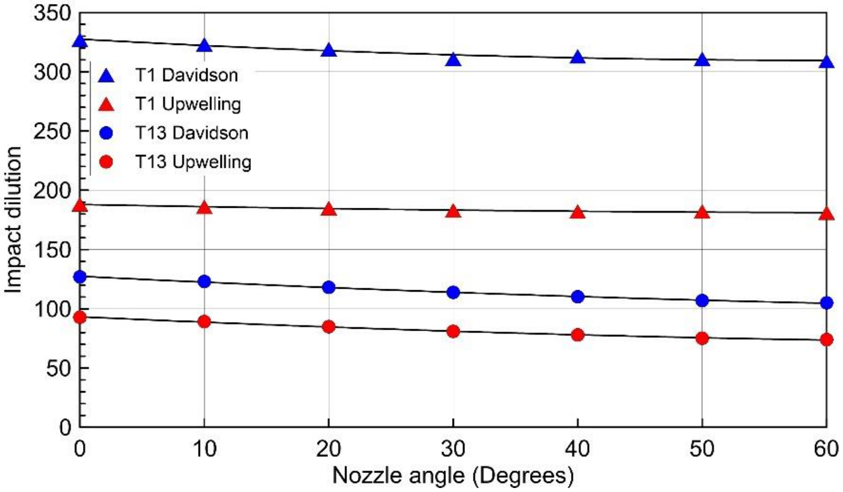


Figure 8. Effect of nozzle angle on dilution for selected buoyant discharge scenarios.

The results are insensitive to nozzle angle, especially for the very buoyant case of mainly pure secondary effluent (T1). Changing the nozzles from horizontal to 60° for the Davidson condition reduces dilution from 327 to 309, and for Upwelling condition from 188 to 181. For case T13 the corresponding reductions are from 127 to 105 and from 93 to 75. The percentage reductions for T13 are greater due to the increased effect of momentum flux, and therefore nozzle angle. More modest changes in orientation result in lesser effect; for a 30° nozzle the dilution reductions range from 3 to 13%.

Table 11. Effect of nozzle Angle on Dilution for Selected Buoyant Effluent Scenarios

Case ID	Oceanic Season	Effluent conditions			Nozzle angle	UM3 simulations	
		Flow (mgd)	Salinity (ppt)	Density	(deg)	Average dilution	Rise height (centerline) (ft)
T1	Upwelling	19.88	1.00	999.0	0	188	57
					10	186	58
					20	185	58
					30	183	59
					40	182	60
					50	182	61
					60	181	61
T1	Davidson	19.88	1.00	999.0	0	327	100
					10	323	100
					20	319	100
					30	311	100
					40	313	100
					50	311	100
					60	309	100
T13	Upwelling	29.08	28.54	1021.2	0	93	28
					10	89	29
					20	85	30
					30	81	31
					40	78	33
					50	75	35
					60	74	37
T13	Davidson	29.08	28.54	1021.2	0	127	57
					10	123	57
					20	118	57
					30	114	58
					40	110	60
					50	107	61
					60	105	63

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APPENDIX A. 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 B. ADDITIONAL SCENARIOS

In a memorandum from Trussell Technologies, Inc. dated July 21, 2017, dilution simulations for some additional scenarios were requested. They were contained in table 9 of that memo, which is reproduced below.

