APPENDIX D3

Ocean Plan Compliance Assessment

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DRAFT Revised Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant

Technical Memorandum
July 2016

Prepared for:

MRWPCA

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DRAFT Revised Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant

Technical Memorandum

Pure Water Monterey
A Groundwater Replenishment Project

July 2016

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Table of Contents

1 Introduction 2
1.1 Treatment through the Proposed CalAm Desalination Facility 3
1.2 Treatment through the RTP and Proposed AWT Facilities 3
1.3 California Ocean Plan 4
1.4 Future Ocean Discharges 5
1.5 Objective of Technical Memorandum 8
2 Methodology for Ocean Plan Compliance Assessment 8
2.1 Methodology for Determination of Discharge Water Quality 8
2.1.1 Secondary Effluent 10
2.1.2 Desalination Brine 10
2.1.3 Combined Ocean Discharge Concentrations 11
2.2 Ocean Modeling Methodology 12
2.2.1 Ocean Modeling Scenarios 13
2.2.2 Ocean Modeling Assumptions 17
3 Ocean Plan Compliance Results 17
3.1 Water Quality of Combined Discharge 17
3.2 Ocean Modeling Results 20
3.3 Ocean Plan Compliance Results 22
4 Conclusions 28
5 References 29
Appendix A 30
Appendix B 39

1 Introduction

In response to State Water Resources Control Board (SWRCB) Water Rights Orders WR 95-10 and WR 2009-0060, two proposed projects are in development on the Monterey Peninsula to provide potable water to offset pending reductions of Carmel River water diversions: (1) a seawater desalination project known as the **Monterey Peninsula Water Supply Project** (MPWSP), and (2) a groundwater replenishment project known as the **Pure Water Monterey Groundwater Replenishment Project** (GWR Project). The capacity of the MPWSP is dependent on whether the GWR Project is constructed.

If the GWR Project is not constructed, the MPWSP would entail California American Water ("CalAm") building a seawater desalination facility capable of producing 9.6 million gallons per day (mgd) of drinking water. In a variation of that project where the GWR Project is constructed, known as the **Monterey Peninsula Water Supply Project Variant** ("Variant"), CalAm would build a smaller desalination facility capable of producing 6.4 mgd of drinking water, and a partnership between the Monterey Peninsula Water Management District (MPWMD) and the Monterey Regional Water Pollution Control Agency (MRWPCA) would build an advanced water treatment facility ("AWT Facility") capable of producing up to 3,700 acre-feet per year (AFY) (3.3 mgd)[1] of highly purified recycled water to enable CalAm to extract 3,500 AFY (3.1 mgd) from the Seaside Groundwater Basin for delivery to their customers (the AWT Facility is part of the GWR Project).

The AWT Facility would purify secondary-treated wastewater (*i.e.*, secondary effluent) from MRWPCA's Regional Treatment Plant (RTP), and this highly purified recycled water would be injected into the Seaside Groundwater Basin and later extracted for municipal water supplies. Both the proposed desalination facility and the proposed AWT Facility would employ reverse osmosis (RO) membranes to purify the waters, and as a result, both projects would produce RO concentrate waste streams that would be disposed through the existing MRWPCA ocean outfall: the brine concentrate from the desalination facility ("Desal Brine"), and the RO concentrate from the AWT Facility ("GWR Concentrate").

The goal of this technical memorandum is to analyze whether the discharges from the proposed projects through the existing ocean outfall would impact marine water quality, and thus, human health, marine biological resources, or beneficial uses of the receiving waters. A similar assessment of the GWR Project on its own was previously performed (Trussell Technologies, 2015, see Appendix B), and so this document provides complementary information focused on the MPWSP and the Variant projects.

The original version of this document (Trussell Technologies, 2015b) and an addendum report to that document (Trussell Technologies, 2015c) were included in both the GWR Project Consolidated Final Environmental Impact Report (CFEIR) and the MPWSP draft Environmental Impact Report (EIR). This version has been updated to include new water quality data and flow

[1] One million gallons per day is equal to 1,121 acre-feet per year. The AWT Facility would be capable of producing up to 4 mgd of highly purified recycled water on a daily basis, but production would fluctuate throughout the year, such that the average annual production would be 3.3 mgd (3,700 AFY) in a non-drought year.

scenarios for the MPWSP and Variant to address data gaps noted in the original analyses (2015b and 2015c).

1.1 Treatment through the Proposed CalAm Desalination Facility

This section describes the proposed treatment train for the MPWSP and Variant desalination facility. Seawater from the Monterey Bay would be extracted through subsurface slant wells beneath the ocean floor and piped to a new CalAm-owned desalination facility. This facility would consist of granular media pressure filters, cartridge filters, a two-pass RO membrane system, RO product-water stabilization (for corrosion control), and disinfection (Figure 1). The RO process is expected to recover 42 percent of the influent seawater flow as product water, while the remainder of the concentrated influent water becomes the Desal Brine. The MPWSP and Variant product water (desalinated water) would be used for municipal drinking water, while the Desal Brine would be blended with (1) available RTP secondary effluent, (2) brine that is trucked and stored at the RTP, and (3) GWR Concentrate (for the Variant only), and discharged to the ocean through the existing MRWPCA ocean outfall. The volume of Desal Brine is dependent on the project size: 13.98 and 8.99 mgd for the MPWSP and Variant, respectively.

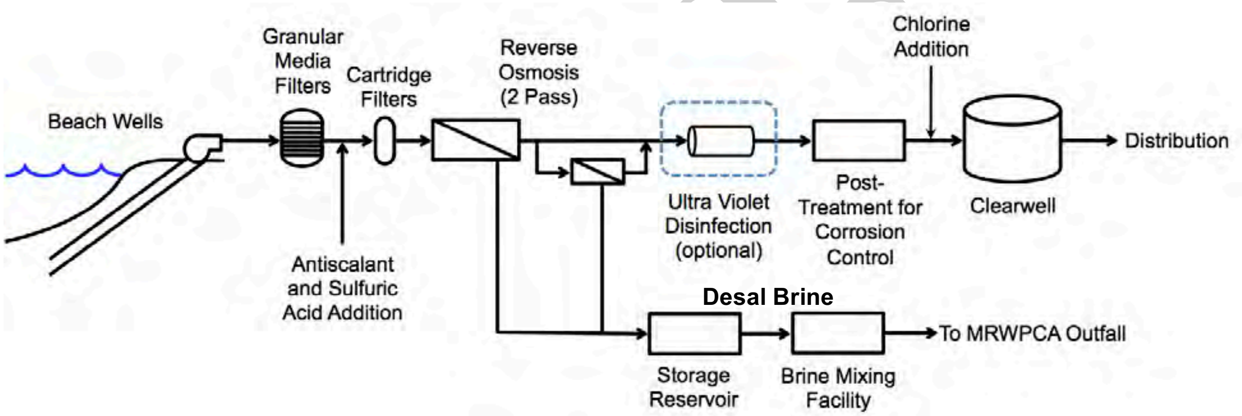

Figure 1 – Schematic of CalAm desalination facilities

1.2 Treatment through the RTP and Proposed AWT Facilities

The existing MRWPCA RTP treatment process includes screening, primary sedimentation, secondary biological treatment through trickling filters followed by a solids contactor (*i.e.*, bio-flocculation), and clarification (Figure 2). Much of the secondary effluent undergoes tertiary treatment (granular media filtration and disinfection) to produce recycled water used for agricultural irrigation. The unused secondary effluent is discharged to the Monterey Bay through the MRWPCA outfall. MRWPCA also accepts trucked brine waste for ocean disposal ("hauled brine"), which is stored in a pond and mixed with secondary effluent for disposal.

The proposed AWT Facility would include several advanced treatment technologies for purifying the secondary effluent: ozone (O_3), biologically active filtration (BAF) (this is an optional unit process), membrane filtration (MF), RO, and an advanced oxidation process (AOP) using ultraviolet light ("UV") and hydrogen peroxide. MRWPCA and the MPWMD conducted a pilot-scale study of the ozone, MF, and RO components of the AWT Facility from December 2013 through July 2014, successfully demonstrating the ability of the various treatment processes to produce highly purified recycled water that complies with the California

Groundwater Replenishment Water Recycling Criteria ("Groundwater Replenishment Regulations"),[2] the SWRCB's Anti-degradation and Recycled Water Policies,[3] and the Water Quality Control Plan for the Central Coastal Basin (Basin Plan)[4] standards, objectives and guidelines for groundwater. Water quality monitoring of the concentrate from the RO was also conducted during the pilot-scale study.

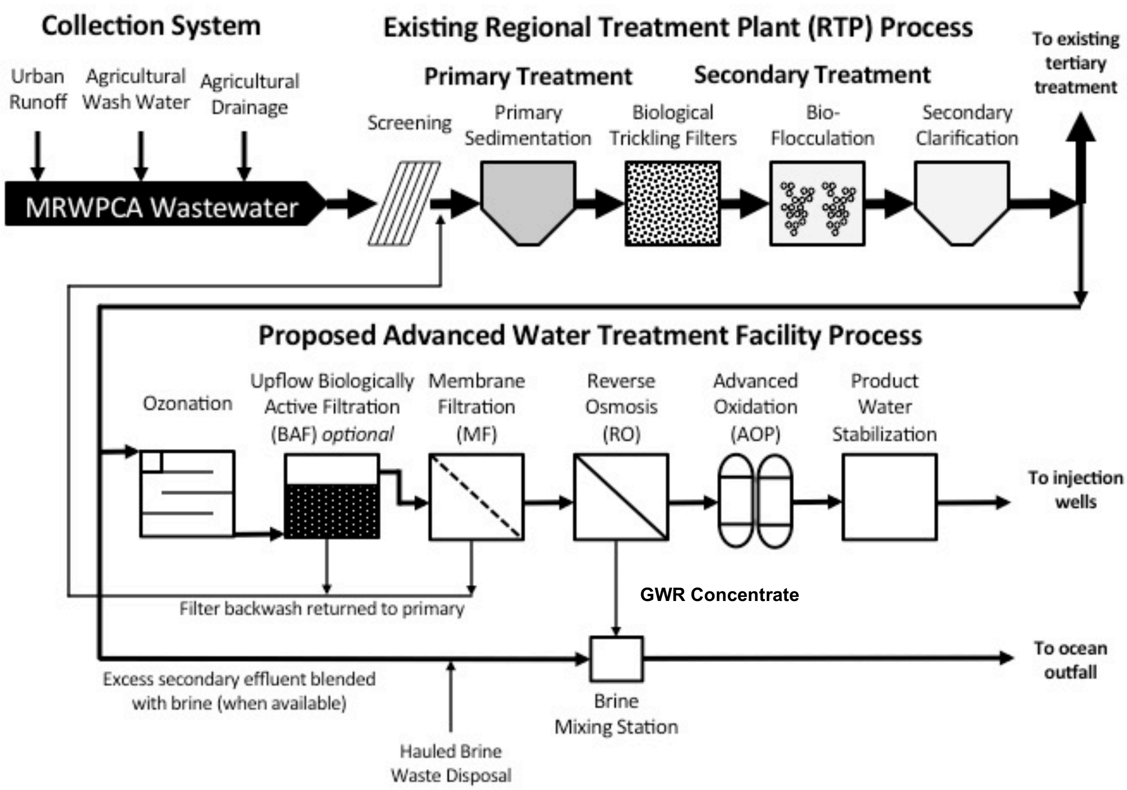

Figure 2 – Schematic of existing MRWPCA RTP and proposed AWT Facility treatment

1.3 California Ocean Plan

The SWRCB 2012 Ocean Plan ("Ocean Plan") sets forth water quality objectives for the ocean with the intent of preserving the quality of the ocean water for beneficial uses, including the protection of both human and aquatic ecosystem health (SWRCB, 2012). Regional Water Quality Control Boards utilize these objectives to develop water quality-based effluent limitations for ocean dischargers that have a reasonable potential to exceed the water quality objectives.

When municipal wastewater flows are released from an outfall, the wastewater and ocean water undergo rapid mixing due to the momentum (from specially designed diffusers) and buoyancy of

[2] SWRCB (2014) Water Recycling Criteria. Title 22, Division 4, Chapter 3, California Code of Regulations.

[3] See http://www.swrcb.ca.gov/plans_policies/

[4] See http://www.waterboards.ca.gov/centralcoast/publications_forms/publications/basin_plan/docs/basin_plan_2011.pdf

the discharge.[5] The mixing occurring in the rising plume is affected by the buoyancy and momentum of the discharge, a process referred to as initial dilution (NRC, 1993). For rising plumes, the Ocean Plan defines the initial dilution as complete when "the diluting wastewater ceases to rise in the water column and first begins to spread horizontally," (*i.e.*, when the momentum from the discharge has dissipated). For more saline discharges, a sinking plume can form when the discharge is denser than the ambient water (also known as a negatively buoyant plume). In the case of negatively buoyant plumes, the Ocean Plan defines the initial dilution as complete when "the momentum induced velocity of the discharge ceases to produce significant mixing of the waste, or the diluting plume reaches a fixed distance from the discharge to be specified by the Regional Board, whichever results in the lower estimate for initial dilution."

The Ocean Plan objectives are to be met after the initial dilution of the discharge. The initial dilution occurs in an area known as the zone of initial dilution (ZID). The extent of dilution in the ZID is quantified and referred to as the minimum probable initial dilution (D_m). The water quality objectives established in the Ocean Plan are adjusted by the D_m to derive the National Pollutant Discharge Elimination System (NPDES) permit limits for a wastewater discharge prior to ocean dilution.

The current MRWPCA wastewater discharge is governed by NPDES permit R3-2014-0013 issued by the Central Coast Regional Water Quality Control Board ("RWQCB"). Because the existing NPDES permit for the MRWPCA ocean outfall must be amended to discharge Desal Brine, comparing future discharge concentrations to the current NPDES permit limits (that will likely change when the permit is amended) would not be an appropriate metric or threshold for determining whether the proposed projects would have a significant impact on marine water quality. Instead, compliance with the Ocean Plan objectives was selected as an appropriate threshold for determining whether or not the proposed projects would result in a significant impact requiring mitigation.

Dr. Philip Roberts, a Professor in the School of Civil and Environmental Engineering at the Georgia Institute of Technology, conducted modeling of the ocean discharge and estimated D_m values for scenarios involving different flows of the proposed projects and different ambient ocean conditions. These ocean modeling results were combined with projected discharge water quality to assess compliance with the Ocean Plan.

1.4 Future Ocean Discharges

A summary schematic of the MPWSP and Variant is presented in Figure 3. For the MPWSP, 23.58 mgd of ocean water (design capacity) would be treated in the desalination facility; an RO recovery of 42% would lead to an MPWSP Desal Brine flow of 13.98 mgd that would be discharged through the outfall. Secondary effluent from the RTP would also be discharged through the outfall, although the flow would be variable depending on both the raw wastewater flow and the proportion being processed through the tertiary treatment system at the Salinas Valley Reclamation Plant (SVRP) to produce recycled water for agricultural irrigation. The third

[5] Municipal wastewater effluent, being effectively fresh water in terms of salinity, is less dense than seawater and thus rises (due to buoyancy) while it mixes with ocean water. GWR Concentrate, whether by itself or mixed with municipal wastewater effluent, is less dense than seawater and also rises (due to buoyancy) while it mixes with ocean water.

and final discharge component is hauled brine that is trucked to the RTP and blended with secondary effluent prior to discharge. The maximum anticipated flow of this stream is 0.1 mgd (blend of brine and secondary effluent). These three discharge components (Desal Brine, secondary effluent, and hauled brine) would be mixed at the proposed Brine Mixing Facility prior to ocean discharge.

For the Variant, 15.93 mgd of ocean water (design capacity) would be pumped to the desalination facility, and an RO recovery of 42% would result in a Variant Desal Brine flow of 8.99 mgd. The Variant would include the GWR Project, which involves the addition of new source waters to the RTP that would alter the water quality of the secondary effluent produced by the RTP. The secondary effluent in the Variant is referred to as "Variant secondary effluent," and would be different in quality from the MPWSP secondary effluent. Under the GWR Project, a portion of the secondary effluent would be fed to the AWT Facility, and the resultant GWR Concentrate (maximum 0.94 mgd) would be discharged through the outfall. The hauled brine received at the RTP would continue to be blended with secondary effluent prior to discharge, the quality of the blended brine and secondary effluent will change as a result of the change in secondary effluent quality; the hauled brine for the Variant is referred to as "Variant hauled brine." The discharge components for the MPWSP and Variant are summarized in Table 1.

Table 1 – Discharge waters Included in each analysis

Project	Desal Brine	Secondary Effluent	Variant Secondary Effluent	Hauled Brine	Variant Hauled Brine [a]	GWR Concentrate
MPWSP	✓ (13.98 mgd)	✓ (flow varies)		✓ (0.1 mgd)		
Variant	✓ (8.99 mgd)		✓ (flow varies)		✓ (0.1 mgd)	✓ (0.94 mgd)

[a] This is placed in a separate category because it contains Variant secondary effluent.

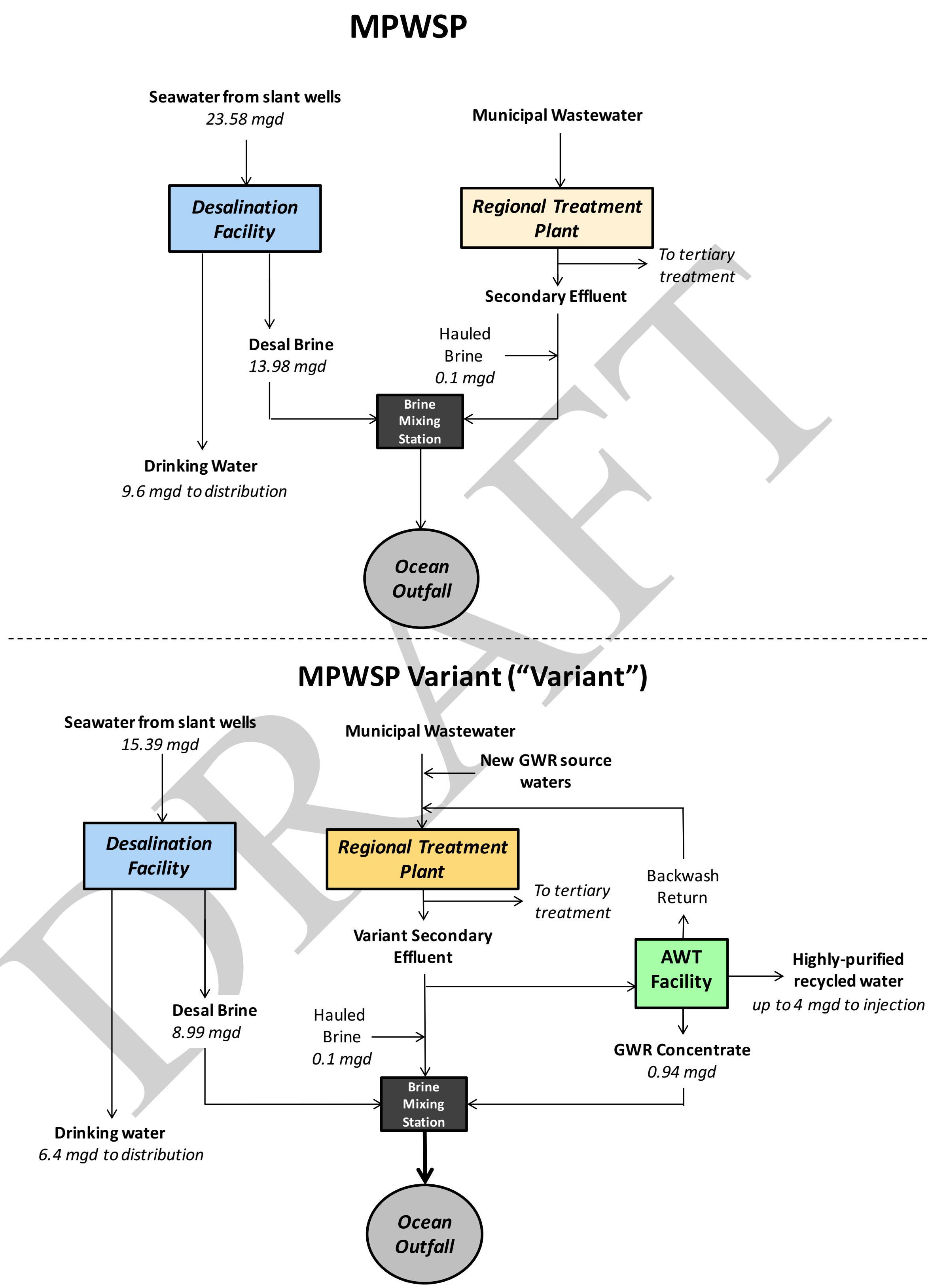

Figure 3 – Flow schematics for the MPWSP and Variant projects (specified flow rates are at design capacity)

1.5 Objective of Technical Memorandum

Trussell Technologies, Inc. ("Trussell Tech") estimated worst-case in-pipe water quality for the various ocean discharge scenarios (*i.e.*, prior to dilution through ocean mixing) for the proposed projects. Dr. Roberts' ocean discharge modeling and the results of the water quality analysis were then used to provide an assessment of whether the proposed projects would consistently meet Ocean Plan water quality objectives. The objective of this technical memorandum is to summarize the assumptions, methodology, results and conclusions of the Ocean Plan compliance assessment for the MPWSP and Variant.

2 Methodology for Ocean Plan Compliance Assessment

Water quality data from various sources for the different treatment process influent and waste streams were compiled. Trussell Tech combined these data for different flow scenarios and used ocean modeling results (*i.e.*, D_m values) to assess compliance of different discharge scenarios with the Ocean Plan objectives. This section documents the data sources and provides further detail on the methodology used to perform this analysis. A summary of the methodology is presented in Figure 4.

2.1 Methodology for Determination of Discharge Water Quality

The amounts and combinations of various wastewaters that would be disposed through the MRWPCA outfall will vary depending on the capacity, seasonal and daily flow characteristics, and extent and timing of implementation of the proposed projects.

Detailed discussions about the methods used to determine the discharge water qualities related to the GWR Project were previously discussed and can be found in Appendix B. This previous analysis included water quality estimates of the secondary effluent, Variant secondary effluent, hauled brine, Variant hauled brine, and the GWR Concentrate (*i.e.*, all of the discharges except for the Desal Brine). In the previous analysis, Trussell Tech assumed that the highest observed values for the various Ocean Plan constituents within each type of water flowing to and treated at the RTP, including the AWT Facility as applicable, to be the worst-case water quality.[6] These same data and assumptions were used in the analysis described in this memorandum. Use of these worst-case water quality concentrations ensures that the analysis in this memorandum is conservative related to the Ocean Plan compliance assessment (and thus, the impact analysis for the MPWSP environmental review processes).

To determine the impact of the MPWSP and Variant, the worst-case water quality of the Desal Brine was estimated using available data from CalAm's temporary test subsurface slant well on the CEMEX mine property in Marina, California. Long-term pumping and water quality

[6] The exception to this statement is cyanide. In mid-2011, Monterey Bay Analytical Service (MBAS) began performing the cyanide analysis on the RTP secondary effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore the results were questionable. Therefore, although the cyanide concentrations reported by MBAS are presented, they are not used in the analysis for evaluating compliance with the Ocean Plan objectives.

sampling from this well began in April 2015.[7] As in the previous Ocean Plan compliance assessments, the highest observed concentrations in the slant well were used for this Ocean Plan compliance assessment.