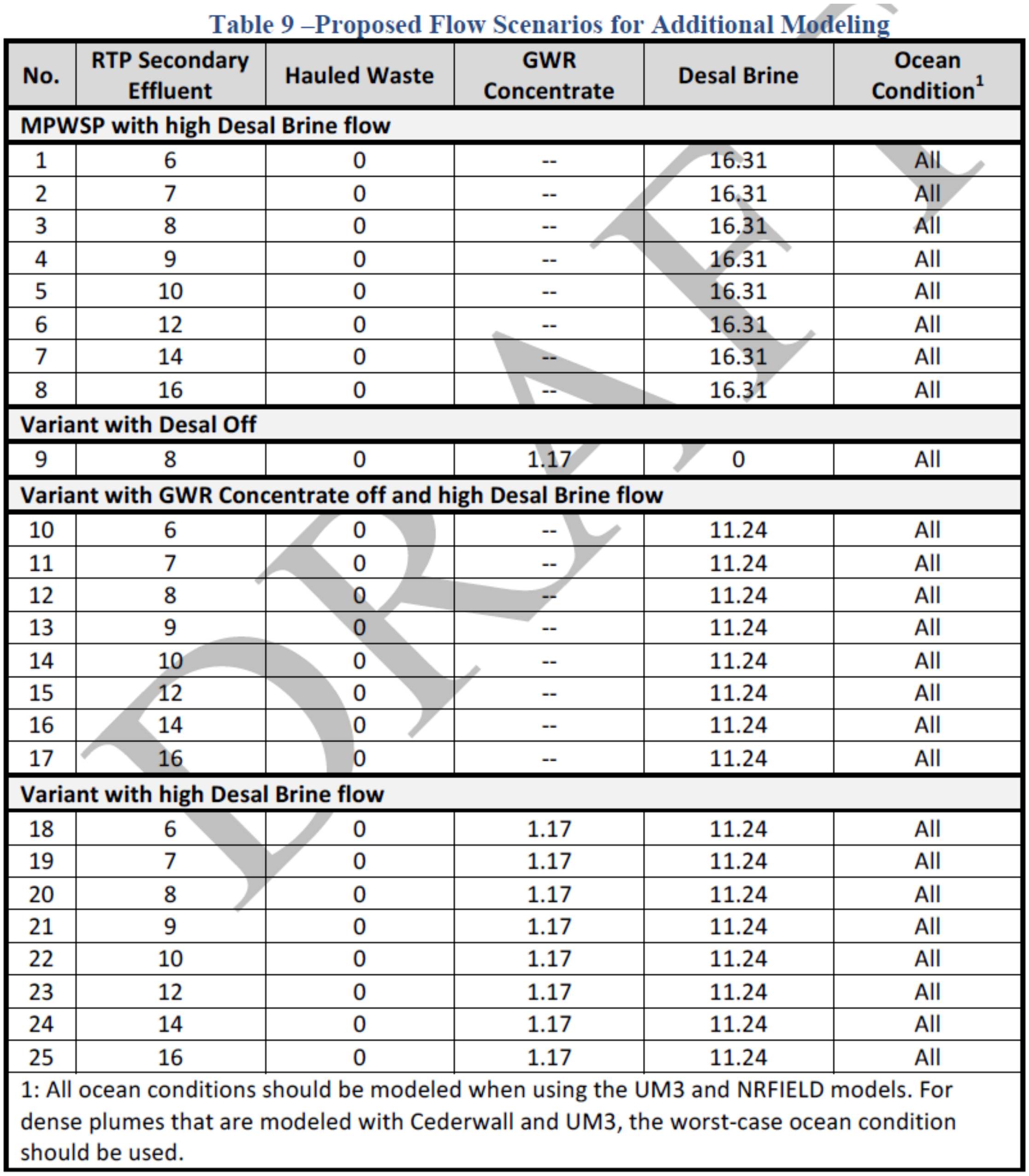

Table 9 –Proposed Flow Scenarios for Additional Modeling

No.	RTP Secondary Effluent	Hauled Waste	GWR Concentrate	Desal Brine	Ocean Condition[1]
MPWSP with high Desal Brine flow					
1	6	0	--	16.31	All
2	7	0	--	16.31	All
3	8	0	--	16.31	All
4	9	0	--	16.31	All
5	10	0	--	16.31	All
6	12	0	--	16.31	All
7	14	0	--	16.31	All
8	16	0	--	16.31	All
Variant with Desal Off					
9	8	0	1.17	0	All
Variant with GWR Concentrate off and high Desal Brine flow					
10	6	0	--	11.24	All
11	7	0	--	11.24	All
12	8	0	--	11.24	All
13	9	0	--	11.24	All
14	10	0	--	11.24	All
15	12	0	--	11.24	All
16	14	0	--	11.24	All
17	16	0	--	11.24	All
Variant with high Desal Brine flow					
18	6	0	1.17	11.24	All
19	7	0	1.17	11.24	All
20	8	0	1.17	11.24	All
21	9	0	1.17	11.24	All
22	10	0	1.17	11.24	All
23	12	0	1.17	11.24	All
24	14	0	1.17	11.24	All
25	16	0	1.17	11.24	All

1: All ocean conditions should be modeled when using the UM3 and NRFIELD models. For dense plumes that are modeled with Cederwall and UM3, the worst-case ocean condition should be used.

The flow conditions for these additional scenarios are summarized in Table B1. Dilutions were simulated according to the same procedures as outlined in Sections 4 and 5. The results for dense discharges are summarized in Table B2 and for buoyant discharges in Table B3.

Table B1. Additional Modeled Discharge Scenarios

Case ID	Scenario	Constituent flows (mgd)				Combined effluent		
		Brine	Secondary effluent	GWR	Hauled brine	Flow (mgd)	Salinity (ppt)	Density (kg/m^3)
AT1	MPWSP with high desal brine flow	16.31	6.00	0.00	0.0	22.31	42.78	1032.7
AT2		16.31	7.00	0.00	0.0	23.31	40.98	1031.3
AT3		16.31	8.00	0.00	0.0	24.31	39.33	1030.0
AT4		16.31	9.00	0.00	0.0	25.31	37.81	1028.7
AT5		16.31	10.00	0.00	0.0	26.31	36.40	1027.6
AT6		16.31	12.00	0.00	0.0	28.31	33.89	1025.6
AT7		16.31	14.00	0.00	0.0	30.31	31.70	1023.8
AT8		16.31	16.00	0.00	0.0	32.31	29.79	1022.2
AV9	Variant with desal off	0.00	8.00	1.17	0.0	9.17	1.44	999.3
AV10	Variant with GWR concentrate off and high desal brine flow	11.24	6.00	0.00	0.0	17.24	38.24	1029.1
AV11		11.24	7.00	0.00	0.0	18.24	36.19	1027.4
AV12		11.24	8.00	0.00	0.0	19.24	34.35	1025.9
AV13		11.24	9.00	0.00	0.0	20.24	32.69	1024.6
AV14		11.24	10.00	0.00	0.0	21.24	31.19	1023.4
AV15		11.24	12.00	0.00	0.0	23.24	28.58	1021.3
AV16		11.24	14.00	0.00	0.0	25.24	26.38	1019.5
AV17		11.24	16.00	0.00	0.0	27.24	24.50	1018.0
AV18	Variant with high desal brine flow	11.24	6.00	1.17	0.0	18.41	36.18	1027.4
AV19		11.24	7.00	1.17	0.0	19.41	34.36	1025.9
AV20		11.24	8.00	1.17	0.0	20.41	32.71	1024.6
AV21		11.24	9.00	1.17	0.0	21.41	31.22	1023.4
AV22		11.24	10.00	1.17	0.0	22.41	29.87	1022.3
AV23		11.24	12.00	1.17	0.0	24.41	27.48	1020.4
AV24		11.24	14.00	1.17	0.0	26.41	25.46	1018.7
AV25		11.24	16.00	1.17	0.0	28.41	23.73	1017.3

Table B2. Summary of Dilution Simulations for Dense Additional Scenarios

Case ID	Effluent conditions			Port conditions				Predictions			At impact (ZID)		At BMZ	
	Flow (mgd)	Salinity (ppt)	Density (kg/m3)	Flow (gpm)	Diam. (inch)	Velocity (ft/s)	Froude no.	Dilution	Dilution	Impact distance (ft)	Dilution	Salinity increment (ppt)	Dilution	Salinity increment (ppt)
AT1	22.3	42.78	1032.7	116.0	2.06	11.2	57.9	22.1	21.4	16.6	21.4	0.42	25.7	0.35
AT2	23.3	40.98	1031.3	120.7	2.08	11.4	60.7	22.8	22.8	18.1	22.8	0.34	27.4	0.28
AT3	24.3	39.33	1030.0	125.5	2.10	11.6	69.2	25.0	24.5	19.8	24.5	0.24	29.4	0.20
AT4	25.3	37.81	1028.7	130.3	2.11	12.0	81.4	28.2	27.2	22.3	27.2	0.16	32.6	0.14
AT5	26.3	36.40	1027.6	135.1	2.13	12.2	97.8	32.5	30.2	25.3	30.2	0.10	36.2	0.08
AT6	28.3	33.89	1025.6	144.7	2.16	12.7	195.3	58.6	44.9	39.0	44.9	0.01	53.9	0.01
AV10	17.2	38.24	1029.1	89.4	1.94	9.7	66.0	24.7	24.6	18.2	24.6	0.20	29.5	0.17
AV11	18.2	36.19	1027.4	93.6	1.96	10.0	86.1	30.0	28.8	22.0	28.8	0.10	34.6	0.08
AV12	19.2	34.35	1025.9	98.4	1.99	10.2	133.0	42.4	37.4	29.7	37.4	0.03	44.9	0.02
AV18	18.4	36.18	1027.4	94.7	1.97	10.0	86.4	30.0	28.7	22.0	28.7	0.10	34.4	0.08
AV19	19.4	34.36	1025.9	99.5	1.99	10.3	135.0	42.9	37.6	29.8	37.6	0.03	45.1	0.02