The methodology for determining the water quality of the Desal Brine and secondary effluent is further described in this section (the methodology for all other discharge waters can be found in Appendix B). A summary of which discharge waters are considered for both the MPWSP and Variant, and which data sources were used in the determination of the water quality for each discharge stream is shown in Figure 4.

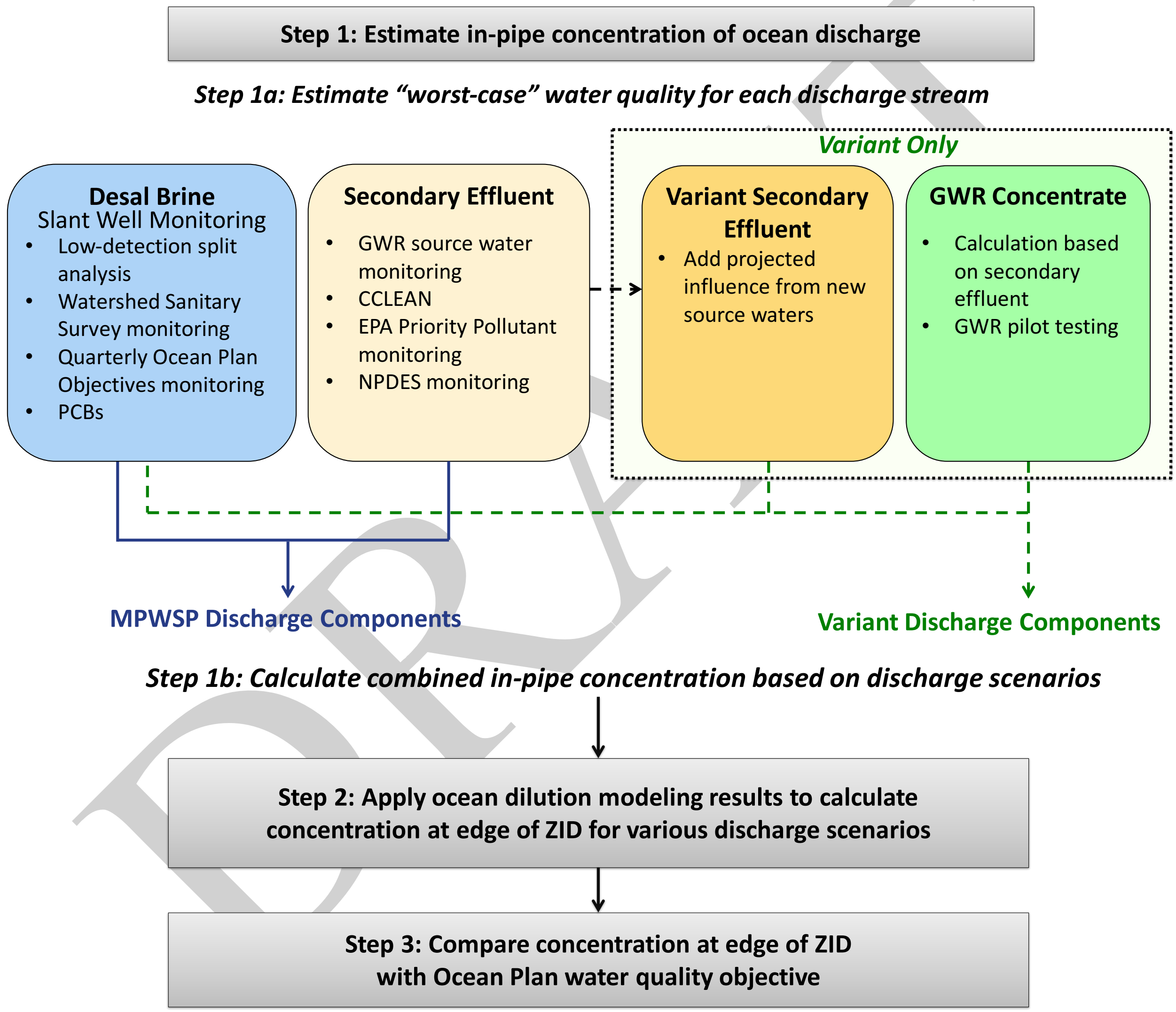

Figure 4 – Logic flow chart for determination of MPWSP and Variant compliance with Ocean Plan objectives.

[7] The well was shut down on June 5, 2015 to assess regional trends in aquifer water levels and resumed pumping October 27, 2015. The well was shut down again between March 4, 2016 and May 2, 2016 for discharge line repairs. No water quality data were collected during shutdown periods.

2.1.1 Secondary Effluent

For the MPWSP, the discharged secondary effluent would not be impacted by additional source waters that would be brought in for the Variant; therefore, the historical secondary effluent quality was used in the analysis. The following sources of data were considered for selecting a secondary effluent concentration for each constituent in the analysis:

- Secondary effluent water quality monitoring conducted for the GWR Project from July 2013 through June 2014.
- Historical NPDES compliance water quality data collected semi-annually by MRWPCA (2005-2014).
- Historical Priority Pollutant data collected annually by MRWPCA (2004-2014).
- Water quality data collected by the Central Coast Long-Term Environmental Assessment Network (CCLEAN) (2008-2015).

The secondary effluent concentration for each constituent selected for the analysis was the maximum reported value from the above sources. In some cases, constituents were not detected (ND) in any of the source waters; in these cases, the values are reported as ND(<MRL). In cases where the analysis of a constituent that was detected but not quantified, the result is reported as less than the Method Reporting Limit ND(<MRL).[8] Because the actual concentration could be any value equal to or less than the MRL, the conservative approach is to use the value of the MRL. For some ND constituents, the MRL exceeds the Ocean Plan objective, and thus no compliance determination can be made.[9] A detailed discussion of the cases where a constituent was reported as less than the MRL is included in the GWR Project technical memorandum in Appendix B (Trussell Technologies, 2015a).

2.1.2 Desalination Brine

Trussell Tech used the following four sources of data for the Desal Brine water quality assessment:

- A one-time 7-day composite sample from the test slant well with separate analysis of particulate and dissolved phase fractions of constituents using low-detection CCLEAN analysis techniques (February 18-25, 2016). The maximum total concentration was used in this analysis (*i.e.* the sum of the concentration in the particulate and dissolved phase

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[8] The lowest amount of an analyte in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions (*i.e*., the lower limit of quantitation). Therefore, acceptable quality control and quality assurance procedures are calibrated to the MRL, or lower. To take into account day-to-day fluctuations in instrument sensitivity, analyst performance, and other factors, the MRL is established at three times the Method Detection Limit (or greater). The Method Detection Limit is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. (40 Code of Federal Regulations Section136 Appendix B).

[9] This phenomenon is common in the implementation of the Ocean Plan where for some constituents, suitable analytical methods are not capable of measuring low enough to quantify the minimum toxicologically relevant concentrations. For these constituents, a discharge is considered compliant if the monitoring results are less than the MRL.

fractions).[10] Of the constituents analyzed with this split phase method,[11] all were detected 100% in the dissolved phase, except PCBs, which were detected 99% in the dissolved phase.

- CalAm Watershed Sanitary Survey monitoring program monthly test slant well sampling water quality results (May 2015 – February 2016).[12]
- Quarterly sampling of the test slant well for constituents specified in the Ocean Plan (November 2015 and February 2016).
- Test slant well sampling by Geoscience Support Services, Inc. ("Geoscience") every other month for polychlorinated biphenyls (PCBs) (May 2015 – February 2016).[11]

The maximum value observed in any of the data sources was assumed to be the "worst-case" water quality for the raw seawater feeding the desalination facility. If a constituent was ND in all samples, and multiple analysis methods were used with varying MRL values, the highest MRL was assumed for compliance analysis; the exception to this statement is when data was available from the low detection limit 7-day composite sample. As for the secondary effluent water quality, if the sample results of a constituent reported the concentration as less than the MRL, the MRL was assumed for compliance analysis and the concentration is reported as ND(<MRL) in this TM. Equation 1 was used to calculate a conservative estimate of the Desal Brine concentration (C_{Brine}) for each constituent by using a concentration factor of 1.73, which was calculated assuming complete rejection of the constituent in the feed water (C_{Feed}) and a 42 percent recovery ($\%_R$) through the seawater RO membranes.

$$C_{Brine} = \frac{C_{Feed}}{1-\%_R} \quad (1)$$

The original Technical Memorandum (TM) (Trussell Technologies, 2015b) noted that no data were available for several Ocean Plan constituents. For constituents that lacked Desal Brine data, a concentration of zero was assumed for the previous analysis, such that the partial influence of the other discharge streams could still be assessed. Thus, a complete "worst-case" assessment for these constituents was not previously possible. The updated analysis discussed in this TM includes data for all of the constituents where no data were previously available, except for toxicity, which will be discussed in Section 2.2.

2.1.3 Combined Ocean Discharge Concentrations

Having estimated the worst-case concentrations for each of the discharge components, the combined concentration prior to discharge was determined as a flow-weighted average of the contributions of each of the discharge components appropriate for the MPWSP and Variant.

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[10] Only method detection limits were provided for these results. When a constituent was ND in this dataset, the method detection limit was used for analysis.

[11] Hexachlorobutadiene, hexachlorobenzene, HCH, heptachlor, Aldrin, chlordane, DDT, heptachlor epoxide, dieldrin, Endrin, endosulfans, toxaphene, PCBs

[12] The well was shut down on June 5, 2015 to assess regional trends in aquifer water levels and resumed pumping October 27, 2015. The well was shut down again between March 4, 2016 and May 2, 2016 for discharge line repairs. No water quality data were collected during shutdown periods.

2.2 Ocean Modeling Methodology

In order to determine Ocean Plan compliance, Trussell Tech used the following information: (1) the in-pipe (*i.e.*, pre-ocean dilution) concentration of a constituent ($C_{in\text{-}pipe}$) that was developed as discussed in the previous section, (2) the minimum probable dilution for the ocean mixing (D_m) for the discharge flow scenarios that were modeled by Dr. Roberts[13] (Roberts, P. J. W, 2016), and (3) the background concentration of the constituent in the ocean ($C_{Background}$) that is specified in Table 3 of the Ocean Plan (SWRCB, 2012). With this information, the concentration at the edge of the zone of initial dilution (C_{ZID}) was calculated using the following equation:

$$C_{ZID} = \frac{C_{In-pipe} + D_m * C_{Background}}{1 + D_m} \quad (2)$$

The C_{ZID} was then compared to the Ocean Plan water quality objectives[14] in Table 1 of the Ocean Plan (SWRCB, 2012). In this table, there are three categories of objectives: (1) Objectives for Protection of Marine Aquatic Life, (2) Objectives for Protection of Human Health – Non-Carcinogens, and (3) Objectives for Protection of Human Health – Carcinogens. There are three objectives for each constituent included in the first category (for marine aquatic life): six-month median, daily maximum and instantaneous maximum concentration. For the other two categories, there is one objective: 30-day average concentration. When a constituent had three objectives, the lowest objective, the six-month median, was used to estimate compliance. This approach was taken because the discharge scenarios, discussed in further detail below, could be experienced for six months, and therefore the 6-month median objective would need to be met. For the ammonia objectives (specifically, the total ammonia concentration calculated as the sum of unionized ammonia (NH_3) and ionized ammonia (NH_4), expressed in µg/L as N) the daily maximum and 6-month median objectives were evaluated.

For each discharge scenario, if the C_{ZID} was below the Ocean Plan objective, then it was assumed that the discharge would comply with the Ocean Plan. However, if the C_{ZID} exceeds the Ocean Plan objective, then it was concluded that the discharge scenario could violate the Ocean Plan objective. Note that this approach could not be applied for some constituents, *viz.*, acute toxicity, chronic toxicity, and radioactivity. Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of the constituents. These constituents were measured individually for the secondary effluent and GWR Concentrate, and these individual concentrations would comply with the Ocean Plan

[13] The Ocean Plan defines D_m differently than Dr. Roberts. A value of 1 must be subtracted from the dilution estimates provided by Dr. Roberts prior to using Equation 1.

[14] Note that the Ocean Plan also defines effluent limitations for oil and grease, suspended solids, settleable solids, turbidity, and pH (see Ocean Plan Table 2). These parameters were not evaluated in this assessment. It is assumed that, if necessary, the pH of the water would be adjusted to be within acceptable limits prior to discharge. Oil and grease, suspended solids, settable solids, and turbidity in the GWR Concentrate and Desal Brine would be significantly lower than the secondary effluent. Prior to the AWT Facility RO treatment process, the process flow would be treated by MF, which will reduce these parameters, and the waste stream from the MF will be returned to RTP headworks. Prior to the Desalination Facility RO treatment process, the process flow would be treated by granular media filters and cartridge filters, which reduce these parameters. The waste stream from the granular media filter would be further treated in gravity thickening basins prior to any discharge of the decant through the ocean outfall. The cartridge filters will be disposed off-site and the solids will not be returned to the process.

objectives. Toxicity testing on the seawater was not included in the analysis for this TM; it will be evaluated by another method not discussed in this TM.

Dr. Roberts performed modeling of 16 discharge scenarios for the MPWSP and Variant that include combinations of Desal Brine, secondary effluent, GWR Concentrate, and hauled brine (Roberts, P. J. W, 2016). All scenarios assume the maximum flow rates for the GWR Concentrate, Desal Brine and hauled brine, which is a conservative assumption in terms of constituent loading and minimum dilution.

2.2.1 Ocean Modeling Scenarios

The modeled scenarios are summarized in Tables 2 and 3 for the MPWSP and the Variant, respectively. The baseline MPWSP discharge scenario in Table 2 that has no Desal Brine (*i.e.* Scenario 1) is shown for completeness, but will not be analyzed in this TM as this flow scenario would fall under MRWPCA's existing NPDES permit, for which a D_m value is already established. The Variant discharge scenarios that have no Desal Brine (*i.e.* Scenarios 11 through 15) have already been analyzed and found to comply with the Ocean Plan (Trussell Tech 2015, see Appendix B); these scenarios are shown in Table 3 for completeness, but for simplicity, the analysis of these scenarios is not repeated in Section 3.

Table 2 - Modeled flow scenarios for the MPWSP

No.	Discharge Scenario	Discharge Flows (mgd)		
		Secondary Effluent	Desal Brine	Hauled Brine [a]
1	Baseline - high secondary effluent [b]	19.78	0	0.1
2	Desal Brine with no secondary effluent	0	13.98	0.1
3	Desal Brine with low secondary effluent	1	13.98	0.1
4	Desal Brine with low secondary effluent	2	13.98	0.1
5	Desal Brine with moderate secondary effluent	9	13.98	0.1
6	Desal Brine with high secondary effluent [b]	19.78	13.98	0.1

[a] Hauled brine was not included in the modeling of MPWSP flow scenarios; however, the change in both flow and TDS from the addition of hauled brine is less then 1% and thus is expected to have a negligible impact on the modeled D_m.

[b] Note that RTP wastewater flows have been declining in recent years as a result of water conservation; while 19.78 mgd is higher than current RTP wastewater flows, this is expected to be a conservative scenario with respect to ocean modeling, compared to using the current wastewater flows of 16 to 18 mgd.

MPWSP Flow Scenarios:

(1) **Baseline – high secondary effluent:** The baseline flow scenario with no Desal Brine. This scenario represents times when the desalination facility is offline, the demand for recycled water is lowest (*e.g.*, during winter months), and the SVRP is not operational.

(2) **Desal Brine with no secondary effluent:** The maximum influence of the Desal Brine on the overall discharge (*i.e.*, no secondary effluent discharged). This scenario would be representative of conditions when demand for recycled water is highest (*e.g.*,

during summer months), and all of the RTP secondary effluent is recycled through the SVRP for agricultural irrigation.

(3-4) **Desal Brine with low secondary effluent:** Desal Brine discharged with a relatively low amount of secondary effluent, resulting in a negatively buoyant plume. This scenario represents times when demand for recycled water is high, but there is excess secondary effluent that is discharged to the ocean.

(5) **Desal Brine with moderate secondary effluent:** Desal Brine discharged with a relatively moderate secondary effluent flow that results in a plume with slightly negative buoyancy. This scenario would be representative of conditions when demand for recycled water is low, and there is excess secondary effluent that is discharged to the ocean.

(6) **Desal Brine with high secondary effluent:** Desal Brine discharged with a relatively high amount of secondary effluent, resulting in a positively buoyant plume. This scenario would be representative of conditions when demand for recycled water is lowest (*e.g.*, during winter months), and the SVRP is not operational.

Table 3 – Modeled flow scenarios for the Variant

No.	Discharge Scenario	Discharge Flows (mgd)			
		Secondary Effluent	Desal Brine	GWR Concentrate	Hauled Brine [a]
1	Desal Brine only	0	8.99	0	0.1
2	Desal Brine with low secondary effluent	1	8.99	0	0.1
3	Desal Brine with low secondary effluent	2	8.99	0	0.1
4	Desal Brine with moderate secondary effluent	5.8	8.99	0	0.1
5	Desal Brine with high secondary effluent [b]	19.78	8.99	0	0.1
6	Desal Brine with GWR Concentrate and no secondary effluent	0	8.99	0.94	0.1
7	Desal Brine with GWR Concentrate and low secondary effluent	1	8.99	0.94	0.1
8	Desal Brine with GWR Concentrate and low secondary effluent	3	8.99	0.94	0.1
9	Desal Brine with GWR Concentrate and moderate secondary effluent	5.3	8.99	0.94	0.1
10	Desal Brine with GWR Concentrate and high secondary effluent	15.92	8.99	0.94	0.1
11	RTP design capacity with GWR Concentrate [c]	24.7	0	0.94	0.1
12	RTP capacity with GWR Concentrate with current port configuration [c]	23.7	0	0.94	0.1
13	Minimum secondary effluent flow with GWR Concentrate [c]	0	0	0.94	0.1
14	Minimum secondary effluent flow with GWR Concentrate during Davidson oceanic conditions [c]	0.4	0	0.94	0.1
15	Moderate secondary effluent flow with GWR concentrate [c]	3	0	0.94	0.1

[a] Hauled brine was not included in the modeling of Variant scenarios involving discharge of desalination brine. However, the change in both flow and TDS from the addition of hauled brine is less than 1% and thus is expected to have a negligible impact on the modeled D_m.
[b] Note that RTP wastewater flows have been declining in recent years as a result of conservation; while 19.68 mgd is higher than current RTP wastewater flows, this is expected to be a conservative scenario with respect to ocean modeling, compared to using the current wastewater flows of 16 to 18 mgd.
[c] Scenarios 11 through 15 were analyzed as part of a previous analysis (see Appendix B), and based on the documented assumptions, the GWR Concentrate would comply with the Ocean Plan objectives; therefore, these scenarios are not discussed further in this memorandum.

Variant Flow Scenarios:

(1) **Desal Brine only:** Desal Brine discharged without secondary effluent or GWR Concentrate. This scenario would be representative of conditions when the smaller (6.4 mgd) desalination facility is in operation, but the AWT Facility is not operating

(*e.g.*, offline for maintenance), and all of the secondary effluent is recycled through the SVRP (*e.g.*, during high irrigation water demand summer months).

(2-3) **Desal Brine with low secondary effluent:** Desal Brine discharged with low secondary effluent flow, but no GWR Concentrate, which results in a negatively buoyant plume. This scenario would be representative of times when the smaller desalination facility is in operation, but the AWT Facility is not operating (*e.g.* offline for maintenance), and most of the secondary effluent is recycled through the SVRP (*e.g.*, during high irrigation water demand summer months).

(4) **Desal Brine with moderate secondary effluent:** Desal Brine discharged with a relatively moderate flow of secondary effluent, but no GWR concentrate, which results in a plume with slightly negative buoyancy. This scenario represents times when demand for recycled water is low (*e.g.*, during winter months), and the AWT Facility is not operating.

(5) **Desal Brine with high secondary effluent:** Desal Brine discharged with a relatively high flow of secondary effluent, but no GWR concentrate, resulting in a positively buoyant plume. This scenario would be representative of conditions when demand for recycled water is lowest (*e.g.*, during winter months), and neither the SVRP nor the AWT Facility are operational.

(6) **Desal Brine with GWR Concentrate and no secondary effluent:** Desal Brine discharged with GWR Concentrate and no secondary effluent. This scenario would be representative of the condition where both the desalination facility and the AWT Facility are in operation, and there is the highest demand for recycled water through the SVRP (*e.g.*, during summer months).

(7-8) **Desal Brine with GWR Concentrate and low secondary effluent:** Desal Brine discharged with low secondary effluent flow and GWR Concentrate, which results in a negatively buoyant plume. This scenario would be representative of times when both the desalination facility and the AWT Facility are in operation, and most of the secondary effluent is recycled through the SVRP (*e.g.*, during high irrigation water demand summer months).

(9) **Desal Brine with GWR Concentrate and moderate secondary effluent:** Desal Brine discharged with GWR Concentrate and a relatively moderate secondary effluent flow that results in a plume with slightly negative buoyancy. This scenario represents times when both the desalination facility and the AWT Facility are operating, but demand for recycled water is low and there is excess secondary effluent discharged to the ocean.

(10) **Desal Brine with GWR Concentrate and high secondary effluent:** Desal Brine discharged with GWR Concentrate and a relatively high flow of secondary effluent. The reduction of secondary effluent flow between Scenario 5 and this scenario is a result of the AWT Facility operation. This would be a typical discharge scenario when there is no demand for tertiary recycled water (*e.g.*, during winter months).

(11-15) **Variant conditions with no Desal Brine contribution**: These scenarios represent a range of conditions that would exist when the CalAm desalination facilities were offline for any reason. These conditions were previously evaluated (Trussell Tech, 2015) and thus are not discussed further in this technical memorandum.

2.2.2 Ocean Modeling Assumptions

Dr. Roberts documented the modeling assumptions and results in a technical memorandum (Roberts, P. J. W., 2016). The modeling assumptions were specific to ambient oceanic conditions: Davidson (November to March), Upwelling (April to August), and Oceanic (September to October).[15] In order to conservatively demonstrate Ocean Plan compliance, the lowest D_m from the applicable ocean conditions was used for each flow scenario. For all scenarios, the ocean modeling was performed assuming all 129 operational diffuser ports were open.

Three methods were used when modeling the ocean mixing: (1) the Cederwall formula (for neutral and negatively buoyant plumes only), (2) the mathematical model UM_3 in the United States Environmental Protection Agency's (EPA's) Visual Plume suite, and (3) the NRFIELD model (for positively buoyant plumes only), also from the EPA's Visual Plume suite (Roberts, P. J. W., 2016). When results were provided from multiple methods, the minimum predicted D_m value was used in this analysis as a conservative approach.

3 Ocean Plan Compliance Results

3.1 Water Quality of Combined Discharge

As described above, the first step in the Ocean Plan compliance analysis was to estimate the worst-case water quality for the future wastewater discharge components (*viz.*, Desal Brine, secondary effluent, hauled brine and GWR Concentrate). The estimated water quality for each type of discharge is provided in Table 4. The Desal Brine water quality previously assumed in Trussell Technologies, 2015b is also included in Table 4 for reference ("Previous Desal Brine"); only the updated Desal Brine water quality was used in this analysis ("Updated Desal Brine"). Specific assumptions and data sources for each constituent are documented in the Table 4 footnotes.