Table B3. Summary of Dilution Simulations for Buoyant Additional Scenarios

Case ID	Season	Effluent conditions			Port conditions				UM3 simulations		NRFIELD simulations		
		Flow (mgd)	Salinity (ppt)	Density	Flow (gpm)	Diam. (inch)	Velocity (ft/s)	Froude no.	Average dilution	Rise height centerline (ft)	Minimum dilution	Rise height centerline (ft)	Rise height top (ft)
AT7	Upwelling	30.31	31.70	1023.8	157.8	2.20	13.3	123.3	88	19			
	Davidson								120	45			
	Oceanic								90	17			
AT8	Upwelling	32.31	29.79	1022.2	179.2	2.26	14.3	98.6	90	26			
	Davidson								118	53			
	Oceanic								88	23			
AV9	Upwelling	9.17	1.44	999.3	55.9	1.72	7.7	22.4	244	48	234	35	48
	Davidson								467	100	584	67	100
	Oceanic								309	66	315	42	60
AV13	Upwelling	20.24	32.69	1024.6	108.9	2.03	10.8	133.6	91	17			
	Davidson								100	15			
	Oceanic								138	41			
AV14	Upwelling	21.24	31.19	1023.4	114.9	2.06	11.1	96.5	88	20			
	Davidson								124	47			
	Oceanic								88	18			
AV15	Upwelling	23.24	28.58	1021.3	126.9	2.08	12.0	76.2	96	28			
	Davidson								133	55			
	Oceanic								95	26			
AV16	Upwelling	25.24	26.38	1019.5	138.7	2.11	12.7	68.1	100	32			
	Davidson								144	64			
	Oceanic								104	35			
AV17	Upwelling	27.24	24.50	1018.0	151.1	2.15	13.4	63.6	103	36			
	Davidson								155	73			
	Oceanic								109	41			

Table B3. Summary of Dilution Simulations for Buoyant Additional Scenarios

Case ID	Season	Effluent conditions			Port conditions				UM3 simulations		NRFIELD simulations		
		Flow (mgd)	Salinity (ppt)	Density	Flow (gpm)	Diam. (inch)	Velocity (ft/s)	Froude no.	Average dilution	Rise height centerline (ft)	Minimum dilution	Rise height centerline (ft)	Rise height top (ft)
AV20	Upwelling	20.41	32.71	1024.6	110.1	2.02	11.0	136.9	92	17			
	Davidson								139	41			
	Oceanic								101	15			
AV21	Upwelling	21.41	31.22	1023.4	116.1	2.02	11.6	102.6	91	20			
	Davidson								126	64			
	Oceanic								91	18			
AV22	Upwelling	22.41	29.87	1022.3	116.4	2.06	11.2	81.3	93	24			
	Davidson								128	51			
	Oceanic								90	21			
AV23	Upwelling	24.41	27.48	1020.4	134.0	2.10	12.4	71.8	98	30			
	Davidson								138	59			
	Oceanic								101	31			
AV24	Upwelling	26.41	25.46	1018.7	145.8	2.14	13.0	65.4	101	34			
	Davidson								149	68			
	Oceanic								106	38			
AV25	Upwelling	28.4	23.73	1017.3	157.6	2.17	13.7	62.3	105	37			
	Davidson								161	78			
	Oceanic								110	43			

APPENDIX C. EFFECT OF NOZZLE ANGLE ON DILUTION

In order to further investigate the effect of nozzle angle on dilution for various scenarios, additional model runs were undertaken for horizontal and 60° nozzles. Most were previously analyzed cases, whose flow properties are given in Tables 3 and 4. Table C1 summarizes the properties of the new cases.

Dilutions were simulated according to the same procedures as outlined in Sections 4 and 5. Table C2 summarizes the results for dense discharges. For the buoyant cases, only Upwelling and Davidson conditions were run to bracket the expected results. Because NRFIELD only allows for horizontal nozzles, only results for UM3 are shown in Table C3.

Table C1. Further Modeled Discharge Scenarios

Case ID	Scenario	Constituent flows (mgd)				Combined effluent		
		Brine	Secondary effluent	GWR	Hauled brine	Flow (mgd)	Salinity (ppt)	Density (kg/m^3)
1	GWR only	0.00	0.00	1.17	0.0	1.17	5.80	1002.6
5		0.00	0.40	1.17	0.0	1.57	4.53	1001.6
7		0.00	0.60	1.17	0.0	1.77	4.11	1001.3
12		0.00	2.00	1.17	0.0	3.17	2.65	1000.2
16		0.00	4.00	1.17	0.0	5.17	1.93	999.7
17		0.00	4.50	1.17	0.0	5.67	1.83	999.6
18		0.00	5.00	1.17	0.0	6.17	1.75	999.5
32		0.00	23.40	1.17	0.0	24.57	1.04	999.0
New	Variant with normal flows and GWR offline	8.99	10.00	0.00	0.0	18.99	27.99	1020.8
New2		8.99	6.50	1.17	0.0	16.66	32.14	1024.1
New3		8.99	7.00	1.17	0.0	17.16	31.23	1023.4

Table C2. Summary of Dilution Simulations for Dense Scenarios

		Effluent conditions			Port conditions				Impact dilution predictions			At impact (ZID)		AT BMZ	
Case ID	Nozzle angle (deg)	Flow (mgd)	Salinity (ppt)	Density (kg/m^3)	Flow (gpm)	Diam. (in.)	Velocity (ft/s)	Froude no.	Cederwall	Abessi & Roberts 2015a	UM3	Dilution	Salinity incr-ement (ppt)	Dilution	Salinity incr-ement (ppt)
T5	0	17.08	48.04	1037.0	86.2	1.92	9.6	38.6	17.7	-	18.5	17.7	0.83	21.2	0.69
	60	17.08	48.04	1037.0	86.2	1.92	9.6	38.6	-	68.9	-	68.9	0.21	82.6	0.18
T10	0	22.08	37.34	1028.3	114.2	2.05	11.1	80.6	28.2	-	27.5	27.5	0.15	33.0	0.12
	60	22.08	37.34	1028.3	114.2	2.05	11.1	80.6	-	143.7	-	143.7	0.03	172.4	0.02
T20	0	21.41	44.73	1034.3	110.3	2.04	10.8	48.1	19.6	-	20.4	19.6	0.58	23.6	0.48
	60	21.41	44.73	1034.3	110.3	2.04	10.8	48.1	-	85.7	-	85.7	0.13	102.8	0.11
AT6	0	28.31	33.89	1025.6	144.7	2.16	12.7	194.0	58.3	-	44.9	44.9	0.01	53.9	0.01
	60	28.31	33.89	1025.6	144.7	2.16	12.7	194.0	-	345.6	-	345.6	0.00	414.8	0.00
V2	0	9.99	52.48	1040.6	55.8	1.72	7.7	28.9	16.3	-	16.9	16.3	1.17	19.6	0.98
	60	9.99	52.48	1040.6	55.8	1.72	7.7	28.9	-	51.5	-	51.5	0.37	61.9	0.31
V4	0	11.99	43.86	1033.6	61.5	1.76	8.1	40.3	18.8	-	19.8	18.8	0.56	22.6	0.47
	60	11.99	43.86	1033.6	61.5	1.76	8.1	40.3	-	71.8	-	71.8	0.15	86.1	0.12
V6	0	13.99	37.70	1028.6	73.4	1.85	8.8	64.3	24.6	-	24.9	24.6	0.18	29.5	0.15
	60	13.99	37.70	1028.6	73.4	1.85	8.8	64.3	-	114.6	-	114.6	0.04	137.5	0.03
V8	0	15.99	33.09	1024.9	76.3	1.87	8.9	382.9	110.2	-	67.6	67.6	0.00	81.1	0.00
	60	15.99	33.09	1024.9	76.3	1.87	8.9	382.9	-	682.3	-	682.3	0.00	818.8	0.00
V16	0	10.16	52.19	1040.3	56.8	1.72	7.8	29.7	16.5	-	17.3	16.5	1.14	19.8	0.95
	60	10.16	52.19	1040.3	56.8	1.72	7.8	29.7	-	52.9	-	52.9	0.36	63.5	0.30
V17	0	11.16	47.59	1036.6	56.1	1.72	7.8	33.6	17.4	-	18.3	17.4	0.82	20.9	0.68
	60	11.16	47.59	1036.6	56.1	1.72	7.8	33.6	-	59.9	-	59.9	0.24	71.9	0.20
V19	0	13.16	40.48	1030.9	68.3	1.81	8.5	50.3	21.1	-	21.8	21.1	0.34	25.4	0.28
	60	13.16	40.48	1030.9	68.3	1.81	8.5	50.3	-	89.6	-	89.6	0.08	107.6	0.07
V22	0	15.46	34.57	1026.1	79.8	1.89	9.1	114.2	37.7	-	34.3	34.3	0.04	41.2	0.03
	60	15.46	34.57	1026.1	79.8	1.89	9.1	114.2	-	203.5	-	203.5	0.01	244.2	0.01
V23	0	16.16	33.11	1024.9	83.3	1.91	9.3	395.8	113.5	-	68.5	68.5	0.00	82.2	0.00
	60	16.16	33.11	1024.9	83.3	1.91	9.3	395.8	-	705.4	-	705.4	0.00	846.5	0.00