Table 4 – Estimated worst-case water quality for the various discharge waters

Constituent	Units	Updated Desal Brine	Previous Desal Brine	Secondary Effluent		Hauled Brine		GWR Concentrate	Footnotes
				MPWSP	*Variant*	*MPWSP*	*Variant*		
Objectives for protection of marine aquatic life – 6-month median limit									
Arsenic	µg/L	17.2	37.9	45	45	45	45	12	2,6,16,21
Cadmium	µg/L	5.0	7.9	1	1.2	1	1.2	6.4	1,7,15,21
Chromium (Hexavalent)	µg/L	ND(<0.03)	–	ND(<2)	2.7	130	130	14	3,7,15,21
Copper	µg/L	0.5	3.07	10	10.5	39	39	55	1,7,15,21,28
Lead	µg/L	ND(<0.5)	6.4	ND(<0.5)	0.82	0.76	0.82	4.3	1,3,7,15,21
Mercury	µg/L	0.414	ND(<0.3)	0.019	0.089	0.044	0.089	0.510	1,10,16,21
Nickel	µg/L	11.0	ND(<8.6)	5.2	13.1	5.2	13.1	69	1,7,15,21
Selenium	µg/L	ND(<0.09)	55.2	3	6.5	75	75	34	2,7,15,21
Silver	µg/L	0.50	0.064	ND(<0.19)	ND(<1.59)	ND(<0.19)	ND(<1.59)	ND(<0.19)	3,9,18,21
Zinc	µg/L	9.5	ND(<35)	20	48.4	20	48.4	255	1,7,15,21
Cyanide (MBAS data)	µg/L	--	--	81	89.5	81	89.5	143	1,7,16,20
Cyanide	µg/L	ND(<8.6)	ND(<8.6)	7.2	7.2	46	46	38	1,11,15,20,21
Total Chlorine Residual	µg/L	--	ND(<200)	ND(<200)	ND(<200)	ND(<200)	ND(<200)	ND(<200)	5
Ammonia (as N) 6-mo median	µg/L	143.1	ND(<86.2)	36,400	36,400	36,400	36,400	191,579	1,6,15,21,27

15 Note that these ranges assign the transitional months to the ocean condition that is typically more restrictive at relevant discharge flows.

Constituent	Units	Updated Desal Brine	Previous Desal Brine	Secondary Effluent		Hauled Brine		GWR Concentrate	Footnotes
				MPWSP	*Variant*	*MPWSP*	*Variant*		
Ammonia (as N) daily max	µg/L	143.1	ND(<86.2)	49,000	49,000	49,000	49,000	257,895	1,6,15,21,27
Acute Toxicity	TUa	--	–	2.3	2.3	2.3	2.3	0.77	1,12,16,17,24
Chronic Toxicity	TUc	--	–	40	40	80	40	100	1,12,16,17,24
Phenolic Compounds (non-chlorinated)	µg/L	ND(<86.2)	–	69	69	69	69	363	1,6,14,15,23,25 26
Chlorinated Phenolics	µg/L	ND(<34.5)	–	ND(<20)	ND(<20)	ND(<20)	ND(<20)	ND(<20)	3,9,18,23,25,26
Endosulfan	µg/L	ND(<3.4E-6)	6.7E-05	0.015	0.048	0.015	0.048	0.25	1,10,14,15,22,25
Endrin	µg/L	ND(<1.6E-6)	2.8E-05	0.000079	0.000079	0.000079	0.000079	0.00042	4,8,15,22
HCH (Hexachlorocyclohexane)	µg/L	0.000043	0.00068	0.034	0.060	0.034	0.060	0.314	1,15,22,25
Radioactivity (Gross Beta)	pCi/L	ND(<5.17)	–	32	32	307	307	34.8	1,6,12,16,17,23
Radioactivity (Gross Alpha)	pCi/L	22.4	–	18	18	457	457	14.4	1,6,12,16,17,23
Objectives for protection of human health – non carcinogens – 30-day average limit									
Acrolein	µg/L	ND(<3.4)	–	ND(<5)	9.0	ND(<5)	9.0	47	3,7,15,23
Antimony	µg/L	0.19	16.6	0.65	0.79	0.65	0.79	4.1	1,6,15,21
Bis (2-chloroethoxy) methane	µg/L	ND(<16.7)	–	ND(<0.5)	ND(<4.2)	ND(<0.5)	ND(<4.2)	ND(<1)	3,9,18,23
Bis (2-chloroisopropyl) ether	µg/L	ND(<16.7)	–	ND(<0.5)	ND(<4.2)	ND(<0.5)	ND(<4.2)	ND(<1)	3,9,18,23
Chlorobenzene	µg/L	ND(<0.9)	–	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,21
Chromium (III)	µg/L	17	106.9	3.0	7.3	87	87	38	2,6,15,21
Di-n-butyl phthalate	µg/L	ND(<16.7)	–	ND(<5)	ND(<7)	ND(<5)	ND(<7)	ND(<1)	3,9,18,23
Dichlorobenzenes	µg/L	ND(<0.9)	–	1.6	1.6	1.6	1.6	8	1,6,15,21
Diethyl phthalate	µg/L	ND(<0.9)	–	ND(<5)	ND(<5)	ND(<5)	ND(<5)	ND(<1)	3,9,18,23
Dimethyl phthalate	µg/L	ND(<0.9)	–	ND(<2)	ND(<2)	ND(<2)	ND(<2)	ND(<0.5)	3,9,18,23
4,6-dinitro-2-methylphenol	µg/L	ND(<84.5)	–	ND(<0.5)	ND(<20)	ND(<0.5)	ND(<20)	ND(<5)	3,9,18,23
2,4-dinitrophenol	µg/L	ND(<86.2)	–	ND(<0.5)	ND(<13)	ND(<0.5)	ND(<13)	ND(<5)	3,9,18,23
Ethylbenzene	µg/L	ND(<0.9)	–	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,21
Fluoranthene	µg/L	ND(<0.2)	0.0019	0.00654	0.00654	0.00654	0.00654	0.03442	4,9,18,23
Hexachlorocyclopentadiene	µg/L	ND(<0.09)	–	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.05)	3,9,18,23
Nitrobenzene	µg/L	ND(<41.4)	–	ND(<0.5)	ND(<2.3)	ND(<0.5)	ND(<2.3)	ND(<1)	3,9,18,23
Thallium	µg/L	ND(<0.1)	ND(<1.7)	ND(<0.5)	0.69	ND(<0.5)	0.69	3.7	3,7,15,21
Toluene	µg/L	ND(<0.9)	ND(<0.9)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,21
Tributyltin	µg/L	ND(<0.08)	–	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.05)	ND(<0.02)	3,13,18,23
1,1,1-trichloroethane	µg/L	ND(<0.9)	ND(<0.9)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,21
Objectives for protection of human health – carcinogens – 30-day average limit									
Acrylonitrile	µg/L	ND(<3.4)	–	ND(<2)	2.5	ND(<2)	2.5	13	3,7,15,23
Aldrin	µg/L	ND(<6.7E-5)	–	ND(<0.005)	ND(<0.007)	ND(<0.005)	ND(<0.007)	ND(<0.01)	3,9,18,23
Benzene	µg/L	ND(<0.9)	ND(<0.9)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,21
Benzidine	µg/L	ND(<86.2)	–	ND(<0.5)	ND(<19.8)	ND(<0.5)	ND(<19.8)	ND(<0.05)	3,9,18,23
Beryllium	µg/L	ND(<0.9)	ND(<1.7)	ND(<0.5)	ND(<0.69)	0.0052	0.0052	ND(<0.5)	3,9,17,18,21
Bis(2-chloroethyl)ether	µg/L	ND(<41.4)	–	ND(<0.5)	ND(<4.2)	ND(<0.5)	ND(<4.2)	ND(<1)	3,9,18,23
Bis(2-ethyl-hexyl)phthalate	µg/L	ND(<1.0)	ND(<1.0)	78	78	78	78	411	2,6,15,23
Carbon tetrachloride	µg/L	ND(<0.9)	ND(<0.5)	ND(<0.5)	0.50	ND(<0.5)	0.50	2.66	3,7,15,21
Chlordane	µg/L	1.45E-5	0.0002	0.00068	0.00068	0.00068	0.00068	0.0036	4,8,14,15,22,25
Chlorodibromomethane	µg/L	ND(<0.9)	–	ND(<0.5)	2.4	ND(<0.5)	2.4	13	3,7,15,21
Chloroform	µg/L	ND(<0.9)	–	2	39	2	39	204	2,7,15,21
DDT	µg/L	1.7E-6	0.00055	0.0001	0.0001	0.0012	0.0012	0.006	4,7,14,19,22,25
1,4-dichlorobenzene	µg/L	ND(<0.9)	ND(<0.9)	1.6	1.6	1.6	1.6	8.4	1,6,15,21
3,3-dichlorobenzidine	µg/L	ND(<86.2)	–	ND(<0.025)	ND(<19)	ND(<0.025)	ND(<19)	ND(<2)	3,9,18,23
1,2-dichloroethane	µg/L	ND(<0.9)	ND(<0.9)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,21
1,1-dichloroethylene	µg/L	ND(<0.9)	ND(<0.9)	ND(<0.5)	ND(<0.5)	0.5	0.5	ND(<0.5)	3,9,18,21
Dichlorobromomethane	µg/L	ND(<0.9)	–	ND(<0.5)	2.6	ND(<0.5)	2.6	14	3,7,15,21
Dichloromethane	µg/L	ND(<0.9)	ND(<0.9)	0.55	0.64	0.55	0.64	3.4	1,7,15,21
1,3-dichloropropene	µg/L	ND(<0.9)	ND(<0.9)	ND(<0.5)	0.56	ND(<0.5)	0.56	3.0	3,7,15,21
Dieldrin	µg/L	4.7E-5	8.8E-05	0.0001	0.0001	0.0006	0.0006	0.0033	4,7,19,22
2,4-dinitrotoluene	µg/L	ND(<0.2)	–	ND(<2)	ND(<2)	ND(<2)	ND(<2)	ND(<0.1)	3,9,18,23
1,2-diphenylhydrazine	µg/L	ND(<16.7)	–	ND(<0.5)	ND(<4.2)	ND(<0.5)	ND(<4.2)	ND(<1)	3,9,18,23
Halomethanes	µg/L	ND(<0.9)	–	0.54	1.4	0.73	1.4	7.5	2,7,14,15,21
Heptachlor	µg/L	ND(<6.9E-7)	8.6E-06	ND(<0.01)	ND(<0.01)	ND(<0.01)	ND(<0.01)	ND(<0.01)	3,9,18,22
Heptachlor epoxide	µg/L	ND(<1.6E-6)	ND(<0.02)	0.000079	0.000079	0.000079	0.000079	0.000416	4,8,15,22
Hexachlorobenzene	µg/L	ND (<6.5E-5)	ND(<0.09)	0.000078	0.000078	0.000078	0.000078	0.000411	4,8,15,22,23
Hexachlorobutadiene	µg/L	ND(<3.4E-7)	–	0.000009	0.000009	0.000009	0.000009	0.000047	4,8,15,22
Hexachloroethane	µg/L	ND(<16.7)	–	ND(<0.5)	ND(<2.3)	ND(<0.5)	ND(<2.3)	ND(<0.5)	3,9,18,23
Isophorone	µg/L	ND(<0.9)	–	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,23
N-Nitrosodimethylamine	µg/L	ND(<0.003)	ND(<0.003)	0.017	0.096	0.017	0.096	0.150	2,7,16,17,23

Constituent	Units	Updated Desal Brine	Previous Desal Brine	Secondary Effluent		Hauled Brine		GWR Concentrate	Footnotes
				MPWSP	Variant	MPWSP	Variant		
N-Nitrosodi-N-Propylamine	µg/L	ND(<0.003)	ND(<0.003)	0.076	0.076	0.076	0.076	0.019	2,6,16,17,23
N-Nitrosodiphenylamine	µg/L	ND(<16.7)	–	ND(<0.5)	ND(<2.3)	ND(<0.5)	ND(<2.3)	ND(<1)	3,9,18,23
PAHs	µg/L	2.2E-3	0.012	0.03	0.03	0.03	0.03	0.19	4,8,14,15,22,25
PCBs	µg/L	0.00013	0.002	0.00068	0.00068	0.00068	0.00068	0.00357	4,8,14,15,22,25
TCDD Equivalents	µg/L	ND (<2.5E-5)	–	1.37E-7	1.42E-7	1.37E-7	1.42E-7	7.46E-7	4,13,14,15,23,25
1,1,2,2-tetrachloroethane	µg/L	ND(<0.9)	ND(<0.9)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,21
Tetrachloroethylene	µg/L	ND(<0.9)	ND(<0.9)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,21
Toxaphene	µg/L	3.97E-5	ND(<0.0013)	0.0071	0.0071	0.0071	0.0071	0.0373	4,8,15,22
Trichloroethylene	µg/L	ND(<0.9)	ND(<0.9)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,21
1,1,2-trichloroethane	µg/L	ND(<0.9)	ND(<0.9)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,21
2,4,6-trichlorophenol	µg/L	ND(<16.7)	–	ND(<0.5)	ND(<2.3)	ND(<0.5)	ND(<2.3)	ND(<1)	3,9,18,23
Vinyl chloride	µg/L	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	ND(<0.5)	3,9,18,21

Table 4 Footnotes:

MPWSP Secondary Effluent and Hauled Brine

[1] The value reported is based on MRWPCA historical data.

[2] The value reported is based on secondary effluent data collected during the GWR Project source water monitoring programs (not impacted by the proposed new source waters), and are representative of future water quality under the MPWSP scenario.

[3] The MRL provided represents the limit from NPDES monitoring data for secondary effluent and hauled waste. In cases where constituents had varying MRLs, in general, the lowest MRL is reported.

[4] RTP effluent value presented based on CCLEAN data.

Total Chlorine Residual

[5] For all waters, it is assumed that dechlorination will be provided such that the total chlorine residual will be below detection.

Variant Secondary Effluent and Hauled Brine

[6] Existing RTP effluent exceeds concentrations observed in other proposed source waters; the value reported is the existing secondary effluent value.

[7] The proposed new source waters may increase the secondary effluent concentration; the value reported is based on predicted source water blends.

[8] RTP effluent value is based on CCLEAN data; no other source waters were considered due to MRL differences.

[9] MRL provided represents the maximum flow-weighted MRL based on the blend of source waters.

[10] The only water with a detected concentration was the RTP effluent, however the flow-weighted concentration increases due to higher MRLs for the proposed new source waters.

[11] Additional source water data are not available; the reported value is for RTP effluent.

[12] Calculation of the flow-weighted concentration was not feasible due to constituent. The maximum observed value is reported.

[13] Agricultural Wash Water data are based on an aerated sample, instead of a raw water sample.

[14] This value in the Ocean Plan is an aggregate of several congeners or compounds. Per the approach described in the Ocean Plan, for cases where the individual congeners/compounds were less than the MRL, a value of 0 is assumed in calculating the aggregate value.

GWR Concentrate Data

[15] The value presented represents a calculated value assuming no removal prior to RO, complete rejection through RO membrane, and an 81% RO recovery.

[16] The value represents the maximum value observed during the pilot testing study.

[17] The calculated value for the AWT Facility data (described in note 15) was not used in the analysis because it was not considered representative. It is expected that the value would increase as a result of treatment through the AWT Facility (*e.g.* formation of N-Nitrosodimethylamine as a disinfection by-product), or that it will not concentrate linearly through the RO (*e.g.* toxicity and radioactivity).

[18] The MRL provided represents the limit from the source water and pilot testing monitoring programs.

[19] The value presented represents a calculated value assuming 93% and 84% removal through primary and secondary treatment for DDT and dieldrin, respectively, and 36% and 44% removal through ozone for DDT and dieldrin, respectively, complete rejection through the RO membrane, and an 81% RO recovery. The assumed removals are based on results from ozone bench-scale testing of Blanco Drain water blended with secondary effluent and low detection sampling through the RTP.

Cyanide Data

[20] In mid-2011, MBAS began performing the cyanide analysis on the RTP effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore questionable. Therefore, the cyanide values as measured by MBAS are listed separately from other cyanide values, and the MBAS data were not be used in the analysis for evaluating compliance with the Ocean Plan objectives.

Desal Brine Data

[21] The value reported is based on test slant well data collected through the Watershed Sanitary Survey.

[22] The value reported is based on data from the one-time 7-day composite sample from the test slant well. If ND, the method detection limit was used for the analysis instead of the MRL. MRLs were not available for this data set.

[23] The value reported is based on data from the test slant well collected through the quarterly Ocean Plan constituents monitoring.

[24] Acute and chronic toxicity have not been measured or estimated

[25] This value in the Ocean Plan is an aggregate of several congeners or compounds. Per the approach described in the Ocean Plan, for cases where the individual congeners/compounds were less than the MRL, a value of 0 is assumed in calculating the aggregate value.

[26] Chlorinated phenolic compounds is the sum of the following: 4-chloro-3-methylphenol, 2-chlorophenol, pentachlorophenol, 2,4,5-trichlorophenol, and 2,4,6-trichlorophenol. Non-chlorinated phenolic compounds is the sum of the following: 2,4-dimethylphenol, 4,6-Dinitro-2-methylphenol, 2,4-dinitrophenol, 2-methylphenol, 4-methylphenol, 2-nitrophenol, 4-nitrophenol, and phenol.

General

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

[28] The value reported for the Variant secondary effluent was calculated using the median of the data collected for the new source waters and is an estimate of the potential increase in concentration of the secondary effluent based on predicted source water blends. The value reported for the Desal Brine was calculated with the median of the data collected from the test slant well and assuming a 42% recovery through the RO. The median values were used because the maximum values detected in both sources appear to be outliers, and because the Ocean Plan objective is a 6-month median concentration, it is reasonable to use the median value detected from these source waters.

3.2 Ocean Modeling Results

The estimated minimum probable dilution (D_m) for each discharge scenario is presented in Tables 5 and 6 (Roberts, P. J. W., 2016). For discharge scenarios that were modeled with more than one modeling method, the lowest D_m (*i.e.*, most conservative) is reported in the tables below. For the MPWSP, the flow scenarios in which little or no secondary effluent was discharged (Scenarios 2, 3 and 4) resulted in the lowest D_m values as a result of the discharge plume being negatively buoyant. At higher secondary effluent flows, the discharge plume would be positively buoyant, resulting in an increased D_m, as evidenced in Scenario 6. The same trend was observed for Variant scenarios.

Table 5 – Flow scenarios and modeled D_m values used for Ocean Plan compliance analysis for MPWSP

No.	Discharge Scenario (Ocean Condition)	Discharge flows (mgd)			D_m [b]
		Secondary effluent	Desal Brine	Hauled brine [a]	
2	Desal Brine with no secondary effluent	0	13.98	0.1	14.6
3	Desal Brine with low secondary effluent	1	13.98	0.1	15.2
4	Desal Brine with low secondary effluent	2	13.98	0.1	16.0
5	Desal Brine with moderate secondary effluent	9	13.98	0.1	34.3
6	Desal Brine with high secondary effluent [c]	19.78	13.98	0.1	153

[a] Hauled brine was not included in the modeling of MPWSP flow scenarios; however, the change in both flow and TDS from the addition of hauled brine is less than 1% and thus is expected to have a negligible impact on the modeled D_m.

[b] Several models were used to predict the minimal probable dilution value (UM_3, Cederwall for neutral and negatively buoyant plumes, and NRFIELD for buoyant plumes). Values included here are the model results (D_m values) that resulted in the lowest D_m. A value of 1 has also been subtracted from Dr. Roberts' values to take into account the different definition of dilution/D_m provided by Dr. Roberts versus the Ocean Plan.

[c] Note that RTP wastewater flows have been declining in recent years as a result of conservation; while 19.68 mgd is higher than current RTP wastewater flows, this is expected to be a conservative scenario with respect to ocean modeling, compared to using the current wastewater flows of 16 to 18 mgd.

Table 6 – Flow scenarios and modeled D_m values used for Ocean Plan compliance analysis for Variant

No.	Discharge Scenario	Discharge Flows (mgd)				D_m [b]
		Secondary Effluent	Desal Brine	GWR Concentrate	Hauled Brine [a]	
1	Desal Brine only	0	8.99	0	0.1	14.9
2	Desal Brine with low secondary effluent	1	8.99	0	0.1	15.7
3	Desal Brine with low secondary effluent	2	8.99	0	0.1	16.7
4	Desal Brine with moderate secondary effluent	5.8	8.99	0	0.1	31.5
5	Desal Brine with high secondary effluent [b]	19.78	8.99	0	0.1	104
6	Desal Brine with GWR Concentrate and no secondary effluent	0	8.99	0.94	0.1	15.6
7	Desal Brine with GWR Concentrate and low secondary effluent	1	8.99	0.94	0.1	16.4
8	Desal Brine with GWR Concentrate and low secondary effluent	3	8.99	0.94	0.1	20.3
9	Desal Brine with GWR Concentrate and moderate secondary effluent	5.3	8.99	0.94	0.1	54.4
10	Desal Brine with GWR Concentrate and high secondary effluent	15.92	8.99	0.94	0.1	194

[a] Hauled brine was not included in the modeling of Variant scenarios involving discharge of desalination brine. However, the change in both flow and TDS from the addition of hauled brine is less than 1% and thus is expected to have a negligible impact on the modeled D_m.
[b] Several models were used to predict the minimal probable dilution value (UM_3, Cederwall for neutral and negatively buoyant plumes, and NRFIELD for buoyant plumes). Values included here are the model results (D_m values) that resulted in the lowest D_m. A value of 1 has also been subtracted from Dr. Roberts' values to take into account the different definition of dilution/D_m provided by Dr. Roberts versus the Ocean Plan.

3.3 Ocean Plan Compliance Results

The flow-weighted in-pipe concentration for each constituent was calculated for each modeled discharge scenario using the water quality presented in Table 4 and the discharge flows presented in Tables 2 and 3. The in-pipe concentration was then used to calculate the concentration at the edge of the ZID using the D_m values presented in Tables 5 and 6. The resulting concentrations for each constituent in each scenario were compared to the Ocean Plan objectives to assess compliance. The estimated concentrations for the 15 flow scenarios (5 for the MPWSP and 10 for the Variant) for all constituents are presented as concentrations at the edge of the ZID (Appendix A, Table A1 and A3) and as a percentage of the Ocean Plan objective (Appendix A, Table A2 and A4).

It was identified that some constituents are estimated to exceed the Ocean Plan objective for some discharge scenarios. Seventeen[16] constituents were highlighted to potentially exceed the Ocean Plan water quality objectives; however, ten[17] of these constituents were never detected above the MRL in any of the source waters, and the MRLs are higher than the Ocean Plan objective.[18] Due to this insufficient analytical sensitivity, no compliance conclusion can be drawn for these constituents. This is a typical occurrence for ocean discharges since the MRL of the approved compliance analysis method is higher than the Ocean Plan objective for certain constituents.

Of the constituents detected in the source waters, seven were identified as having potential to exceed the Ocean Plan objective in the Variant. Within this subset, acrylonitrile, beryllium and TCDD equivalents were detected in some of the source waters, but not in the others. For these analyses, the MRLs themselves were above the Ocean Plan objective. To assess the blended concentrations for these constituents, a value of zero was assumed for any sources when the concentration was below the MRL.[19] This approach is a "best-case" scenario because it assumes the lowest possible concentration—namely, a value of zero—for any constituent below the reporting limit. This approach is still useful, however, to bracket the analysis and assess the potential for Ocean Plan compliance issues under best-case conditions. Through this method, TCDD equivalents shows potential to exceed the Ocean Plan objective for the Variant. The predicted concentration of acrylonitrile[20] and beryllium at the edge of the ZID is less than the Ocean Plan objective and therefore did not show exceedances through this "best-case" analysis.