Table C2. Summary of Dilution Simulations for Dense Scenarios

		Effluent conditions			Port conditions				Impact dilution predictions			At impact (ZID)		AT BMZ	
Case ID	**Nozzle angle (deg)**	**Flow (mgd)**	**Salinity (ppt)**	**Density (kg/m^3)**	**Flow (gpm)**	**Diam. (in.)**	**Velocity (ft/s)**	**Froude no.**	**Cederwall**	**Abessi & Roberts 2015a**	**UM3**	**Dilution**	**Salinity incr-ement (ppt)**	**Dilution**	**Salinity incr-ement (ppt)**
V32	0	11.24	58.23	1045.2	63.3	1.78	8.2	26.5	15.4	-	16.1	15.4	1.61	18.5	1.34
	60	11.24	58.23	1045.2	63.3	1.78	8.2	26.5	-	47.2	-	47.2	0.53	56.6	0.44
V36	0	14.24	46.13	1035.5	72.7	1.84	8.8	38.8	18.1	-	19.0	18.1	0.71	21.7	0.59
	60	14.24	46.13	1035.5	72.7	1.84	8.8	38.8	-	69.1	-	69.1	0.19	82.9	0.15
AV10	0	17.24	38.24	1029.1	89.4	1.94	9.7	65.9	24.7	-	27.5	24.7	0.20	29.6	0.17
	60	17.24	38.24	1029.1	89.4	1.94	9.7	65.9	-	117.4	-	117.4	0.04	140.9	0.03
AV12	0	19.24	34.35	1025.9	98.4	1.99	10.2	132.4	42.2	-	37.4	37.4	0.03	44.9	0.02
	60	19.24	34.35	1025.9	98.4	1.99	10.2	132.4	-	235.9	-	235.9	0.00	283.1	0.00
V39	0	12.41	53.29	1041.2	61.5	1.76	8.1	29.5	16.2	-	17.0	16.2	1.23	19.5	1.02
	60	12.41	53.29	1041.2	61.5	1.76	8.1	29.5	-	52.6	-	52.6	0.38	63.1	0.32
V43	0	15.41	43.07	1033.0	80.0	1.89	9.2	45.6	19.6	-	20.2	19.6	0.50	23.5	0.41
	60	15.41	43.07	1033.0	80.0	1.89	9.2	45.6	-	81.2	-	81.2	0.12	97.5	0.10
V45	0	17.41	38.21	1029.0	90.3	1.95	9.7	66.0	24.7	-	18.4	18.4	0.26	22.1	0.22
	60	17.41	38.21	1029.0	90.3	1.95	9.7	66.0	-	117.7	-	117.7	0.04	141.2	0.03
AV19	0	19.41	34.36	1025.9	99.5	1.99	10.3	134.4	42.8	-	37.6	37.6	0.03	45.1	0.02
	60	19.41	34.36	1025.9	99.5	1.99	10.3	134.4	-	239.4	-	239.4	0.00	287.3	0.00