A list of the constituents that may exceed the Ocean Plan are shown at their estimated concentration at the edge of the ZID in Table 7 for the MPWSP and Table 8 for the Variant, and as the concentration at the edge of the ZID as a percentage of the Ocean Plan objective in Table 9 and 10 for the MPWSP and Variant, respectively. The "best-case" scenario compliance assessment results for TCDD equivalents is also included in these tables.

[16] Ammonia, chlorinated phenolics, 2,4-dinitrophenol, tributyltin, acrylonitrile, aldrin, benzidine, beryllium, bis(2-chloroethyl)ether, chlordane, 3,3-dichlorobenzidine, 1,2-diphenylhydrazine, heptachlor, PCBs, TCDD equivalents, toxaphene, 2,4,6-trichlorophenol

[17] Chlorinated phenolics, 2,4-dinitrophenol, tributyltin, aldrin, benzidine, bis(2-chloroethyl)ether, 3,3-dichlorobenzidine, 1,2-diphenylhydrazine, heptachlor, 2,4,6-trichlorophenol

[18] The exceptions to this statement are: 2,4-dinitrophenol was ND in the MPWSP Secondary Effluent, and this MRL is lower than the Ocean Plan objective (*i.e.*, MRL = 0.5 ug/L versus 4 ug/L = objective); heptachlor was not detected above the MRL in the slant well, and this MRL is lower than the Ocean Plan objective (*i.e.*, MRL = 0.00000069 ug/L versus 0.00005 ug/L).

[19] Additionally, the Ocean Plan states that for constituents that are made up of an aggregate of constituents, a concentration of 0 can be assumed for the individual constituents that are not detected above the MRL, such as TCDD equivalents.

[20] Acrylonitrile was only detected in one potential source water for the Variant. It was not detected in any potential source waters for the MPWSP Project; therefore, a compliance determination cannot be made for the MPWSP Project and only partial determination can be made for the Variant.

Table 7 – Predicted concentrations at the edge of the ZID for Ocean Plan constituents of concern in the MPWSP [a]

Constituent	Units	Ocean Plan Objective	Estimated Concentration at Edge of ZID by Scenario				
			MPWSP				
			2	3	4	5	6
Objectives for protection of marine aquatic life - 6-month median limit							
Ammonia (as N) – 6-mo median [b]	µg/L	600	25.7	172.1	287	409.0	139.2
Objectives for protection of human health - carcinogens - 30-day average limit [c d]							
Chlordane	µg/L	2.3E-05	1.23E-06	3.91E-06	6.00E-06	7.89E-06	2.65E-06
PCBs	µg/L	1.9E-05	8.76E-06	1.07E-05	1.20E-05	9.86E-06	2.94E-06
TCDD Equivalents [d]	µg/L	3.9E-09	6.23E-11	6.17E-10	1.05E-09	1.53E-09	5.22E-10
Toxaphene [e]	µg/L	2.1E-04	5.75E-06	3.42E-05	5.65E-05	7.99E-05	2.71E-05

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.
[b] Ammonia (as N) represents the total ammonia concentration, *i.e.* the sum of unionized ammonia (NH_3) and ionized ammonia (NH_4).
[c] Acrylonitrile was only detected in one potential source water for the Variant Project. It was not detected in any potential source waters for the MPWSP Project; therefore, a compliance determination cannot be made for the MPWSP Project and only partial determination can be made for the Variant Project.
[d] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

Table 8 – Predicted concentrations at the edge of the ZID for Ocean Plan constituents of concern in the Variant [a]

Constituent	Units	Ocean Plan Objective	Estimated Concentration at Edge of ZID by Scenario									
			Variant									
			1	2	3	4	5	6	7	8	9	10
Objectives for protection of marine aquatic life - 6-month median limit												
Ammonia (as N) – 6-mo median [b]	µg/L	600	34	245	396	446	239	1111	1154	1060	445	151
Objectives for protection of human health - carcinogens - 30-day average limit [c]												
Chlordane	µg/L	2.3E-05	1.37E-6	5.24E-6	7.98E-6	8.61E-6	4.53E-6	2.15E-5	2.22E-5	2.03E-5	8.49E-6	2.86E-6
PCBs	µg/L	1.9E-05	8.72E-6	1.15E-5	1.33E-5	1.07E-5	4.85E-6	2.77E-5	2.76E-5	2.40E-5	9.68E-6	3.05E-6
TCDD Equivalents [c]	µg/L	3.9E-09	9.81E-11	9.26E-10	1.52E-9	1.73E-9	9.30E-10	4.30E-9	4.47E-9	4.11E-9	1.73E-9	5.87E-10
Toxaphene [d]	µg/L	2.1E-04	7.37E-6	4.84E-5	7.77E-5	8.72E-5	4.66E-5	2.17E-4	2.25E-4	2.07E-4	8.68E-5	2.94E-5

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.
[b] Ammonia (as N) represents the total ammonia concentration, *i.e.* the sum of unionized ammonia (NH_3) and ionized ammonia (NH_4).
[c] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[d] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

Table 9 – Predicted concentrations at the edge of the ZID expressed as percentage of Ocean Plan Objective for constituents of in the MPWSP [a]

Constituent	Units	Ocean Plan Objective	Est. Percentage of Ocean Plan objective at Edge of ZID by Scenario				
			MPWSP				
			2	3	4	5	6
Objectives for protection of marine aquatic life - 6-month median limit							
Ammonia (as N) – 6-mo median [b]	µg/L	600	4%	29%	48%	68%	23%
Objectives for protection of human health – carcinogens – 30-day average limit [c d]							
Chlordane	µg/L	2.3E-05	5%	17%	26%	34%	12%
PCBs	µg/L	1.9E-05	46%	56%	63%	52%	15%
TCDD Equivalents [d]	µg/L	3.9E-09	2%	16%	27%	39%	13%
Toxaphene [e]	µg/L	2.1E-04	3%	16%	27%	38%	13%

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.
[b] Ammonia (as N) represents the total ammonia concentration, *i.e.* the sum of unionized ammonia (NH_3) and ionized ammonia (NH_4).
[c] Acrylonitrile was only detected in one potential source water for the Variant Project. It was not detected in any potential source waters for the MPWSP Project; therefore, a compliance determination cannot be made for the MPWSP Project and only partial determination can be made for the Variant Project.
[d] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

Table 10 – Predicted concentrations at the edge of the ZID expressed as percentage of Ocean Plan Objective for constituents of in the Variant [a]

Constituent	Units	Ocean Plan Objective	Est. Percentage of Ocean Plan objective at Edge of ZID by Scenario – Variant 1	2	3	4	5	6	7	8	9	10
Objectives for protection of marine aquatic life - 6-month median limit												
Ammonia (as N) – 6-mo median [b]	µg/L	600	5.7%	41%	66%	74%	40%	185%	192%	177%	74%	25%
Objectives for protection of human health - carcinogens - 30-day average limit [c]												
Chlordane	µg/L	2.3E-05	6%	23%	35%	37%	20%	94%	97%	88%	37%	12%
PCBs	µg/L	1.9E-05	46%	61%	70%	57%	26%	146%	145%	126%	51%	16%
TCDD Equivalents [c]	µg/L	3.9E-09	3%	24%	39%	44%	24%	110%	115%	105%	44%	15%
Toxaphene [d]	µg/L	2.1E-04	4%	23%	37%	42%	22%	103%	107%	99%	41%	14%

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.
[b] Ammonia (as N) represents the total ammonia concentration, *i.e.* the sum of unionized ammonia (NH_3) and ionized ammonia (NH_4).
[c] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[d] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

Potential issues were identified to occur when there is no, or relatively low, secondary effluent flow mixed with hauled brine, GWR Concentrate and Desal Brine, as in Variant Scenarios 6, 7 and 8. The constituents of interest related to these scenarios are ammonia, chlordane, PCBs, TCDD equivalents, and toxaphene. Ammonia is expected to be the constituent with the highest exceedance, being 1.92 times the Ocean Plan objective in Scenario 7 (1 mgd secondary effluent with hauled brine, GWR Concentrate and Desal Brine). This scenario is problematic because constituents that have relatively high loadings in the secondary effluent are concentrated in the GWR Concentrate. This scenario assumes the GWR Concentrate flow is much smaller than the Desal Brine flow, such that the resulting discharge plume is negatively buoyant and achieves poor ocean dilution. Based on this analysis, Scenarios 6, 7 and 8 have been identified as having constituents that may exceed the Ocean Plan objective.

Chlordane, PCBs, and toxaphene were only detected when analyzed with low-detection methods, which have far greater sensitivity than standard methods. These results were used to investigate potential to exceed Ocean Plan objectives because these objectives are orders of magnitude below detection limits of methods currently used for discharge compliance.

4 Conclusions

The purpose of this analysis was to assess the ability of the MPWSP and Variant to comply with the Ocean Plan objectives. Trussell Tech used a conservative approach to estimate the water qualities of the secondary effluent, GWR Concentrate, Desal Brine and hauled brine for these projects. These water quality data were then combined for various discharge scenarios, and a concentration at the edge of the ZID was calculated for each constituent and scenario. Seventeen constituents showed potential to exceed the Ocean Plan objectives. These constituents can be divided into three categories:

- Detected concentrations exceed Ocean Plan objectives (Category I): four constituents were detected in all source waters and the blended concentration at the edge of the ZID exceeded the Ocean Plan objective
- Insufficient analytical sensitivity to determine compliance (Category II): ten constituents were not detected above the MRL in any of the source waters, but the MRL was not sensitive enough to demonstrate compliance with the Ocean Plan objective
- Combination of Categories I and II: discharge blends contain sources with exceedances of Ocean Plan objectives (Category I) and sources whose compliance is indeterminate (Category II).

Based on the data, assumptions, modeling, and analytical methodology presented in this technical memorandum, the Variant shows a potential to exceed certain Ocean Plan objectives under specific discharge scenarios. In particular, potential issues were identified for the Variant discharge scenarios involving low secondary effluent flows with Desal Brine and GWR Concentrate: discharges are predicted to exceed or come close to exceeding multiple Ocean Plan objectives, specifically those for ammonia, chlordane, PCBs, TCDD equivalents, and toxaphene. Ammonia clearly exceeds the Ocean Plan objective and must be resolved for the Variant. TCDD equivalents shows a potential to exceed the Ocean Plan objective through a best-case analysis. Chlordane, PCBs and toxaphene, which were predicted to exceed the objectives, were detected at concentrations that are orders of magnitude below detection limits of methods currently used for discharge compliance.

5 References

Central Coast Long-term Environmental Assessment Network, 2014. *Regional Monitoring Program Annual Report*. Submitted to California Water Board, Central Coast Region, San Luis Obispo, CA.

Central Coast Regional Water Quality Control Board, 2014. Waste Discharge Requirements for the Monterey Regional Water Pollution Control Agency Regional Treatment Plant.

National Research Council (NRC), 1993. "Managing Wastewater in Coastal Urban Areas". National Academy Press, Washington, D.C.

Roberts, P. J. W, 2016. "Modeling Brine Disposal into Monterey Bay". *Draft Technical Memorandum to Environmental Science Associates (ESA)*. 4 May.

State Water Resources Control Board, California Environmental Protection Agency (SWRCB), 2012. *California Ocean Plan: Water Quality Control Plan, Ocean Waters of California*.

Trussell Technologies, Inc (Trussell Tech), 2015a. "Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project." *Technical Memorandum prepared for MRWPCA and MPWMD*. Feb.

Trussell Technologies, Inc (Trussell Tech), 2015b. "Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant." *Technical Memorandum prepared for MRWPCA and MPWMD*. March.

Trussell Technologies, Inc (Trussell Tech), 2015c. "Addendum Report to Ocean Plan Compliance Assessment Reports: Monterey Peninsula Water Supply Project, Pure Water Monterey Groundwater Replenishment Project, and the Monterey Peninsula Water Supply Project Variant." *Technical Memorandum prepared for MRWPCA and MPWMD*. April.

Appendix A

Table A1 – Complete list of predicted concentrations of Ocean Plan constituents at the edge of the ZID for the MPWSP

Constituent	Units	Ocean Plan Objective	Estimated Concentration at Edge of ZID by Scenario				
			MPWSP				
			2	3	4	5	6
Objectives for protection of marine aquatic life - 6-month median limit							
Arsenic	µg/L	8	3.9	4.0	4.1	3.7	3.2
Cadmium	µg/L	1	0.3	0.3	0.3	0.1	0.02
Chromium (Hexavalent)	µg/L	2	0.1	0.1	0.1	0.04	0.01
Copper	µg/L	3	1.9	2.0	2.0	2.1	2.0
Lead	µg/L	2	0.03	0.03	0.03	0.01	0.003
Mercury	µg/L	0.04	0.03	0.02	0.02	0.01	0.002
Nickel	µg/L	5	0.7	0.7	0.6	0.2	0.05
Selenium	µg/L	15	0.04	0.05	0.05	0.04	0.01
Silver	µg/L	0.7	0.2	<0.2	<0.2	<0.2	<0.2
Zinc	µg/L	20	8.1	8.1	8.2	8.2	8.0
Cyanide	µg/L	1	0.6	0.5	0.5	0.2	0.1
Total Chlorine Residual	µg/L	2	–	–	–	–	–
Ammonia (as N) - 6-mo median	µg/L	600	25.7	172.1	287	409.0	139.2
Ammonia (as N) - Daily Max	µg/L	2,400	31.4	228.8	384	549.8	187.2
Acute Toxicity [a]	TUa	0.3					
Chronic Toxicity [a]	TUc	1					
Phenolic Compounds (non-chlorinated)	µg/L	30	5.5	5.2	4.9	2.2	0.5
Chlorinated Phenolics [b]	µg/L	1	<2.20	<2.06	<1.92	<0.82	<0.17
Endosulfan	µg/L	0.009	7.05E-06	6.77E-05	1.15E-04	1.68E-04	5.72E-05
Endrin	µg/L	0.002	1.35E-07	4.45E-07	6.86E-07	9.09E-07	3.05E-07
HCH (Hexachlorocyclohexane)	µg/L	0.004	1.82E-05	1.56E-04	2.63E-04	3.81E-04	1.30E-04
Radioactivity (Gross Beta) [a]	pCi/L	0.0					
Radioactivity (Gross Alpha) [a]	pCi/L	0.0					
Objectives for protection of human health – non carcinogens – 30-day average limit							
Acrolein	µg/L	220	<0.2	<0.2	<0.2	<0.1	<0.03
Antimony	µg/L	1200	0.01	0.01	0.01	0.01	0.003
Bis (2-chloroethoxy) methane	µg/L	4.4	<1.1	<1.0	<0.9	<0.3	<0.05
Bis (2-chloroisopropyl) ether	µg/L	1200	<1.1	<1.0	<0.9	<0.3	<0.05
Chlorobenzene	µg/L	570	<0.1	<0.1	<0.05	<0.02	<0.004
Chromium (III)	µg/L	190000	1.1	1.0	0.9	0.3	0.1
Di-n-butyl phthalate	µg/L	3500	<1.1	<1.0	<0.9	<0.3	<0.1
Dichlorobenzenes	µg/L	5100	<0.1	0.1	0.1	0.03	0.01
Diethyl phthalate	µg/L	33000	<0.1	<0.1	<0.1	<0.1	<0.02
Dimethyl phthalate	µg/L	820000	<0.1	<0.1	<0.1	<0.04	<0.01
4,6-dinitro-2-methylphenol	µg/L	220	<5.4	<4.8	<4.3	<1.5	<0.2
2,4-Dinitrophenol [b]	µg/L	4.0	<5.5	<4.9	<4.4	<1.5	<0.2
Ethylbenzene	µg/L	4100	<0.1	<0.1	<0.05	<0.02	<0.004
Fluoranthene	µg/L	15	<0.01	0.01	0.01	0.003	0.0005
Hexachlorocyclopentadiene	µg/L	58	<0.01	<0.01	<0.01	<0.01	<0.002
Nitrobenzene	µg/L	4.9	<2.6	<2.4	<2.1	<0.7	<0.1
Thallium	µg/L	2	<0.01	<0.01	<0.01	<0.01	<0.002
Toluene	µg/L	85000	<0.06	<0.05	<0.05	<0.02	<0.004
Tributyltin [b]	µg/L	0.0014	<0.01	<0.005	<0.005	<0.002	<0.0004
1,1,1-Trichloroethane	µg/L	540000	<0.1	<0.1	<0.05	<0.02	<0.004
Objectives for protection of human health – carcinogens – 30-day average limit							
Acrylonitrile [c d]	µg/L	0.10	--	--	--	--	--
Aldrin [b]	µg/L	0.000022	<6.51E-06	<2.63E-05	<4.18E-05	<5.70E-05	<1.92E-05

Constituent	Units	Ocean Plan Objective	Estimated Concentration at Edge of ZID by Scenario				
			MPWSP				
			2	3	4	5	6
Benzene	µg/L	5.9	<0.1	<0.1	<0.05	<0.02	<0.004
Benzidine [b]	µg/L	0.000069	<5.5	<4.9	<4.4	<1.5	<0.2
Beryllium [d]	µg/L	0.033	2.38E-6	2.14E-6	1.91E-6	6.41E-7	1.00E-7
Bis(2-chloroethyl)ether [b]	µg/L	0.045	<2.6	<2.4	<2.1	<0.7	<0.1
Bis(2-ethyl-hexyl)phthalate	µg/L	3.5	0.1	0.4	0.7	0.9	0.3
Carbon tetrachloride	µg/L	0.90	<0.1	<0.1	<0.05	<0.02	<0.004
Chlordane	µg/L	0.000023	1.23E-6	3.91E-6	6.00E-6	7.89E-6	2.65E-6
Chlorodibromomethane	µg/L	8.6	<0.1	<0.1	<0.05	<0.02	<0.004
Chloroform	µg/L	130	0.1	0.1	0.1	0.04	0.01
DDT	µg/L	0.00017	1.53E-7	5.28E-7	8.21E-7	1.09E-6	3.68E-7
1,4-Dichlorobenzene	µg/L	18	0.1	0.1	0.1	0.03	0.01
3,3-Dichlorobenzidine [b]	µg/L	0.0081	<5.5	<4.9	<4.4	<1.5	<0.2
1,2-Dichloroethane	µg/L	28	<0.1	<0.1	<0.05	<0.02	<0.004
1,1-Dichloroethylene	µg/L	0.9	0.1	0.1	0.05	0.02	0.004
Dichlorobromomethane	µg/L	6.2	<0.1	<0.1	<0.05	<0.02	<0.004
Dichloromethane	µg/L	450	<0.1	0.1	0.05	0.02	0.004
1,3-dichloropropene	µg/L	8.9	<0.1	<0.1	<0.05	<0.02	<0.004
Dieldrin	µg/L	0.00004	3.01E-6	3.15E-6	3.21E-6	2.01E-6	5.37E-7
2,4-Dinitrotoluene	µg/L	2.6	<0.01	<0.02	<0.02	<0.03	<0.01
1,2-Diphenylhydrazine [b]	µg/L	0.16	<1.1	<1.0	<0.9	<0.3	<0.05
Halomethanes	µg/L	130	0.1	0.1	0.05	0.02	0.004
Heptachlor [b]	µg/L	0.00005	<4.60E-06	<4.51E-05	<7.69E-05	<1.12E-04	<3.81E-05
Heptachlor Epoxide	µg/L	0.00002	1.35E-07	4.45E-07	6.86E-07	9.09E-07	3.05E-07
Hexachlorobenzene	µg/L	0.00021	4.18E-06	4.08E-06	3.93E-06	1.99E-06	4.72E-07
Hexachlorobutadiene	µg/L	14	2.60E-08	6.03E-08	8.68E-08	1.06E-07	3.52E-08
Hexachloroethane	µg/L	2.5	<1.1	<1.0	<0.9	<0.3	<0.05
Isophorone	µg/L	730	<0.1	<0.1	<0.05	<0.02	<0.004
N-Nitrosodimethylamine	µg/L	7.3	0.0002	0.0003	0.0003	0.0002	0.0001
N-Nitrosodi-N-Propylamine	µg/L	0.38	0.0003	0.001	0.001	0.001	0.0003
N-Nitrosodiphenylamine	µg/L	2.5	<1.1	<1.0	<0.9	<0.3	<0.05
PAHs	µg/L	0.0088	1.51E-04	2.48E-04	3.23E-04	3.45E-04	1.11E-04
PCBs	µg/L	0.000019	8.76E-06	1.07E-05	1.20E-05	9.86E-06	2.94E-06
TCDD Equivalents [d]	µg/L	3.9E-09	6.23E-11	6.17E-10	1.05E-09	1.53E-09	5.22E-10
1,1,2,2-Tetrachloroethane	µg/L	2.3	<0.1	<0.1	<0.05	<0.02	<0.004
Tetrachloroethylene	µg/L	2.0	<0.1	<0.1	<0.05	<0.02	<0.004
Toxaphene [e]	µg/L	2.1E-04	5.75E-06	3.42E-05	5.65E-05	7.99E-05	2.71E-05
Trichloroethylene	µg/L	27	<0.1	<0.1	<0.05	<0.02	<0.004
1,1,2-Trichloroethane	µg/L	9.4	<0.1	<0.1	<0.05	<0.02	<0.004
2,4,6-Trichlorophenol [b]	µg/L	0.29	<1.1	<1.0	<0.9	<0.3	<0.05
Vinyl chloride	µg/L	36	<0.03	<0.03	<0.03	<0.01	<0.003

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent.

[b] All observed values from some data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[c] Acrylonitrile was only detected in one potential source water for the Variant Project. It was not detected in any potential source waters for the MPWSP Project; therefore, a compliance determination cannot be made for the MPWSP Project and only partial determination can be made for the Variant Project.

[d] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance

determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

Table A2 – Complete list of predicted concentrations at the edge of the ZID expressed as a percentage of Ocean Plan[a]

Constituent	Units	Ocean Plan Objective	Percentage of Ocean Plan Objective at Edge of ZID by Scenario [a]				
			MPWSP				
			2	3	4	5	6
Objectives for protection of marine aquatic life - 6-month median limit							
Arsenic	µg/L	8	49%	50%	51%	46%	40%
Cadmium	µg/L	1	32%	29%	26%	10%	2%
Chromium (Hexavalent)	µg/L	2	3%	3%	3%	2%	1%
Copper	µg/L	3	64%	65%	67%	69%	68%
Lead	µg/L	2	2%	2%	2%	1%	0.2%
Mercury	µg/L	0.04	67%	61%	54%	20%	4%
Nickel	µg/L	5	14%	13%	12%	5%	1%
Selenium	µg/L	15	0.3%	0.3%	0.4%	0.3%	0.1%
Silver	µg/L	0.7	26%	<26%	<25%	<24%	<23%
Zinc	µg/L	20	40%	41%	41%	41%	40%
Cyanide	µg/L	1	57%	54%	51%	23%	5%
Total Chlorine Residual	µg/L	2	–	–	–	–	–
Ammonia (as N) - 6-mo median	µg/L	600	4%	29%	48%	68%	23%
Ammonia (as N) - Daily Max	µg/L	2,400	1%	10%	16%	23%	8%
Acute Toxicity [b]	TUa	0.3					
Chronic Toxicity [b]	TUc	1					
Phenolic Compounds (non-chlorinated)	µg/L	30	18%	17%	16%	7%	2%
Chlorinated Phenolics [c]	µg/L	1	--	--	--	--	--
Endosulfan	µg/L	0.009	0.1%	1%	1%	2%	1%
Endrin	µg/L	0.002	0.01%	0.02%	0.03%	0.05%	0.02%
HCH (Hexachlorocyclohexane)	µg/L	0.004	0.5%	4%	7%	10%	3%
Radioactivity (Gross Beta) [b]	pci/L	0.0					
Radioactivity (Gross Alpha) [b]	pci/L	0.0					
Objectives for protection of human health – non carcinogens – 30-day average limit							
Acrolein	µg/L	220	<0.1%	<0.1%	<0.1%	<0.1%	<0.01%
Antimony	µg/L	1200	0.0010%	0.0011%	0.0012%	0.0009%	0.0002%
Bis (2-chloroethoxy) methane	µg/L	4.4	<24%	<22%	<20%	<7%	<1%
Bis (2-chloroisopropyl) ether	µg/L	1200	<0.09%	<0.08%	<0.07%	<0.02%	<0.01%
Chlorobenzene	µg/L	570	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Chromium (III)	µg/L	190000	0.0006%	0.0005%	0.0005%	0.0002%	0.00003%
Di-n-butyl phthalate	µg/L	3500	<0.03%	<0.03%	<0.03%	<0.01%	<0.01%
Dichlorobenzenes	µg/L	5100	0.001%	0.001%	0.001%	0.001%	0.0002%
Diethyl phthalate	µg/L	33000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Dimethyl phthalate	µg/L	820000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
4,6-dinitro-2-methylphenol	µg/L	220	<2%	<2%	<2%	<1%	<0.1%
2,4-Dinitrophenol [c]	µg/L	4.0	--	--	--	--	--
Ethylbenzene	µg/L	4100	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Fluoranthene	µg/L	15	0.1%	0.1%	0.1%	0.02%	0.003%
Hexachlorocyclopentadiene	µg/L	58	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Nitrobenzene	µg/L	4.9	<54%	<48%	<43%	<15%	<2%
Thallium	µg/L	2	<0.3%	<0.4%	<0.4%	<0.4%	<0.1%
Toluene	µg/L	85000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Tributyltin [c]	µg/L	0.0014	--	--	--	--	--
1,1,1-Trichloroethane	µg/L	540000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%

Constituent	Units	Ocean Plan Objective	Percentage of Ocean Plan Objective at Edge of ZID by Scenario [a]				
			MPWSP				
			2	3	4	5	6
Objectives for protection of human health – carcinogens – 30-day average limit							
Acrylonitrile [d e]	µg/L	0.10	--	--	--	--	--
Aldrin [c]	µg/L	0.000022	--	--	--	--	--
Benzene	µg/L	5.9	<1%	<1%	<1%	<0.3%	<0.1%
Benzidine [c]	µg/L	0.000069	--	--	--	--	--
Beryllium [e]	µg/L	0.033	0%	0%	0%	0%	0%
Bis(2-chloroethyl)ether [c]	µg/L	0.045	--	--	--	--	--
Bis(2-ethyl-hexyl)phthalate	µg/L	3.5	3%	12%	19%	25%	9%
Carbon tetrachloride	µg/L	0.90	<6%	<6%	<5%	<2%	<0.5%
Chlordane	µg/L	0.000023	5%	17%	26%	34%	12%
Chlorodibromomethane	µg/L	8.6	<1%	<1%	<1%	<0.2%	<0.05%
Chloroform	µg/L	130	0.04%	0.04%	0.05%	0.03%	0.01%
DDT	µg/L	0.00017	0.09%	0.31%	0.48%	0.64%	0.22%
1,4-Dichlorobenzene	µg/L	18	0.3%	0.3%	0.3%	0.2%	0.05%
3,3-Dichlorobenzidine [c]	µg/L	0.0081	--	--	--	--	--
1,2-Dichloroethane	µg/L	28	<0.2%	<0.2%	<0.2%	<0.1%	<0.02%
1,1-Dichloroethylene	µg/L	0.9	6%	6%	5%	2%	0.5%
Dichlorobromomethane	µg/L	6.2	<1%	<1%	<1%	<0.3%	<0.1%
Dichloromethane	µg/L	450	0.01%	0.01%	0.01%	0.005%	0.001%
1,3-dichloropropene	µg/L	8.9	<1%	<1%	<1%	<0.2%	<0.05%
Dieldrin	µg/L	0.00004	8%	8%	8%	5%	1%
2,4-Dinitrotoluene	µg/L	2.6	<0.5%	<1%	<1%	<1%	<0.3%
1,2-Diphenylhydrazine [c]	µg/L	0.16	--	--	--	--	--
Halomethanes	µg/L	130	0.04%	0.04%	0.04%	0.02%	0.003%
Heptachlor [c]	µg/L	0.00005	--	--	--	--	--
Heptachlor Epoxide	µg/L	0.00002	1%	2%	3%	5%	2%
Hexachlorobenzene	µg/L	0.00021	2%	2%	2%	1%	0.2%
Hexachlorobutadiene	µg/L	14	1.86E-7%	4.30E-7%	6.20E-7%	7.60E-7%	2.52E-7%
Hexachloroethane	µg/L	2.5	<43%	<38%	<35%	<12%	<2%
Isophorone	µg/L	730	<0.008%	<0.007%	<0.007%	<0.003%	<0.001%
N-Nitrosodimethylamine	µg/L	7.3	0.003%	0.004%	0.004%	0.003%	0.001%
N-Nitrosodi-N-Propylamine	µg/L	0.38	0.1%	0.1%	0.2%	0.2%	0.1%
N-Nitrosodiphenylamine	µg/L	2.5	<43%	<38%	<34%	<12%	<2%
PAHs	µg/L	0.0088	2%	3%	4%	4%	1%
PCBs	µg/L	0.000019	46%	56%	63%	52%	15%
TCDD Equivalents [e]	µg/L	3.9E-09	2%	16%	27%	38%	13%
1,1,2,2-Tetrachloroethane	µg/L	2.3	<2%	<2%	<2%	<1%	<0.2%
Tetrachloroethylene	µg/L	2.0	<3%	<3%	<2%	<1%	<0.2%
Toxaphene [e]	µg/L	2.1E-04	3%	16%	27%	38%	13%
Trichloroethylene	µg/L	27	<0.2%	<0.2%	<0.2%	<0.1%	<0.02%
1,1,2-Trichloroethane	µg/L	9.4	<1%	<1%	<1%	<0.2%	<0.04%
2,4,6-Trichlorophenol [c]	µg/L	0.29	--	--	--	--	--
Vinyl chloride	µg/L	36	<0.1%	<0.1%	<0.1%	<0.04%	<0.01%

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%). Also, shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

Table A3 – Complete list of predicted concentrations of Ocean Plan constituents at the edge of the ZID for the Variant

Constituent	Units	Ocean Plan Objective	Estimated Concentration at Edge of ZID by Scenario									
			Variant									
			1	2	3	4	5	6	7	8	9	10
Objectives for protection of marine aquatic life - 6-month median limit												
Arsenic	µg/L	8	3.9	4.0	4.1	3.8	3.3	3.8	4.0	4.0	3.4	3.2
Cadmium	µg/L	1	0.3	0.3	0.2	0.1	0.02	0.3	0.3	0.2	0.1	0.01
Chromium (Hexavalent)	µg/L	2	0.09	0.09	0.09	0.06	0.02	0.16	0.2	0.1	0.05	0.01
Copper	µg/L	3	1.9	2.0	2.0	2.1	2.1	2.2	2.3	2.2	2.1	2.0
Lead	µg/L	2	0.03	0.03	0.03	0.02	0.01	0.1	0.05	0.04	0.02	0.004
Mercury	µg/L	0.04	0.03	0.02	0.02	0.01	0.002	0.03	0.02	0.02	0.01	0.002
Nickel	µg/L	5	0.7	0.7	0.6	0.4	0.1	1.0	0.9	0.7	0.3	0.1
Selenium	µg/L	15	0.1	0.1	0.1	0.1	0.05	0.2	0.2	0.2	0.1	0.03
Silver	µg/L	0.7	0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Zinc	µg/L	20	8.1	8.3	8.5	8.5	8.3	9.5	9.5	9.3	8.5	8.2
Cyanide	µg/L	1	0.6	0.6	0.5	0.3	0.1	0.7	0.7	0.5	0.2	0.05
Total Chlorine Residual	µg/L	2	–	–	–	–	–	–	–	–	–	–
Ammonia (as N) - 6-mo median	µg/L	600	34	245	396	446	239	1111	1154	1060	445	151
Ammonia (as N) - Daily Max	µg/L	2,400	43	328	531	600	322	1493	1551	1425	598	203
Acute Toxicity [a]	TUa	0.3										
Chronic Toxicity [a]	TUc	1										
Phenolic Compounds (non-chlorinated)	µg/L	30	5.4	5.0	4.7	2.4	0.7	6.7	6.2	4.8	1.8	0.4
Chlorinated Phenolics [b]	µg/L	1	<2.2	<2.0	<1.8	<0.9	<0.2	<2.0	<1.8	<1.4	<0.5	<0.1
Endosulfan	µg/L	0.009	3.3E-05	3.1E-04	5.1E-04	5.9E-04	3.2E-04	1.5E-03	1.4E-03	1.4E-03	5.9E-04	2.0E-04
Endrin	µg/L	0.002	1.5E-07	6.0E-07	9.2E-07	9.9E-07	5.2E-07	2.5E-06	2.6E-06	2.3E-06	9.8E-07	3.3E-07
HCH (Hexachlorocyclohexane)	µg/L	0.004	4.4E-05	3.9E-04	6.4E-04	7.3E-04	3.9E-04	1.8E-03	1.9E-03	1.7E-03	7.3E-04	2.5E-04
Radioactivity (Gross Beta) [a]	pci/L	0.0										
Radioactivity (Gross Alpha) [a]	pci/L	0.0										
Objectives for protection of human health – non carcinogens – 30-day average limit												
Acrolein	µg/L	220	0.2	0.2	0.3	0.2	0.1	0.5	0.4	0.4	0.1	0.04
Antimony	µg/L	1200	0.01	0.02	0.02	0.01	0.01	0.03	0.03	0.03	0.01	0.004
Bis (2-chloroethoxy) methane	µg/L	4.4	<1.0	<0.9	<0.8	<0.4	<0.1	<0.9	<0.8	<0.6	<0.2	<0.04
Bis (2-chloroisopropyl) ether	µg/L	1200	<1.0	<0.9	<0.8	<0.4	<0.1	<0.9	<0.8	<0.6	<0.2	<0.04
Chlorobenzene	µg/L	570	<0.1	<0.05	<0.04	<0.02	<0.01	<0.05	<0.05	<0.04	<0.01	<0.003
Chromium (III)	µg/L	190000	1.1	1.0	0.9	0.4	0.1	1.2	1.1	0.8	0.3	0.1
Di-n-butyl phthalate	µg/L	3500	<1.0	<0.9	<0.8	<0.4	<0.1	<0.9	<0.8	<0.6	<0.2	<0.1
Dichlorobenzenes	µg/L	5100	0.1	0.1	0.1	0.04	0.01	0.1	0.1	0.1	0.03	0.01
Diethyl phthalate	µg/L	33000	<0.1	<0.1	<0.1	<0.1	<0.04	<0.1	<0.1	<0.1	<0.04	<0.02
Dimethyl phthalate	µg/L	820000	<0.1	<0.1	<0.1	<0.04	<0.02	<0.1	<0.1	<0.05	<0.02	<0.01

Constituent	Units	Ocean Plan Objective	Estimated Concentration at Edge of ZID by Scenario									
			Variant									
			1	2	3	4	5	6	7	8	9	10
4,6-dinitro-2-methylphenol	µg/L	220	<5.3	<4.6	<4.1	<1.8	<0.4	<4.6	<4.1	<3.0	<1.0	<0.2
2,4-Dinitrophenol [b]	µg/L	4.0	<5.4	<4.7	<4.1	<1.8	<0.3	<4.7	<4.1	<3.0	<1.0	<0.2
Ethylbenzene	µg/L	4100	<0.1	<0.05	<0.04	<0.02	<0.01	<0.05	<0.05	<0.04	<0.01	<0.003
Fluoranthene	µg/L	15	0.01	0.01	0.01	0.003	0.001	0.01	0.01	0.01	0.002	0.0003
Hexachlorocyclopentadiene	µg/L	58	<0.01	<0.01	<0.01	<0.01	<0.004	<0.01	<0.01	<0.01	<0.004	<0.002
Nitrobenzene	µg/L	4.9	<2.6	<2.2	<1.9	<0.8	<0.1	<2.2	<2.0	<1.4	<0.5	<0.1
Thallium	µg/L	2	0.01	0.01	0.01	0.01	0.005	0.03	0.03	0.02	0.01	0.003
Toluene	µg/L	85000	<0.1	<0.05	<0.04	<0.02	<0.01	<0.05	<0.05	<0.04	<0.01	<0.003
Tributyltin [b]	µg/L	0.0014	<0.01	<0.005	<0.004	<0.002	<0.001	<0.005	<0.004	<0.003	<0.001	<0.0003
1,1,1-Trichloroethane	µg/L	540000	<0.05	<0.05	<0.04	<0.02	<0.01	<0.05	<0.05	<0.04	<0.01	<0.003
Objectives for protection of human health – carcinogens – 30-day average limit												
Acrylonitrile [c]	µg/L	0.10	0.001	0.007	0.011	0.012	0.007	0.034	0.035	0.031	0.013	0.004
Aldrin [b]	µg/L	0.000022	<9.0E-06	<4.9E-05	<7.8E-05	<8.7E-05	<4.6E-05	<6.4E-05	<9.2E-05	<1.1E-04	<5.6E-05	<2.4E-05
Benzene	µg/L	5.9	<0.1	<0.05	<0.04	<0.02	<0.01	<0.05	<0.05	<0.04	<0.01	<0.003
Benzidine [b]	µg/L	0.000069	<5.4	<4.7	<4.2	<1.8	<0.4	<4.7	<4.2	<3.0	<1.0	<0.2
Beryllium [c]	µg/L	0.033	3.61E-6	3.10E-6	2.66E-6	1.08E-6	1.72E-7	3.14E-6	2.72E-6	1.88E-6	6.15E-7	1.03E-7
Bis(2-chloroethyl)ether [b]	µg/L	0.045	<2.6	<2.2	<1.9	<0.8	<0.2	<2.2	<2.0	<1.4	<0.5	<0.1
Bis(2-ethyl-hexyl)phthalate	µg/L	3.5	0.1	0.6	0.9	1.0	0.5	2.4	2.5	2.3	1.0	0.3
Carbon tetrachloride	µg/L	0.90	0.1	0.05	0.04	0.02	0.01	0.1	0.1	0.04	0.02	0.004
Chlordane	µg/L	0.000023	1.4E-06	5.2E-06	8.0E-06	8.6E-06	4.5E-06	2.2E-05	2.2E-05	2.0E-05	8.5E-06	2.9E-06
Chlorodibromomethane	µg/L	8.6	0.1	0.1	0.1	0.05	0.02	0.1	0.1	0.1	0.04	0.01
Chloroform	µg/L	130	0.1	0.3	0.5	0.5	0.3	1.2	1.3	1.2	0.5	0.2
DDT	µg/L	0.00017	9.6E-07	8.1E-06	1.3E-05	1.5E-05	8.1E-06	3.7E-05	3.9E-05	3.6E-05	1.5E-05	5.1E-06
1,4-Dichlorobenzene	µg/L	18	0.1	0.1	0.1	0.04	0.01	0.1	0.1	0.1	0.03	0.01
3,3-Dichlorobenzidine [b]	µg/L	0.0081	<5.4	<4.7	<4.2	<1.8	<0.4	<4.7	<4.2	<3.0	<1.0	<0.2
1,2-Dichloroethane	µg/L	28	<0.1	<0.05	<0.04	<0.02	<0.01	<0.05	<0.05	<0.04	<0.01	<0.003
1,1-Dichloroethylene	µg/L	0.9	0.1	0.05	0.04	0.02	0.01	0.05	0.05	0.04	0.01	0.003
Dichlorobromomethane	µg/L	6.2	0.1	0.1	0.1	0.05	0.02	0.1	0.1	0.1	0.04	0.01
Dichloromethane	µg/L	450	0.1	0.05	0.05	0.02	0.01	0.1	0.1	0.05	0.02	0.004
1,3-dichloropropene	µg/L	8.9	0.1	0.05	0.05	0.02	0.01	0.1	0.1	0.04	0.02	0.004
Dieldrin	µg/L	0.00004	3.3E-06	6.6E-06	8.8E-06	8.5E-06	4.2E-06	2.1E-05	2.2E-05	2.0E-05	8.1E-06	2.7E-06
2,4-Dinitrotoluene	µg/L	2.6	<0.01	<0.02	<0.03	<0.03	<0.01	<0.01	<0.02	<0.03	<0.01	<0.01
1,2-Diphenylhydrazine [b]	µg/L	0.16	<1.0	<0.9	<0.8	<0.4	<0.1	<0.9	<0.8	<0.6	<0.2	<0.04
Halomethanes	µg/L	130	0.1	0.1	0.1	0.03	0.01	0.1	0.1	0.1	0.03	0.01
Heptachlor [b]	µg/L	0.00005	<7.0E-6	<6.5E-5	<1.1E-4	<1.2E-4	<6.6E-05	<6.3E-05	<1.1E-04	<1.5E-04	<7.5E-05	<3.4E-05
Heptachlor Epoxide	µg/L	0.00002	1.5E-7	6.0E-7	9.2E-7	9.9E-7	5.2E-7	2.5E-6	2.6E-6	2.3E-6	9.8E-7	3.3E-7
Hexachlorobenzene	µg/L	0.00021	4.1E-6	4.0E-6	3.8E-6	2.2E-6	7.0E-7	5.9E-6	5.5E-6	4.4E-6	1.6E-6	4.4E-7
Hexachlorobutadiene	µg/L	14	2.8E-8	7.7E-8	1.1E-7	1.2E-7	6.0E-8	2.9E-7	3.0E-7	2.7E-7	1.1E-7	3.8E-8
Hexachloroethane	µg/L	2.5	<1.0	<0.9	<0.8	<0.3	<0.1	<0.9	<0.8	<0.6	<0.2	<0.04
Isophorone	µg/L	730	<0.1	<0.05	<0.04	<0.02	<0.01	<0.05	<0.05	<0.04	<0.01	<0.003
N-Nitrosodimethylamine	µg/L	7.3	0.0003	0.001	0.001	0.001	0.001	0.001	0.001	0.002	0.001	0.0003
N-Nitrosodi-N-Propylamine	µg/L	0.38	0.0003	0.001	0.001	0.001	0.001	0.0003	0.001	0.001	0.001	0.0003
N-Nitrosodiphenylamine	µg/L	2.5	<1.0	<0.9	<0.8	<0.3	<0.1	<0.9	<0.8	<0.6	<0.2	<0.04
PAHs	µg/L	0.0088	0.0002	0.0003	0.0004	0.0004	0.0002	0.0012	0.0012	0.0010	0.0004	0.0001
PCBs	µg/L	0.000019	8.7E-6	1.2E-5	1.3E-5	1.1E-5	4.8E-6	2.8E-5	2.8E-5	2.4E-5	9.7E-6	3.0E-6
TCDD Equivalents [c]	µg/L	3.9E-09	9.8E-11	9.3E-10	1.5E-9	1.7E-9	9.3E-10	4.3E-9	4.5E-9	4.1E-9	1.7E-9	5.9E-10
1,1,2,2-Tetrachloroethane	µg/L	2.3	<0.1	<0.05	<0.04	<0.02	<0.01	<0.05	<0.05	<0.04	<0.01	<0.003
Tetrachloroethylene	µg/L	2.0	<0.1	<0.05	<0.04	<0.02	<0.01	<0.05	<0.05	<0.04	<0.01	<0.003
Toxaphene [e]	µg/L	2.1E-04	7.4E-06	4.8E-05	7.8E-05	8.7E-05	4.7E-05	2.2E-04	2.3E-04	2.1E-04	8.7E-05	2.9E-05
Trichloroethylene	µg/L	27	<0.1	<0.05	<0.04	<0.02	<0.01	<0.05	<0.05	<0.04	<0.01	<0.003
1,1,2-Trichloroethane	µg/L	9.4	<0.1	<0.05	<0.04	<0.02	<0.01	<0.05	<0.05	<0.04	<0.01	<0.003
2,4,6-Trichlorophenol [b]	µg/L	0.29	<1.0	<0.9	<0.8	<0.3	<0.1	<0.9	<0.8	<0.6	<0.2	<0.04
Vinyl chloride	µg/L	36	<0.03	<0.03	<0.03	<0.02	<0.005	<0.03	<0.03	<0.02	<0.01	<0.003

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR concentrate, and these individual concentrations would comply with the Ocean Plan objectives.
[b] All observed values from some data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.
[c] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.
[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

Table A4 – Complete list of predicted concentrations at the edge of the ZID expressed as a percentage of Ocean Plan[a]

Constituent	Units	Ocean Plan Objective	Percentage of Ocean Plan Objective at Edge of ZID by Scenario [a]									
			Variant									
			1	2	3	4	5	6	7	8	9	10
Objectives for protection of marine aquatic life - 6-month median limit												
Arsenic	µg/L	8	49%	50%	51%	47%	41%	48%	49%	50%	43%	39%
Cadmium	µg/L	1	31%	27%	24%	11%	2%	31%	27%	20%	7%	1%
Chromium (Hexavalent)	µg/L	2	5%	5%	5%	3%	1%	8%	8%	6%	2%	1%
Copper	µg/L	3	64%	66%	68%	69%	68%	75%	75%	75%	70%	68%
Lead	µg/L	2	2%	2%	2%	1%	0.3%	3%	2%	2%	1%	0.2%
Mercury	µg/L	0.04	66%	58%	51%	23%	6%	64%	57%	42%	15%	4%
Nickel	µg/L	5	14%	13%	13%	7%	2%	20%	19%	15%	6%	1%
Selenium	µg/L	15	0.4%	1%	1%	1%	0.3%	2%	2%	1%	1%	0.2%
Silver	µg/L	0.7	26%	<27%	<27%	<26%	<24%	<26%	<26%	<27%	<25%	<24%
Zinc	µg/L	20	41%	42%	43%	43%	41%	47%	48%	47%	43%	41%
Cyanide	µg/L	1	57%	53%	49%	26%	7%	71%	65%	50%	18%	5%
Total Chlorine Residual	µg/L	2	–	–	–	–	–	–	–	–	–	–
Ammonia (as N) - 6-mo median	µg/L	600	6%	41%	66%	74%	40%	185%	192%	177%	74%	25%
Ammonia (as N) - Daily Max	µg/L	2,400	2%	14%	22%	25%	13%	62%	65%	59%	25%	8%
Acute Toxicity [b]	TUa	0.3										
Chronic Toxicity [b]	TUc	1										
Phenolic Compounds (non-chlorinated)	µg/L	30	<18%	<17%	<16%	<8%	<2%	<22%	<21%	<16%	<6%	<1%
Chlorinated Phenolics [c]	µg/L	1	--	--	--	--	--	--	--	--	--	--
Endosulfan	µg/L	0.009	0.4%	3%	6%	7%	4%	16%	17%	15%	7%	2%
Endrin	µg/L	0.002	0.01%	0.03%	0.05%	0.05%	0.03%	0.1%	0.1%	0.1%	0.05%	0.02%
HCH (Hexachlorocyclohexane)	µg/L	0.004	1%	10%	16%	18%	10%	45%	47%	43%	18%	6%
Radioactivity (Gross Beta) [b]	pci/L	0.0										
Radioactivity (Gross Alpha) [b]	pci/L	0.0										
Objectives for protection of human health – non carcinogens – 30-day average limit												
Acrolein	µg/L	220	0.1%	0.1%	0.1%	0.1%	0.03%	0.2%	0.2%	0.2%	0.1%	0.02%
Antimony	µg/L	1200	0.001%	0.001%	0.001%	0.001%	0.0005%	0.003%	0.003%	0.002%	0.001%	0.0003%
Bis (2-chloroethoxy) methane	µg/L	4.4	<24%	<21%	<18%	<8%	<2%	<21%	<18%	<13%	<5%	<1%