Table C3. Summary of Dilution Simulations for Buoyant Further Scenarios

Case ID	Season	Effluent conditions			Port conditions					UM3 simulations	
		Flow (mgd)	Salinity (ppt)	Density (kg/m^3)	Nozzle angle (deg)	Flow (gpm)	Diam. (inch)	Velocity (ft/s	Froude no.	Average dilution	Rise height (centerline) (ft)
New	Upwelling	18.99	27.99	1020.8	0	98.5	1.99	10.2	62.8	101	28
					60					82	34
	Davidson				0					145	55
					60					123	58
V25	Upwelling	21.16	25.48	1018.7	0	109.8	2.03	10.9	56.2	107	33
					60					91	39
	Davidson				0					159	65
					60					141	70
AV14	Upwelling	21.24	31.19	1023.4	0	114.9	2.06	11.1	96.5	88	20
					60					66	28
	Davidson				0					124	47
					60					94	49
AV21	Upwelling	21.41	31.22	1023.4	0	116.1	2.02	11.6	102.6	91	20
					60					68	30
	Davidson				0					126	64
					60					96	49
1	Upwelling	1.17	5.80	1002.6	0	6.8	0.71	5.5	26.6	499	29
					60					488	30
	Davidson				0					987	S
					60					949	S
5	Upwelling	1.57	4.53	1001.6	0	8.1	0.79	5.3	23.7	461	31
					60					447	32
	Davidson				0					853	50
					60					817	50
7	Upwelling	1.77	4.11	1001.3	0	9.3	0.85	5.3	22.6	443	32
					60					428	33
	Davidson				0					800	S
					60					768	S

Table C3. Summary of Dilution Simulations for Buoyant Further Scenarios

		Effluent conditions			Port conditions					UM3 simulations	
Case ID	**Season**	**Flow (mgd)**	**Salinity (ppt)**	**Density (kg/m^3)**	**Nozzle angle (deg)**	**Flow (gpm)**	**Diam. (inch)**	**Velocity (ft/s**	**Froude no.**	**Average dilution**	**Rise height (centerline) (ft)**
12	Upwelling	3.17	2.65	1000.2	0	16.5	1.11	5.5	20.1	359	36
					60					347	37
	Davidson				0					609	59
					60					586	59
16	Upwelling	5.17	1.93	999.7	0	26.9	1.35	6.0	19.9	300	51
					60					291	41
	Davidson				0					517	S
					60					507	S
17	Upwelling	5.67	1.83	999.6	0	29.6	1.40	6.2	19.9	290	S
					60					282	S
	Davidson				0					509	S
					60					504	S
18	Upwelling	6.17	1.75	999.5	0	32.3	1.44	6.4	20.2	282	S
					60					274	S
	Davidson				0					506	S
					60					510	S
32	Upwelling	24.57	1.04	999.0	0	128.0	2.10	11.9	30.9	175	S
					60					168	S
	Davidson				0					291	S
					60					276	S
New2	Upwelling	16.66	32.14	1024.1	0	86.1	1.92	9.5	103.5	92	18
					60					65	26
	Davidson				0					131	43
					60					95	46
New3	Upwelling	17.16	31.23	1023.4	0	89.0	1.94	9.7	87.0	91	20
					60					69	29
	Davidson				0					131	46
					60					102	48