Constituent	Units	Ocean Plan Objective	Percentage of Ocean Plan Objective at Edge of ZID by Scenario [a]									
			Variant									
			1	2	3	4	5	6	7	8	9	10
Bis (2-chloroisopropyl) ether	µg/L	1200	<0.1%	<0.1%	<0.1%	<0.03%	<0.01%	<0.1%	<0.1%	<0.05%	<0.02%	<0.004%
Chlorobenzene	µg/L	570	<0.01%	<0.01%	<0.01%	<0.004%	<0.001%	<0.01%	<0.01%	<0.01%	<0.002%	<0.001%
Chromium (III)	µg/L	190000	0.001%	0.001%	0.0005%	0.0002%	0.0001%	0.001%	0.001%	0.0004%	0.0001%	0.00003%
Di-n-butyl phthalate	µg/L	3500	<0.03%	<0.03%	<0.02%	<0.01%	<0.003%	<0.03%	<0.02%	<0.02%	<0.01%	<0.001%
Dichlorobenzenes	µg/L	5100	0.001%	0.001%	0.001%	0.001%	0.0003%	0.002%	0.002%	0.001%	0.001%	0.0002%
Diethyl phthalate	µg/L	33000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Dimethyl phthalate	µg/L	820000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
4,6-dinitro-2-methylphenol	µg/L	220	<2%	<2%	<2%	<1%	<0.2%	<2%	<2%	<1%	<0.5%	<0.1%
2,4-Dinitrophenol [c]	µg/L	4.0	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	µg/L	4100	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Fluoranthene	µg/L	15	0.1%	0.1%	0.1%	0.02%	0.004%	0.1%	0.1%	0.04%	0.01%	0.002%
Hexachlorocyclopentadiene	µg/L	58	<0.01%	<0.01%	<0.02%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Nitrobenzene	µg/L	4.9	<53%	<45%	<39%	<16%	<3%	<46%	<40%	<28%	<9%	<2%
Thallium	µg/L	2	0.3%	0.5%	1%	0.5%	0.2%	1%	1%	1%	0.5%	0.2%
Toluene	µg/L	85000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Tributyltin [c]	µg/L	0.0014	--	--	--	--	--	--	--	--	--	--
1,1,1-Trichloroethane	µg/L	540000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Objectives for protection of human health – carcinogens – 30-day average limit												
Acrylonitrile [d]	µg/L	0.10	1%	7%	11%	12%	7%	34%	35%	31%	13%	4%
Aldrin [c]	µg/L	0.000022	--	--	--	--	--	--	--	--	--	--
Benzene	µg/L	5.9	<1%	<1%	<1%	<0.4%	<0.1%	<1%	<1%	<1%	<0.2%	<0.1%
Benzidine [c]	µg/L	0.000069	--	--	--	--	--	--	--	--	--	--
Beryllium [d]	µg/L	0.033	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bis(2-chloroethyl)ether [c]	µg/L	0.045	--	--	--	--	--	--	--	--	--	--
Bis(2-ethyl-hexyl)phthalate	µg/L	3.5	3%	16%	25%	28%	15%	69%	72%	66%	27%	9%
Carbon tetrachloride	µg/L	0.90	6%	5%	5%	2%	1%	7%	6%	5%	2%	0.4%
Chlordane	µg/L	0.000023	6%	23%	35%	37%	20%	94%	97%	88%	37%	12%
Chlorodibromomethane	µg/L	8.6	1%	1%	1%	0.5%	0.2%	1%	1%	1%	0.4%	0.1%
Chloroform	µg/L	130	0.1%	0.2%	0.3%	0.4%	0.2%	1%	1%	1%	0.4%	0.1%
DDT	µg/L	0.00017	1%	5%	8%	9%	5%	22%	23%	21%	9%	3%
1,4-Dichlorobenzene	µg/L	18	0.3%	0.3%	0.3%	0.2%	0.1%	1%	0.5%	0.4%	0.2%	0.05%
3,3-Dichlorobenzidine [c]	µg/L	0.0081	--	--	--	--	--	--	--	--	--	--
1,2-Dichloroethane	µg/L	28	<0.2%	<0.2%	<0.2%	<0.1%	<0.02%	<0.2%	<0.2%	<0.1%	<0.05%	<0.01%
1,1-Dichloroethylene	µg/L	0.9	6%	5%	5%	2%	1%	6%	5%	4%	1%	0.4%
Dichlorobromomethane	µg/L	6.2	1%	1%	1%	1%	0.3%	2%	2%	2%	1%	0.2%
Dichloromethane	µg/L	450	0.01%	0.01%	0.01%	0.005%	0.002%	0.01%	0.01%	0.01%	0.004%	0.001%
1,3-dichloropropene	µg/L	8.9	1%	1%	1%	0.3%	0.1%	1%	1%	0.5%	0.2%	0.04%
Dieldrin	µg/L	0.00004	8%	16%	22%	21%	11%	54%	55%	49%	20%	7%
2,4-Dinitrotoluene	µg/L	2.6	<0.5%	<1%	<1%	<1%	<1%	<0.4%	<1%	<1%	<1%	<0.3%
1,2-Diphenylhydrazine [c]	µg/L	0.16	--	--	--	--	--	--	--	--	--	--
Halomethanes	µg/L	130	0.04%	0.04%	0.04%	0.03%	0.01%	0.1%	0.1%	0.1%	0.02%	0.01%
Heptachlor [c]	µg/L	0.00005	--	--	--	--	--	--	--	--	--	--
Heptachlor Epoxide	µg/L	0.00002	1%	3%	5%	5%	3%	12%	13%	12%	5%	2%
Hexachlorobenzene	µg/L	0.00021	2%	2%	2%	1%	0.3%	3%	3%	2%	1%	0.2%
Hexachlorobutadiene	µg/L	14	2E-7%	6E-7%	8E-7%	8E-7%	4E-7%	2E-6%	2E-6%	2E-6%	8E-7%	3E-7%
Hexachloroethane	µg/L	2.5	<42%	<36%	<32%	<14%	<3%	<36%	<32%	<23%	<8%	<1%
Isophorone	µg/L	730	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
N-Nitrosodimethylamine	µg/L	7.3	0.004%	0.01%	0.02%	0.01%	0.01%	0.01%	0.02%	0.02%	0.01%	0.005%
N-Nitrosodi-N-Propylamine	µg/L	0.38	0.1%	0.2%	0.3%	0.3%	0.1%	0.1%	0.2%	0.3%	0.1%	0.1%
N-Nitrosodiphenylamine	µg/L	2.5	<42%	<36%	<32%	<14%	<3%	<36%	<32%	<23%	<8%	<1%

Constituent	Units	Ocean Plan Objective	Percentage of Ocean Plan Objective at Edge of ZID by Scenario [a]									
			Variant									
			1	2	3	4	5	6	7	8	9	10
PAHs	µg/L	0.0088	2%	3%	4%	4%	2%	14%	14%	12%	5%	1%
PCBs	µg/L	0.000019	46%	61%	70%	57%	26%	146%	145%	126%	51%	16%
TCDD Equivalents [d]	µg/L	3.9E-09	3%	24%	39%	44%	24%	110%	115%	105%	44%	15%
1,1,2,2-Tetrachloroethane	µg/L	2.3	<2%	<2%	<2%	<1%	<0.3%	<2%	<2%	<2%	<1%	<0.1%
Tetrachloroethylene	µg/L	2.0	<3%	<2%	<2%	<1%	<0.3%	<2%	<2%	<2%	<1%	<0.2%
Toxaphene [e]	µg/L	2.1E-04	4%	23%	37%	42%	22%	103%	107%	99%	41%	14%
Trichloroethylene	µg/L	27	<0.2%	<0.2%	<0.2%	<0.1%	<0.02%	<0.2%	<0.2%	<0.1%	<0.05%	<0.01%
1,1,2-Trichloroethane	µg/L	9.4	<1%	<1%	<0.5%	<0.2%	<0.1%	<1%	<0.5%	<0.4%	<0.1%	<0.03%
2,4,6-Trichlorophenol [c]	µg/L	0.29	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	µg/L	36	<0.1%	<0.1%	<0.1%	<0.04%	<0.01%	<0.1%	<0.1%	<0.1%	<0.03%	<0.01%

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%). Also, shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

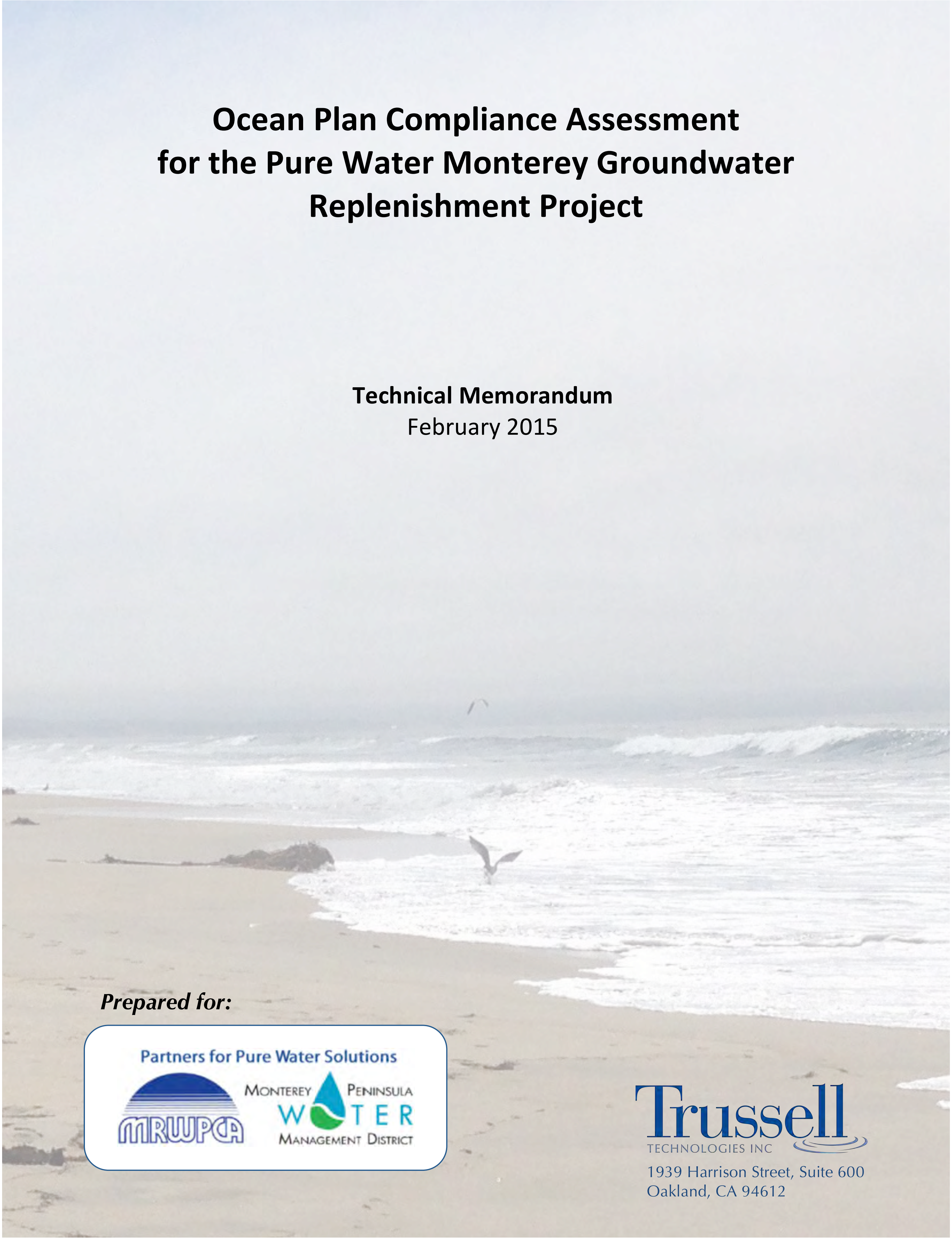
[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] Acrylonitrile, beryllium and TCDD equivalents represent a special case; they were detected in some source waters, but were also not detected above the MRL in others, and the MRL values are above the Ocean Plan objectives. For these constituents, a value of 0 was assumed when it was not detected in a source water and the MRL was above the Ocean Plan objective. This assumption was made to show there is potential for the constituent to exceed the Ocean Plan objective in some flow scenarios, but there is not enough information to provide a complete compliance determination at this time. When only the detected values were considered, acrylonitrile and beryllium did not exceed the Ocean Plan objective by 80% or more and therefore were not included in Tables 7 through 10.

[e] Toxaphene was only detected using the low-detection techniques of the CCLEAN program. It was detected once (09/2011) out of 12 samples collected from the secondary effluent from 2010 through 2015, and during the 7-day composite sample from the test slant well.

Appendix B

Trussell Technologies, Inc (Trussell Tech), 2015. "Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project." *Technical Memorandum prepared for MRWPCA and MPWMD*. Feb.



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

Technical Memorandum
February 2015

Prepared for:

Partners for Pure Water Solutions

MRWPCA

Monterey Peninsula Water Management District

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

Technical Memorandum

February 2015

Prepared By:

Trussell Technologies, Inc.
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Table of Contents

1 Introduction 2
1.1 Treatment through the RTP and AWT Facility 2
1.2 California Ocean Plan 3
1.3 Objective of Technical Memorandum 4
2 Methodology for Ocean Plan Compliance 5
2.1 Methodology for Determination of Discharge Water Quality 5
2.1.1 Future Secondary Effluent 6
2.1.2 GWR RO Concentrate 9
2.1.3 Hauled Brine 9
2.1.4 Combined Ocean Discharge Concentrations 9
2.2 Ocean Modeling and Ocean Plan Compliance Analysis Methodology 10
3 Ocean Plan Compliance Results 12
3.1 Water Quality of Combined Discharge 12
3.2 Ocean Modeling Results 14
3.3 Ocean Plan Compliance Results 16
4 Conclusions 21
5 References 21

1 Introduction

The Monterey Regional Water Pollution Control Agency (MRWPCA) and the Monterey Peninsula Water Management District ("Project Partners") are in the process of developing the Pure Water Monterey Groundwater Replenishment Project ("Proposed Project"). The Proposed Project involves treating secondary effluent from the MRWPCA Regional Treatment Plant (RTP) through the proposed Advanced Water Treatment Facility (AWT Facility) and then injecting this highly purified recycled water into the Seaside Groundwater Basin, later extracting it for replacement of existing municipal water supplies. The Proposed Project will also provide additional tertiary recycled water for agricultural irrigation in northern Salinas Valley as part of the Castroville Seawater Intrusion Project (CISP). A waste stream, known as the reverse osmosis concentrate ("RO concentrate"), would be generated by the AWT Facility and discharged through the existing MRWPCA ocean outfall. The goal of this technical memorandum is to analyze whether the discharge of the Proposed Project's RO concentrate to the ocean through the existing outfall would impact marine water quality, and thus, human health, marine biological resources, or beneficial uses of the receiving waters.

1.1 Treatment through the RTP and AWT Facility

The existing MRWPCA RTP treatment process includes screening, primary sedimentation, secondary biological treatment through trickling filters (TFs), followed by a solids contactor (*i.e.*, bio-flocculation), and then clarification (Figure 1). Much of the secondary effluent undergoes tertiary treatment (granular media filtration and disinfection) to produce recycled water used for agricultural irrigation. The unused secondary effluent is discharged to the Monterey Bay through the MRWPCA Outfall. MRWPCA also accepts trucked brine waste for ocean disposal, which is stored in a pond and mixed with secondary effluent for disposal.

The proposed AWT Facility would include several advanced treatment technologies for purifying the secondary effluent water: ozone (O_3), biologically active filtration (BAF) (this is an optional unit process), membrane filtration (MF), reverse osmosis (RO), and an advanced oxidation process (AOP) using UV-hydrogen peroxide. The Project Partners conducted a pilot-scale study of the ozone, MF, and RO elements of the AWT Facility from December 2013 through July 2014, successfully demonstrating the ability of the various treatment processes to produce highly-purified recycled water that complies with the California Groundwater Replenishment Using Recycled Water Regulations (Groundwater Replenishment Regulations) and Central Coast Water Quality Control Plan (Basin Plan) standards, objectives and guidelines for groundwater.

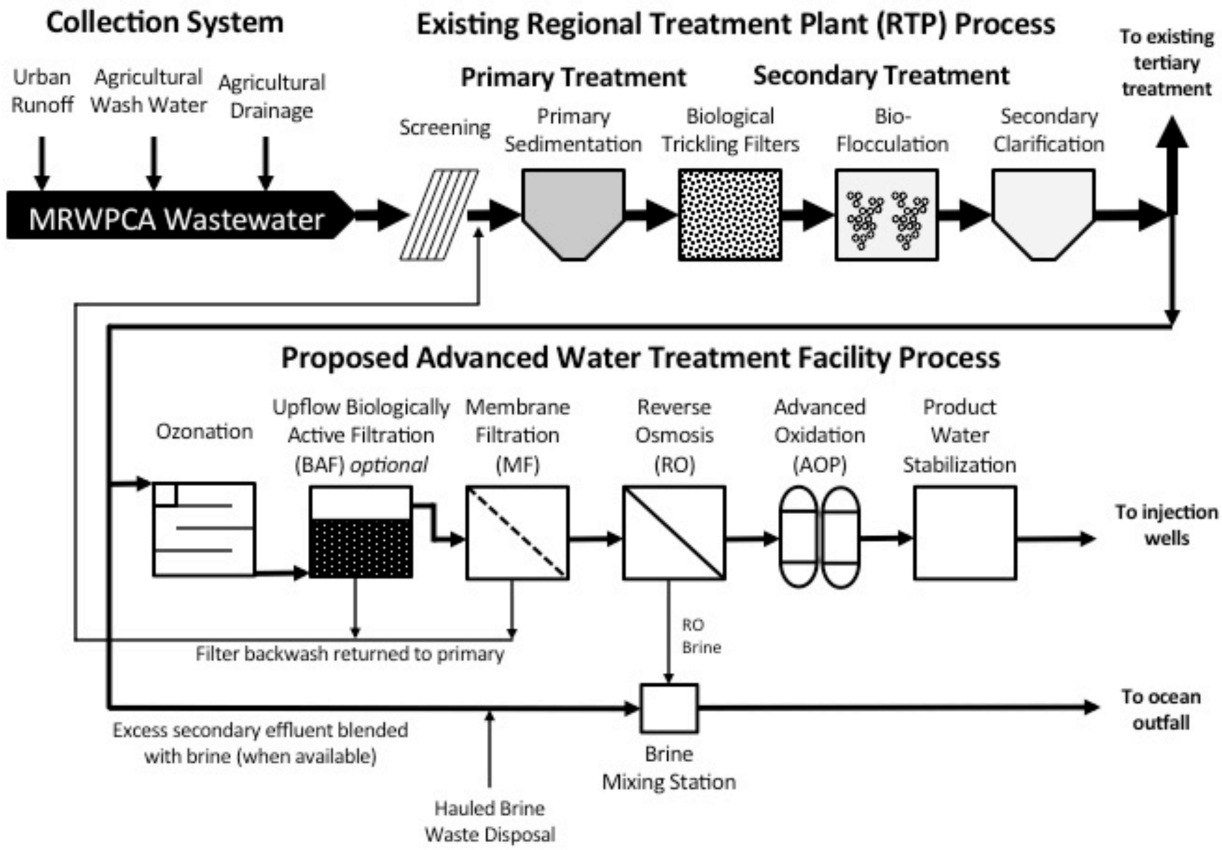

Figure 1 – Simplified diagram of existing MRWPCA RTP and proposed AWT Facility treatment

Reverse osmosis is an excellent removal process, separating out most dissolved constituents from the recycled water. The dissolved constituents removed through RO are concentrated into a waste stream known as the RO concentrate. Unlike the waste streams from the BAF and MF, the RO concentrate cannot be recycled back to the RTP headworks and would be discharged through the MRWPCA Outfall. Discharges through the outfall are subject to National Pollution Discharge Elimination System (NPDES) permitting, which is based on the California State Water Resources Control Board 2012 Ocean Plan ("Ocean Plan"). Monitoring of the RO concentrate was conducted during the Proposed Project's pilot-scale study.

1.2 California Ocean Plan

The Ocean Plan sets forth water quality objectives for ocean discharges with the intent of preserving the quality of the ocean water for beneficial uses, including the protection of both human and aquatic ecosystem health (SWRCB, 2012). For typical wastewater discharges, when released from an outfall, the wastewater and ocean water undergo rapid mixing due to the momentum and buoyancy of the discharge.[1] The mixing occurring in the rising plume is affected

[1] Municipal wastewater effluent, being effectively fresh water, is less dense than seawater and thus rises (due to buoyancy) while it mixes with ocean water.

by the buoyancy and momentum of the discharge, a process referred to as initial dilution (NRC, 1993). The Ocean Plan objectives are to be met after the initial dilution of the discharge into the ocean. The initial dilution occurs in an area known as the zone of initial dilution (ZID). The extent of dilution in the ZID is quantified as the minimum probable initial dilution (D_m). The water quality objectives established in the Ocean Plan are adjusted by the D_m to derive the NPDES ocean discharge limits for a wastewater discharge prior to ocean dilution.

The current MRWPCA wastewater discharge is governed by NPDES permit R3-2014-0013 issued by the Central Coast Regional Water Quality Control Board (RWQCB). Because the existing NPDES permit for the MRWPCA ocean outfall must be amended to discharge the RO concentrate, comparing future discharge concentrations to current NPDES permit limits would not be an appropriate metric or threshold for determining whether the Proposed Project would have a significant impact on marine water quality. Instead, compliance with the Ocean Plan objectives was selected as an appropriate threshold for determining whether or not the Proposed Project would result in a significant impact requiring mitigation. Modeling of the Proposed Project ocean discharge was conducted by FlowScience, Inc. to determine D_m values for the various discharge scenarios. The ocean modeling results were combined with projected discharge water quality to assess compliance with the Ocean Plan.

1.3 Objective of Technical Memorandum

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

2 Methodology for Ocean Plan Compliance

To analyze impacts due to ocean discharge of RO concentrate, the Proposed Project technical team (Trussell Tech with MRWPCA staff) conducted a thorough water quality and flow characterization of the proposed sources of water to be diverted into the wastewater collection system that, after primary and secondary treatment, will be used as influent to the AWT Facility. The team collected all available water quality data for secondary effluent and water quality monitoring results for the Proposed Project new source waters.[2] Using the full suite of data, the team was able to estimate the future worst-case water quality of the combined ocean discharge. With the results of ocean modeling, concentrations at the edge of the ZID were estimated to determine the ability of the Proposed Project to comply with the Ocean Plan. The purpose of this section is to outline the methodology used to make this determination. A summary of the methodology is presented in Figure 2.

2.1 Methodology for Determination of Discharge Water Quality

Water quality data for three types of discharge waters were used to estimate the future combined water quality in the ocean outfall discharge under Proposed Project conditions: (1) the RTP secondary effluent, (2) hauled brine waste (discussed in Section 2.1.3), and (3) the Proposed Project RO concentrate. First, Trussell Tech estimated the potential influence of the new source waters (*e.g.*, agricultural wash water and agricultural drainage waters) on the worst-case water quality for each of the three types of discharge water. The volumetric contribution of each new source water would change under the different flow scenarios that could occur under the Proposed Project. MRWPCA staff estimated the volume that would be collected from source water for each month of the different types of operational years for the Proposed Project (Bob Holden, Source Water Scenarios Spreadsheet, October 16, 2014)[3]. All of the different flow scenarios were considered in developing the assumed worst-case concentrations for the Ocean Plan constituents in the secondary effluent. This conservative approach used the highest observed concentrations from all data sources for each source water in the analysis[4]. Once the estimated worst-case water quality was determined for the RTP secondary effluent, these values were used in estimating the worst-case water qualities for the hauled brine waste and the

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[2] A one-year monitoring program from July 2013 to June 2014 was conducted for five of the potential source waters. Regular monthly and quarterly sampling was carried out for the RTP secondary effluent, agricultural wash water, and Blanco Drain drainage water. Limited sampling of stormwater from Lake El Estero was performed due to seasonal availability, and there was one sampling event for the Tembladero Slough drainage water.

[3] The monthly flows for each source water were estimated by MRWPCA staff for three types of operational years: (1) wet/normal years where a drought reserve is being built, (2) wet/normal years where the drought reserve has been met, and (3) a drought year. Further, two phases of the Proposed Project have been defined for each of these types of years (Phase A and Phase B).

[4] The exception to this statement is cyanide. Only cyanide data collected from April 2005 through January 2011, as part of the NPDES monitoring program, were used in the analysis. In mid-2011, Monterey Bay Analytical Service (MBAS) began performing the cyanide analysis on the RTP effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore the results were questionable. Therefore, although the cyanide concentrations reported by MBAS are presented separately; they are not used in the analysis for evaluating compliance with the Ocean Plan objectives for the EIR.

Proposed Project RO concentrate, as appropriate. The methodology for each type of water is further described in this section.

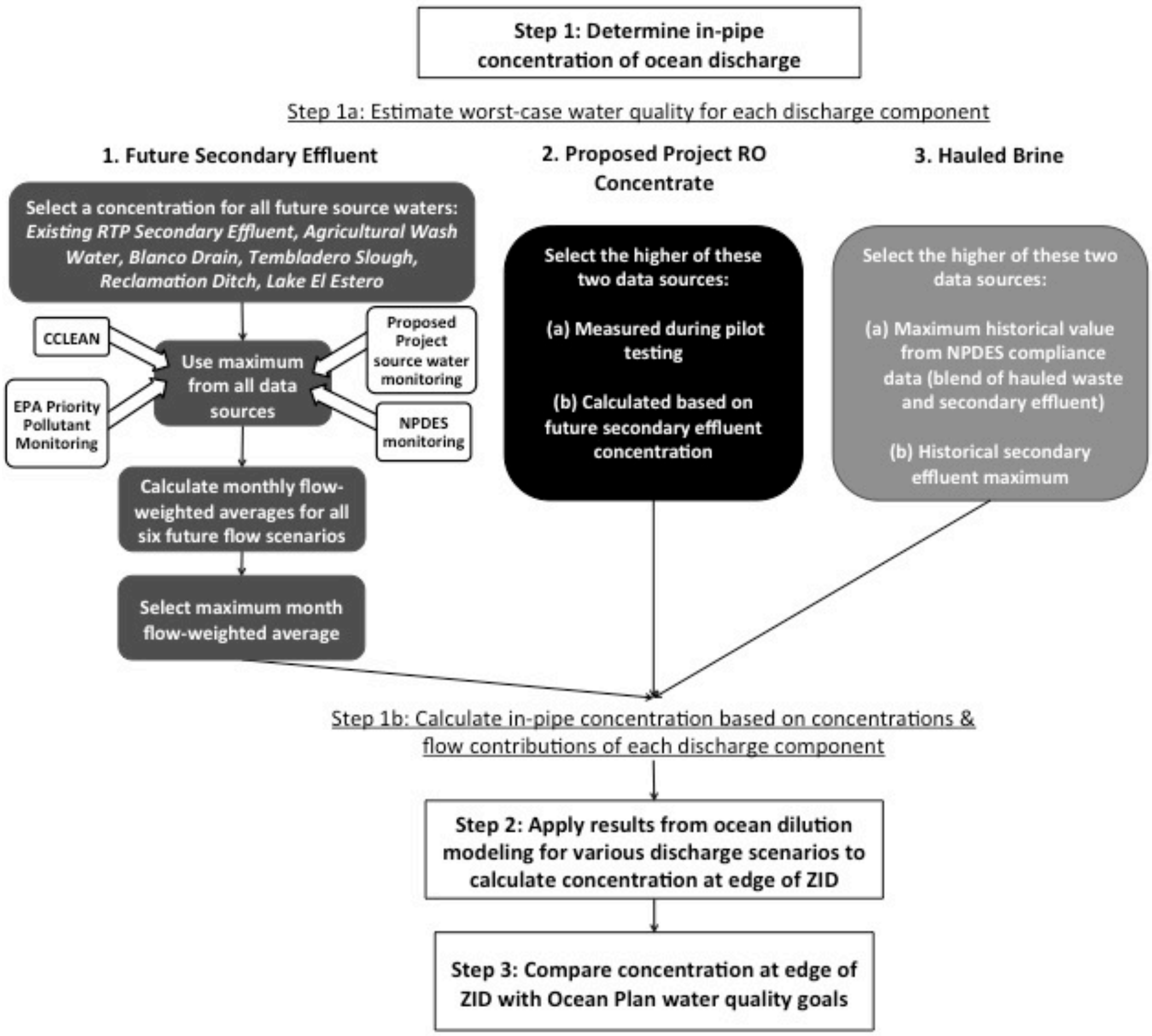

Figure 2 – Logic flow-chart for determination of project compliance with the Ocean Plan objectives

2.1.1 Future Secondary Effluent

Because the Proposed Project involves bringing new source waters into the RTP, the water quality of those source waters as well as the existing secondary effluent needed to be taken into account to estimate the water quality of the future secondary effluent. The following sources of data were considered for selecting an existing secondary effluent concentration for each constituent in the analysis:

- Source water monitoring conducted for the Proposed Project from July 2013 through June 2014
- Historical NPDES compliance data collected semi-annually by MRWPCA (2005-2014)

- Historical Priority Pollutant data collected annually by MRWPCA (2004-2014)
- Data collected by the Central Coast Long-Term Environmental Assessment Network (CCLEAN) (2008-2013)

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

Only one data source was available for several of the new source waters (*i.e.*, agricultural wash water, Blanco Drain, Tembladero Slough, and the Reclamation Ditch[5]), namely, data collected during the source water monitoring conducted for the Proposed Project. From these data, the maximum observed concentration was selected for each source water.

Source water flows used for calculation of blended future secondary effluent concentrations were taken from the six projected operational conditions prepared by MRWPCA staff – Phase A and B for the three conditions: (a) normal/wet year, building reserve, (b) normal/wet year, full reserve, and (c) drought year[6]. For each constituent, a total of 72 future concentrations were calculated – 12 months of the year for the 6 projected future source water flow contributions. Of these concentrations, a maximum monthly flow-weighted concentration was selected for each constituent to be used for the Ocean Plan compliance analysis.

When a constituent cannot be quantified or is not detected, it is reported as less than the Method Reporting Limit (<MRL).[7] Because the actual concentration could be any value equal to or less than the MRL, the conservative approach is to use the value of the MRL in the flow-weighting calculations. In some cases, constituents were not detected in any of the source waters; in this case, the values are reported as ND(<X), where X is the MRL. For some non-detected constituents, the MRL exceeds the Ocean Plan objective, and thus no compliance determination can be made[8].

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[5] For the Reclamation Ditch, water quality data related to the Ocean Plan were not available. Concentrations for the Reclamation Ditch were conservatively assumed to be the higher of either the Blanco Drain or Tembladero Slough concentration.

[6] An alternative scenario exists in which all reasonably available source waters are diverted to the RTP regardless of whether there is demand for recycled water (spreadsheet provided by Larry Hampson, October 17, 2014). This scenario was not evaluated here because it would represent an unlikely flow scenario in which there would be RTP effluent discharged to the ocean in the summer months. Trussell Technologies performed an analysis using this alternative scenario and estimated that the concentrations of the Ocean Plan constituents would be less than or equal to the estimated concentrations of the primary scenarios used in this memorandum, and thus further analysis of the alternative scenario is not included.

[7] The lowest amount of an analyte in a sample that can be quantitatively determined with stated, acceptable precision and accuracy under stated analytical conditions (*i.e*., the lower limit of quantitation). Therefore, acceptable quality control and quality assurance procedures are calibrated to the MRL, or lower. To take into account day-to-day fluctuations in instrument sensitivity, analyst performance, and other factors, the MRL is established at three times the Method Detection Limit (or greater). The Method Detection Limit is the minimum concentration of a substance that can be measured and reported with 99% confidence that the analyte concentration is greater than zero. (40 Code of Federal Regulations Section136 Appendix B).

[8] This phenomenon is common in the implementation of the Ocean Plan where for some constituents, suitable analytical methods are not capable of measuring low enough to quantify the minimum toxicologically relevant concentrations. For these constituents, a discharge is considered compliant if the monitoring results are less than the MRL.

The following approaches were used for addressing the cases where a constituent was reported as less than the MRL:

- **Aggregate constituents with multiple congeners or sub-components:** Some Ocean Plan constituents are a combination of multiple congeners or sub-components (*e.g.*, chlordane, PAHs, PCBs, and TCDD equivalents). Per the Ocean Plan, if individual congeners or sub-components are below the MRL, they are assumed to be zero for the purposes of calculating the aggregate parameter.
- **Combining different types of waters:** The same approach to constituents that were below the MRL was used for both combining different source waters (*i.e.*, predicting future secondary effluent concentrations based on source water contributions) *and* for combining the different discharge components (*i.e.*, RTP secondary effluent, hauled brine, and RO concentrate). For each constituent:
  - ***When all waters had maximum values reported above the MRL*:** The flow-weighted average of the maximum detected concentrations was used when all water had values reported above the MRL.
  - ***When some waters had maximum values reported as less than the MRL*:**
    - When the MRL was *more* than two orders of magnitude greater (*i.e.*, more than 100 times greater) than the highest detected value from the other waters, the waters with maximum concentrations below the MRL were ignored (*i.e.* treated as having a concentration of zero). This case is exclusive to times when CCLEAN data were reported as detections for the RTP secondary effluent, and all of the other source waters were below the MRL[9]. The analytical methods used for CCLEAN are capable of detecting concentrations many orders of magnitude below the detection limits for traditional methods, and thus to include the <MRL from the other methods would overshadow the CCLEAN data. Additionally, in cases where the traditional analytical method had an MRL greater than the Ocean Plan objective, performing the analysis using the high MRL from the non-CCLEAN methods would result in an inability to make a compliance determination for these constituents.
    - When the MRL was *within* two orders of magnitude or less (*i.e.*, less than 100 times greater) than the highest detected value from the other waters, the constituents that were reported as less than the MRL and were assumed to have a concentration at the MRL for the purposes of calculating a flow-weighted average.
  - ***All waters had maximum values reported as less than the MRL*:** A flow-weighted average MRL was calculated for the constituent and the result was reported as less than this combined MRL. For constituents where multiple MRLs exist for the same water (due to different laboratory analysis methods or dilutions), the lowest MRL was used.

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

2.1.2 GWR RO Concentrate

Two potential worst-case concentrations were available for the Proposed Project RO concentrate:

- Measured in the concentrate during pilot testing
- Calculated from the blended future secondary effluent concentration, using the following treatment assumptions[10]:
  - No removal prior to the RO process (*i.e.*, at the RTP or AWT Facility ozone or MF)
  - 81% RO recovery (*i.e.*, of the water feeding into the RO system, 81% is product water, also known as permeate, and 19% is the RO concentrate)
  - Complete rejection of each constituent by the RO membrane

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

2.1.3 Hauled Brine

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

- Historical NPDES compliance data collected semi-annually by MRWPCA (2005-2013) of hauled brine water diluted with existing secondary effluent
- Future secondary effluent concentration, as previously described

The higher of these two values was selected for all constituents; because the hauled brine is diluted by secondary effluent prior to discharge, it is also appropriate to use future secondary effluent concentrations to represent the concentration within hauled brine. Even if a constituent were not present in the hauled brine, if it is present in the secondary effluent it would be present in the combined discharge.

2.1.4 Combined Ocean Discharge Concentrations

Having calculated the worst-case future concentrations for each of the three discharge components, the combined concentration prior to discharge was determined as a flow-weighted average of the contributions of each of the three discharge components. As discussed in Section 3.1, a range of secondary effluent flow conditions was considered.

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

2.2 Ocean Modeling and Ocean Plan Compliance Analysis Methodology

In order to determine Ocean Plan compliance, Trussell Tech used the following information: (1) the in-pipe (*i.e.*, pre-ocean dilution) concentration of a constituent ($C_{\text{in-pipe}}$) that was developed as discussed in the previous section, (2) the minimum probable dilution for the ocean mixing (D_m) for the relevant discharge flow scenarios that was modeled by FlowScience (FlowScience, 2014), and (3) the background concentration of the constituent in the ocean ($C_{\text{Background}}$) 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:

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

The C_{ZID} was then compared to the Ocean Plan objectives[11] in the Ocean Plan's "Table 1" (SWRCB, 2012). As described previously, the in-pipe concentration was estimated as a flow-weighted average of the future secondary effluent, Proposed Project RO concentrate, and hauled brine with the concentrations determined as discussed above. The D_m values for various flow scenarios were determined by modeling (see FlowScience, 2014). Note that this approach could not be applied for some constituents (*e.g.*, acute toxicity, chronic toxicity, and radioactivity[12]). The assumptions used by FlowScience for the ocean discharge dilution modeling are as follows:

- **Flow**: A sensitivity analysis of relationship between D_m and flow rate was performed for the various discharges types. The greatest D_m sensitivity to flow changes was to variations in the RTP secondary effluent flow. To simplify the analysis, the flow scenarios used in the compliance analysis only considered the maximum flows for the hauled brine and the RO concentrate, because these flows result in the lowest D_m, thus making the analysis conservative. The flows considered for each discharge type are as follows:
  - ***Secondary effluent*:** a range of conditions was modeled that reflect realistic future discharge scenarios (minimum flow, moderate flow, and maximum flow).
  - ***Proposed Project RO concentrate*:** 0.94 million gallons per day (mgd), which would be the resulting RO concentrate flow when the AWT Facility is producing

[11] Note that the Ocean Plan (see Ocean Plan Table 2) also defines effluent limitations for oil and grease, suspended solids, settable solids, turbidity, and pH; however, it was not necessary to evaluate these parameters in this assessment. If necessary, the pH of the water would be adjusted to be within acceptable limits prior to discharge. Oil and grease, suspended solids, settable solids, and turbidity do not need to be considered in this analysis as the RO concentrate would be significantly better than the secondary effluent with regards to these parameters. Prior to the RO treatment, the process flow would be treated by MF, which will reduce these parameters, and the waste stream from the MF will be returned to RTP headworks.

[12] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of the constituent. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives (Trussell Technologies, 2014 and 2015). See section 3.4.

4.0 mgd of highly-purified recycled water (corresponds to treating 5.49 mgd of RTP secondary effluent); although the AWT Facility will not be operated at this influent flowrate year round, this is the highest potential RO concentrate flow
    - ***Hauled brine:*** 0.1 mgd, which is the maximum anticipated value (blend of secondary effluent and hauled brine) anticipated by MRWPCA.
- **Total Dissolved Solids (TDS)**: the greatest dilution is achieved when the salinity of the discharge water is the most different from the ambient salinity; therefore, the most conservative TDS will be the highest (*i.e.*, closest to ambient salinity) of:
    - ***Secondary effluent:*** 1,100 milligram per liter (mg/L), which is the maximum expected future TDS, taking into account the flow contribution of each source water and the maximum observed TDS value from each source water
    - ***Proposed Project RO concentrate*:** 5,800 mg/L, which is the maximum expected future TDS based on the maximum expected future secondary effluent TDS and the RO treatment assumptions listed in the section above (*i.e.* in a drought year).
    - ***Hauled brine***: 40,000 mg/L, which is the maximum anticipated value (blend of secondary effluent and hauled brine) from MRWPCA.
- **Ambient salinity**: 33,500 mg/L
- **Temperature**: 20°C

An additional consideration of the ocean dilution modeling is the variation in ocean conditions throughout the year. Three conditions were modeled for all flow scenarios: Davidson (November to March), Upwelling (April to August), and Oceanic (September to October)[13]. In order to conservatively demonstrate Ocean Plan compliance, the lowest D_m from the applicable ocean conditions was used for each flow scenario.

Ocean dilution modeling covered a range of secondary effluent flowrates between 0 and 24.7 mgd[14], and the results showed that Ocean Plan compliance would be achieved when considering all potential secondary effluent flowrates. To simplify the calculation and presentation of these results, representative flowrate ranges were chosen. In order to select the representative flow scenarios to use for the compliance assessment, the balance between in-pipe dilution and dilution through the outfall needed to be taken into account. In general, higher secondary effluent flows being discharged to the ocean would provide dilution of the Proposed Project RO concentrate; however, greater dilution due to ocean water mixing would be provided at lower wastewater discharge flows. The balance of these influences was considered in determining compliance under the five representative discharge conditions that are described in Section 3.2 for the Proposed Project.

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[13] Note that these ranges assign the transitional months to the ocean condition that is typically more restrictive at relevant discharge flows.

[14] The 24.7 mgd represents the secondary effluent flow if the RTP is operating at its design capacity of 29.6 mgd, and there is a net flow of 4.9 mgd to the AWT Facility (a total flow of approximately 5.46 mgd would be sent to the AWT Facility, but 0.55 mgd of MF backwash water is returned to the RTP headworks from the AWT Facility).

3 Ocean Plan Compliance Results

3.1 Water Quality of Combined Discharge

As described above, the first step in the Ocean Plan compliance analysis was to estimate the worst-case water quality for each of the three future discharge components: future RTP effluent, Proposed Project RO concentrate, and hauled brine waste. A summary of the estimated water qualities of these components is given in Table 1. Additional considerations and assumptions for each constituent are documented in the Table 1 notes section.

Table 1 – Summary of estimated worst-case water quality for the three waters that would be discharged through the ocean outfall

Constituent	Units	Secondary Effluent	Hauled Brine	RO Concentrate	Notes
Ocean Plan water quality objectives for protection of marine aquatic life					
Arsenic	µg/L	45	45	12	1,12
Cadmium	µg/L	1.2	1.2	6.4	2,11
Chromium (Hexavalent)	µg/L	2.7	130	14	2,11
Copper	µg/L	25.9	39	136	2,11
Lead	µg/L	0.82	0.82	4.3	2,11
Mercury	µg/L	0.089	0.089	0.510	5,12
Nickel	µg/L	13.1	13.1	69	2,11
Selenium	µg/L	6.5	75	34	2,11
Silver	µg/L	*ND(<1.59)*	ND(<1.59)	ND(<0.19)	4,14
Zinc	µg/L	48.4	48.4	255	2,11
Cyanide (MBAS data)	µg/L	89.5	89.5	143	2,12,13,16
Cyanide	µg/L	7.2	46	38	6,11,16
Total Chlorine Residual	µg/L	*ND(<200)*	*ND(<200)*	*ND(<200)*	10
Ammonia (as N), 6-month median	µg/L	36,400	36,400	191,579	1,11
Ammonia (as N), daily maximum	µg/L	49,000	49,000	257,895	1,11
Acute Toxicity	TUa	2.3	2.3	0.77	7,12,13
Chronic Toxicity	TUc	40	40	100	7,12,13
Phenolic Compounds (non-chlorinated)	µg/L	69	69	363	1,9,11
Chlorinated Phenolics	µg/L	*ND(<20)*	*ND(<20)*	ND(<20)	4,14
Endosulfan	µg/L	0.048	0.048	0.25	5,9,11
Endrin	µg/L	0.000079	0.000079	0.00	3,11
HCH (Hexachlorocyclohexane)	µg/L	0.060	0.060	0.314	11
Radioactivity (Gross Beta)	pCi/L	32	307	34.8	1,7,12,13
Radioactivity (Gross Alpha)	pCi/L	18	457	14.4	1,7,12,13
Objectives for protection of human health - noncarcinogens					
Acrolein	µg/L	9.0	9.0	47	2,11
Antimony	µg/L	0.79	0.79	4	1,11
Bis (2-chloroethoxy) methane	µg/L	*ND(<4.2)*	*ND(<4.2)*	*ND(<1)*	4,14
Bis (2-chloroisopropyl) ether	µg/L	*ND(<4.2)*	*ND(<4.2)*	*ND(<1)*	4,14
Chlorobenzene	µg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
Chromium (III)	µg/L	7.3	87	38	1,11
Di-n-butyl phthalate	µg/L	*ND(<7)*	ND(<7)	*ND(<1)*	4,14
Dichlorobenzenes	µg/L	*1.6*	*1.6*	*8*	1,11
Diethyl phthalate	µg/L	*ND(<5)*	*ND(<5)*	*ND(<1)*	4,14
Dimethyl phthalate	µg/L	*ND(<2)*	*ND(<2)*	*ND(<0.5)*	4,14
4,6-dinitro-2-methylphenol	µg/L	*ND(<20)*	*ND(<20)*	*ND(<5)*	4,14
2,4-dinitrophenol	µg/L	*ND(<13)*	*ND(<13)*	*ND(<5)*	4,14

Constituent	Units	Secondary Effluent	Hauled Brine	RO Concentrate	Notes
Ethylbenzene	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
Fluoranthene	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.1)*	4,14
Hexachlorocyclopentadiene	μg/L	*ND(<0.5)*	*ND(<0.5)*	ND(<0.05)	4,14
Nitrobenzene	μg/L	*ND(<2.3)*	*ND(<2.3)*	*ND(<1)*	4,14
Thallium	μg/L	0.69	0.69	3.7	2,11
Toluene	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
Tributyltin	μg/L	*ND(<0.05)*	*ND(<0.05)*	*ND(<0.02)*	8,14
1,1,1-trichloroethane	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
Objectives for protection of human health - carcinogens					
Acrylonitrile	μg/L	2.5	2.5	13	2,11
Aldrin	μg/L	*ND(<0.007)*	*ND(<0.007)*	*ND(<0.01)*	4,14
Benzene	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
Benzidine	μg/L	ND(<19.8)	*ND(<19.8)*	*ND(<0.05)*	4,14
Beryllium	μg/L	ND(<0.69)	0.0052	*ND(<0.5)*	4,14
Bis(2-chloroethyl)ether	μg/L	ND(<4.2)	*ND(<4.2)*	*ND(<1)*	4,14
Bis(2-ethyl-hexyl)phthalate	μg/L	78	78	411	1,11
Carbon tetrachloride	μg/L	0.5	0.5	2.7	2,11
Chlordane	μg/L	0.000735	0.000735	0.00387	3,9,11
Chlorodibromomethane	μg/L	2.4	2.4	13	2,11
Chloroform	μg/L	39	39	204	2,11
DDT	μg/L	0.0011	0.022	0.035	2,9,11
1,4-dichlorobenzene	μg/L	1.6	1.6	8.4	1,11
3,3-dichlorobenzidine	μg/L	*ND(<19)*	*ND(<19)*	*ND(<2)*	4,14
1,2-dichloroethane	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
1,1-dichloroethylene	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
Dichlorobromomethane	μg/L	2.6	2.6	14	2,11
Dichloromethane (methylenechloride)	μg/L	0.64	0.64	3.4	2,11
1,3-dichloropropene	μg/L	0.56	0.56	3.0	2,11
Dieldrin	μg/L	0.0005	0.0056	0.0029	2,11
2,4-dinitrotoluene	μg/L	*ND(<2)*	*ND(<2)*	*ND(<0.1)*	4,14
1,2-diphenylhydrazine (azobenzene)	μg/L	*ND(<4.2)*	*ND(<4.2)*	*ND(<1)*	4,14
Halomethanes	μg/L	1.4	1.4	7.5	2,9,11
Heptachlor	μg/L	*ND(<0.01)*	*ND(<0.01)*	*ND(<0.01)*	4,14
Heptachlor epoxide	μg/L	0.000059	0.000059	0.000311	3,11
Hexachlorobenzene	μg/L	0.000078	0.000078	0.000411	3,11
Hexachlorobutadiene	μg/L	0.000009	0.000009	0.000047	3,11
Hexachloroethane	μg/L	*ND(<2.3)*	*ND(<2.3)*	*ND(<0.5)*	4,14
Isophorone	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
N-Nitrosodimethylamine	μg/L	0.096	0.096	0.150	2,12,13
N-Nitrosodi-N-Propylamine	μg/L	0.076	0.076	0.019	1,12,13
N-Nitrosodiphenylamine	μg/L	*ND(<2.3)*	*ND(<2.3)*	ND(<1)	4,14
PAHs	μg/L	0.0529	0.0529	0.278	3,9,11
PCBs	μg/L	0.000679	0.000679	0.00357	3,9,11
TCDD Equivalents	μg/L	1.54E-07	1.54E-07	8.09E-07	8,9,11
1,1,2,2-tetrachloroethane	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
Tetrachloroethylene	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
Toxaphene	μg/L	0.00709	0.00709	3.73E-02	3,11
Trichloroethylene	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
1,1,2-trichloroethane	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14
2,4,6-trichlorophenol	μg/L	*ND(<2.3)*	*ND(<2.3)*	*ND(<1)*	4,14
Vinyl chloride	μg/L	*ND(<0.5)*	*ND(<0.5)*	*ND(<0.5)*	4,14

Table 1 Notes:

RTP Effluent and Hauled Brine Data

[1] Existing RTP effluent exceeds concentrations observed in other proposed source waters; the value reported is the existing secondary effluent value.

[2] The proposed new source waters may increase the secondary effluent concentration; the value reported is based on predicted source water blends.

[3] RTP effluent value is based on CCLEAN data; no other source waters were considered due to MRL differences.

[4] MRL provided represents the maximum flow-weighted MRL based on the blend of source waters.

[5] The only water with a detected concentration was the RTP effluent, however the flow-weighted concentration increases due to higher MRLs for the proposed new source waters.

[6] Additional source water data are not available; the reported value is for RTP effluent.

[7] Calculation of the flow-weighted concentration was not feasible due to constituent and the maximum observed value reported.

[8] Agricultural Wash Water data are based on an aerated sample, instead of a raw water sample.

[9] This value in the Ocean Plan is an aggregate of several congeners or compounds. Per the approach described in the Ocean Plan, for cases where the individual congeners/compounds were less than the MRL, a value of 0 is assumed in calculating the aggregate value, as the MRLs span different orders of magnitude.

[10] For all waters, it is assumed that dechlorination will be provided when needed such that the total chlorine residual will be below detection.

RO Concentrate Data

[11] The value presented represents a calculated value assuming no removal prior to RO, complete rejection through RO membrane, and an 81% RO recovery.

[12] The value represents the maximum value observed during the pilot testing study.

[13] The calculated value for the RO concentrate data (described in note 11) was not used in the analysis because it was not considered representative. It is expected that the value would increase as a result of treatment through the AWT Facility (*e.g.* formation of N-Nitrosodimethylamine as a disinfection by-product), or that it will not concentrate linearly through the RO (*e.g.* toxicity and radioactivity).

[14] The MRL provided represents the limit from the source water and pilot testing monitoring programs.

[15] The value presented represents a calculated value assuming 20% removal through primary and secondary treatment, 70% and 90% removal through ozone for DDT and dieldrin, respectively (based on Oram, 2008), complete rejection through the RO membrane, and an 81% RO recovery. The assumed RTP concentrations for Dieldrin and DDT do not include contributions from the agricultural drainage waters. This is because in all but one flow scenario (Scenario 4, described later), either the agricultural drainage waters are not being brought into the RTP because there is sufficient water from other sources (*e.g.* during wet and normal precipitation years), or the RTP effluent is not being discharged to the outfall (*e.g.*, summer months). In this one scenario (Scenario 4), there is a minimal discharge of secondary effluent to the ocean during a drought year under Davidson ocean conditions; for this flow scenario only, different concentrations are assumed for the RTP effluent. DDT and dieldrin concentrations of 0.022 µg/L and 0.0056 µg/L were used for Scenario 4 in the analysis.

Cyanide Data

[16] In mid-2011, MBAS began performing the cyanide analysis on the RTP effluent, at which time the reported values increased by an order of magnitude. Because no operational or source water composition changes took place at this time that would result in such an increase, it is reasonable to conclude the increase is an artifact of the change in analysis method and therefore questionable. Therefore, the cyanide values as measured by MBAS are listed separately from other cyanide values, and the MBAS data were not be used in the analysis for evaluating compliance with the Ocean Plan objectives for the EIR.

3.2 Ocean Modeling Results

FlowScience performed modeling of various discharges that include combinations of RTP secondary effluent, hauled brine waste, and Proposed Project RO concentrate (FlowScience, 2014). Year-round compliance with the Ocean Plan objectives was assessed through the evaluation of five representative discharge scenarios. All scenarios assume the maximum flow rates for the RO concentrate and hauled brine waste, which is a conservative assumption in terms of constituent loading and minimum dilution. Various secondary effluent flows were used in the compliance analysis, which represent the different types of future discharge compositions.

The five scenarios used for the compliance assessment in terms of secondary effluent flows to be discharged with the other discharges are shown in Table 2, and include:

(1) **RTP Design Capacity:** maximum flows for the Proposed Project with all 172 discharge ports open[15]. The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario. This scenario represents the maximum (NPDES) permitted wastewater flow (with the Proposed Project in operation).

(2) **Maximum Flow under Current Port Configuration:** the maximum flow that can be discharged with the current ports configuration (130 of the 172 ports open)[16]. The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario. This scenario was chosen as it represents the maximum wastewater flow under the existing diffuser conditions.

(3) **Minimum Wastewater Flow (Oceanic/Upwelling):** the maximum influence of the Proposed Project RO concentrate on the ocean discharge under Oceanic/Upwelling ocean conditions (*i.e.*, no secondary effluent discharged). The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario.

(4) **Minimum Wastewater Flow (Davidson):** the maximum influence of the Proposed Project RO concentrate on the ocean discharge under Davidson ocean condition (*i.e.*, the minimum wastewater flow). Observed historic wastewater flows generally exceed 0.4 mgd during Davidson oceanic conditions. Additional source waters would be brought into the RTP if necessary to maintain the 0.4 mgd minimum.

(5) **Moderate Wastewater Flow:** conditions with a moderate wastewater flow when the Proposed Project RO concentrate has a greater influence to the water quality than in Scenarios 1 and 2, but where the ocean dilution (D_m) is reduced due to the higher overall discharge flow (*i.e.*, compared to Scenarios 2 and 3). The Davidson ocean condition was used as it represents the worst-case dilution for this flow scenario.

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[15] Note that this scenario would only apply if wastewater flows increased to the point that MRWPCA took action to open the 42 discharge ports that are currently closed. Scenario 2 is the maximum discharge flow under the current port configuration.

[16] For Scenarios 2 through 5, ocean modeling was performed assuming 120 ports open, which would yield more conservative D_m values than 130 ports, as dilution increases with increasing numbers of open ports.

Table 2 – Flow scenarios and modeled D_m values used for Ocean Plan compliance analysis

No.	Discharge Scenario (Ocean Condition)	Flows (mgd)			D_m
		Secondary effluent	RO concentrate	Hauled brine	
1	RTP Design Capacity (Oceanic)	24.7	0.94	0.1	150
2	RTP Capacity with Current Port Configuration (Oceanic)	23.7	0.94	0.1	137
3	Minimum Wastewater Flow (Oceanic)	0	0.94	0.1	523
4	Minimum Wastewater Flow (Davidson)	0.4	0.94	0.1	285
5	Moderate Wastewater Flow Condition (Davidson)	3	0.94	0.1	201

3.3 Ocean Plan Compliance Results

The flow-weighted in-pipe concentration for each constituent was then calculated for each discharge scenario using the water quality presented in Table 1 and the flows presented in Table 2. The in-pipe concentration was then used to calculate the concentration at the edge of the ZID using the D_m values presented in Table 2. The resulting concentrations for each constituent in each scenario were compared to the Ocean Plan objective to assess compliance. The estimated concentrations for all five flow-scenarios are presented as concentrations at the edge of the ZID (Table 3) and as a percentage of the Ocean Plan objective (Table 4). As shown, none of the constituents are expected to exceed 80% of their Ocean Plan objective[17].

Table 3 – Predicted concentrations of Ocean Plan constituents at the edge of the ZID

Constituent	Units	Ocean Plan Objective	Estimated Concentrations at Edge of ZID by Discharge Scenario				
			1	2	3	4	5
Objectives for protection of marine aquatic life							
Arsenic	ug/L	8	3.3	3.3	3.0	3.1	3.2
Cadmium	ug/L	1	0.009	0.01	0.01	0.02	0.01
Chromium (Hexavalent)	ug/L	2	0.02	0.03	0.05	0.07	0.04
Copper	ug/L	3	2.2	2.2	2.2	2.3	2.2
Lead	ug/L	2	0.006	0.007	0.008	0.011	0.008
Mercury	ug/L	0.04	0.006	0.006	0.006	0.006	0.006
Nickel	ug/L	5	0.1	0.1	0.1	0.2	0.1
Selenium	ug/L	15	0.05	0.06	0.07	0.10	0.07
Silver	ug/L	0.7	<0.17	<0.17	<0.16	<0.16	<0.17
Zinc	ug/L	20	8.3	8.3	8.4	8.6	8.4
Cyanide (MBAS data)	ug/L	1	0.61	0.66	0.26	0.44	0.50
Cyanide	ug/L	1	0.056	0.062	0.074	0.105	0.076
Total Chlorine Residual	ug/L	2	<1.3	<1.4	<0.4	<0.7	<1.0
Ammonia (as N) - 6-mo median	ug/L	600	279	306	337	481	359
Ammonia (as N) - Daily Max	ug/L	2,400	375	413	454	648	483

[17] Aldrin, benzidine, 3,3-dichlorobenzidine and heptachlor were not detected in any source waters, however their MRLs are greater than the Ocean Plan objective. Therefore, no percentages are presented Table 4 as no compliance conclusions can be drawn for these constituents. This is a typical occurrence for ocean discharges since the MRL is higher than the ocean plan objective for some constituents.

Constituent	Units	Ocean Plan Objective	Estimated Concentrations at Edge of ZID by Discharge Scenario				
			1	2	3	4	5
Acute Toxicity[a]	TUa	0.3					
Chronic Toxicity[a]	TUc	1					
Phenolic Compounds (non-chlorinated)	ug/L	30	0.53	0.58	0.64	0.91	0.68
Chlorinated Phenolics	ug/L	1	<0.13	<0.14	<0.04	<0.07	<0.10
Endosulfan	ug/L	0.009	0.00037	0.00040	0.00045	0.00064	0.00047
Endrin	ug/L	0.002	6.0E-07	6.7E-07	7.3E-07	1.0E-06	7.8E-07
HCH (Hexachlorocyclohexane)	ug/L	0.004	0.00046	0.00050	0.00055	0.00079	0.00059
Radioactivity (Gross Beta)[a]	pci/L	–					
Radioactivity (Gross Alpha)[a]	pci/L	–					
Objectives for protection of human health - noncarcinogens							
Acrolein	ug/L	220	0.07	0.08	0.08	0.1	0.09
Antimony	ug/L	1200	0.0060	0.0066	0.0073	0.010	0.0078
Bis (2-chloroethoxy) methane	ug/L	4.4	<0.03	<0.03	<0.002	<0.007	<0.02
Bis (2-chloroisopropyl) ether	ug/L	1200	<0.03	<0.03	<0.002	<0.007	<0.02
Chlorobenzene	ug/L	570	<0.003	<0.004	<0.001	<0.002	<0.002
Chromium (III)	ug/L	190000	0.058	0.064	0.082	0.116	0.082
Di-n-butyl phthalate	ug/L	3500	<0.04	<0.05	<0.003	<0.01	<0.03
Dichlorobenzenes	ug/L	5100	0.01	0.01	0.01	0.02	0.02
Diethyl phthalate	ug/L	33000	<0.03	<0.04	<0.003	<0.008	<0.02
Dimethyl phthalate	ug/L	820000	<0.01	<0.01	<0.001	<0.004	<0.008
4,6-dinitro-2-methylphenol	ug/L	220	<0.1	<0.1	<0.01	<0.04	<0.08
2,4-Dinitrophenol	ug/L	4.0	<0.08	<0.09	<0.01	<0.03	<0.06
Ethylbenzene	ug/L	4100	<0.003	<0.004	<0.001	<0.002	<0.002
Fluoranthene	ug/L	15	<0.003	<0.004	<0.0003	<0.001	<0.002
Hexachlorocyclopentadiene	ug/L	58	<0.003	<0.003	<0.0002	<0.001	<0.002
Nitrobenzene	ug/L	4.9	<0.01	<0.02	<0.002	<0.005	<0.01
Thallium	ug/L	2	0.005	0.006	0.006	0.009	0.007
Toluene	ug/L	85000	<0.003	<0.004	<0.001	<0.002	<0.002
Tributyltin	ug/L	0.0014	<0.0003	<0.0004	<0.00004	<0.0001	<0.0002
1,1,1-Trichloroethane	ug/L	540000	<0.003	<0.004	<0.001	<0.002	<0.002
Objectives for protection of human health - carcinogens							
Acrylonitrile	ug/L	0.10	0.02	0.02	0.02	0.03	0.03
Aldrin[b]	ug/L	0.000022	<0.00005	<0.00005	<0.00002	<0.00003	<0.00004
Benzene	ug/L	5.9	<0.003	<0.004	<0.001	<0.002	<0.002
Benzidine[b]	ug/L	0.000069	<0.1	<0.1	<0.004	<0.02	<0.08
Beryllium	ug/L	0.033	0.005	0.005	0.001	0.002	0.003
Bis(2-chloroethyl)ether	ug/L	0.045	<0.03	<0.03	<0.002	<0.007	<0.02
Bis(2-ethyl-hexyl)phthalate	ug/L	3.5	0.60	0.66	0.72	1.03	0.77
Carbon tetrachloride	ug/L	0.90	0.004	0.004	0.005	0.007	0.005
Chlordane	ug/L	0.000023	5.6E-06	6.2E-06	6.8E-06	9.7E-06	7.2E-06
Chlorodibromomethane	ug/L	8.6	0.02	0.02	0.02	0.03	0.02
Chloroform	ug/L	130	0.3	0.3	0.4	0.5	0.4
DDT	ug/L	0.00017	1.6E-05	1.8E-05	6.4E-05	1.1E-04	4.7E-05
1,4-Dichlorobenzene	ug/L	18	0.01	0.01	0.01	0.02	0.02
3,3-Dichlorobenzidine[b]	ug/L	0.0081	<0.1	<0.1	<0.01	<0.03	<0.1
1,2-Dichloroethane	ug/L	28	<0.003	<0.004	<0.001	<0.002	<0.002
1,1-Dichloroethylene	ug/L	0.9	0.003	0.004	0.001	0.002	0.002
Dichlorobromomethane	ug/L	6.2	0.02	0.02	0.02	0.03	0.03
Dichloromethane (methylenechloride)	ug/L	450	0.005	0.01	0.01	0.01	0.01
1,3-dichloropropene	ug/L	8.9	0.004	0.005	0.01	0.01	0.01
Dieldrin	ug/L	0.00004	4.0E-06	4.5E-06	6.1E-06	1.3E-05	5.9E-06
2,4-Dinitrotoluene	ug/L	2.6	<0.01	<0.01	<0.001	<0.003	<0.01
1,2-Diphenylhydrazine (azobenzene)	ug/L	0.16	<0.03	<0.03	<0.002	<0.01	<0.02

Constituent	Units	Ocean Plan Objective	Estimated Concentrations at Edge of ZID by Discharge Scenario				
			1	2	3	4	5
Halomethanes	ug/L	130	0.011	0.012	0.013	0.019	0.014
Heptachlor[b]	ug/L	0.00005	<0.0001	<0.0001	<0.00002	<0.00003	<0.00005
Heptachlor Epoxide	ug/L	0.00002	4.5E-07	5.0E-07	5.5E-07	7.8E-07	5.8E-07
Hexachlorobenzene	ug/L	0.00021	6.0E-07	6.6E-07	7.2E-07	1.0E-06	7.7E-07
Hexachlorobutadiene	ug/L	14	6.9E-08	7.6E-08	8.3E-08	1.2E-07	8.9E-08
Hexachloroethane	ug/L	2.5	<0.01	<0.02	<0.001	<0.004	<0.01
Isophorone	ug/L	730	<0.003	<0.004	<0.001	<0.002	<0.002
N-Nitrosodimethylamine	ug/L	7.3	0.001	0.001	0.0003	0.0005	0.001
N-Nitrosodi-N-Propylamine	ug/L	0.38	0.0005	0.001	0.00005	0.0001	0.0003
N-Nitrosodiphenylamine	ug/L	2.5	<0.01	<0.02	<0.002	<0.01	<0.01
PAHs	ug/L	0.0088	0.00041	0.00045	0.00049	0.00070	0.00052
PCBs	ug/L	0.000019	5.20E-06	5.72E-06	6.29E-06	8.98E-06	6.70E-06
TCDD Equivalents	ug/L	3.9E-09	1.18E-09	1.30E-09	1.42E-09	2.03E-09	1.52E-09
1,1,2,2-Tetrachloroethane	ug/L	2.3	<0.003	<0.004	<0.001	<0.002	<0.002
Tetrachloroethylene	ug/L	2.0	<0.003	<0.004	<0.001	<0.002	<0.002
Toxaphene	ug/L	2.1E-04	5.43E-05	5.97E-05	6.57E-05	9.38E-05	6.99E-05
Trichloroethylene	ug/L	27	<0.003	<0.004	<0.001	<0.002	<0.002
1,1,2-Trichloroethane	ug/L	9.4	<0.003	<0.004	<0.001	<0.002	<0.002
2,4,6-Trichlorophenol	ug/L	0.29	<0.01	<0.02	<0.002	<0.01	<0.01
Vinyl chloride	ug/L	36	<0.003	<0.004	<0.001	<0.002	<0.002

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[b] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

Table 4 – Predicted concentrations of all COP constituents, expressed as percent of Ocean Plan Objective

Constituent	Units	Ocean Plan Objective	Estimated Percentage of Ocean Plan Objective at Edge of ZID by Discharge Scenario[c]				
			1	2	3	4	5
Objectives for protection of marine aquatic life							
Arsenic	ug/L	8	41%	41%	38%	38%	40%
Cadmium	ug/L	1	1%	1%	1%	2%	1%
Chromium (Hexavalent)	ug/L	2	1%	1%	2%	3%	2%
Copper	ug/L	3	73%	73%	75%	78%	75%
Lead	ug/L	2	0.3%	0.3%	0.4%	0.5%	0.4%
Mercury	ug/L	0.04	14%	14%	15%	16%	15%
Nickel	ug/L	5	2%	2%	2%	3%	3%
Selenium	ug/L	15	0.3%	0.4%	0.5%	0.7%	0.5%
Silver	ug/L	0.7	<24%	<24%	<23%	<23%	<24%
Zinc	ug/L	20	42%	42%	42%	43%	42%
Cyanide (MBAS data)	ug/L	1	61%	66%	26%	44%	50%
Cyanide	ug/L	1	6%	6%	7%	10%	8%
Total Chlorine Residual	ug/L	2	-	-	-	-	-
Ammonia (as N) - 6-mo median	ug/L	600	46%	51%	56%	80%	60%
Ammonia (as N) - Daily Max	ug/L	2,400	16%	17%	19%	27%	20%
Acute Toxicity[a]	TUa	0.3					
Chronic Toxicity[a]	TUc	1					
Phenolic Compounds (non-chlorinated)	ug/L	30	2%	2%	2%	3%	2%
Chlorinated Phenolics	ug/L	1	<13%	<14%	<4%	<7%	<10%
Endosulfan	ug/L	0.009	4%	4%	5%	7%	5%
Endrin	ug/L	0.002	0.03%	0.03%	0.04%	0.05%	0.04%
HCH (Hexachlorocyclohexane)	ug/L	0.004	11%	13%	14%	20%	15%
Radioactivity (Gross Beta)[a]	pci/L	–					
Radioactivity (Gross Alpha)[a]	pci/L	–					
Objectives for protection of human health - noncarcinogens							
Acrolein	ug/L	220	0.03%	0.03%	0.04%	0.05%	0.04%
Antimony	ug/L	1200	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Bis (2-chloroethoxy) methane	ug/L	4.4	<0.61%	<0.67%	<0.06%	<0.17%	<0.39%
Bis (2-chloroisopropyl) ether	ug/L	1200	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Chlorobenzene	ug/L	570	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Chromium (III)	ug/L	190000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Di-n-butyl phthalate	ug/L	3500	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Dichlorobenzenes	ug/L	5100	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Diethyl phthalate	ug/L	33000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Dimethyl phthalate	ug/L	820000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
4,6-dinitro-2-methylphenol	ug/L	220	<0.06%	<0.06%	<0.01%	<0.02%	<0.04%
2,4-Dinitrophenol	ug/L	4.0	<2.10%	<2.30%	<0.28%	<0.68%	<1.38%
Ethylbenzene	ug/L	4100	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Fluoranthene	ug/L	15	<0.02%	<0.02%	<0.01%	<0.01%	<0.01%
Hexachlorocyclopentadiene	ug/L	58	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Nitrobenzene	ug/L	4.9	<0.30%	<0.33%	<0.04%	<0.10%	<0.20%
Thallium	ug/L	2	0.27%	0.29%	0.32%	0.46%	0.34%
Toluene	ug/L	85000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Tributyltin	ug/L	0.0014	<23%	<25%	<3%	<8%	<15%
1,1,1-Trichloroethane	ug/L	540000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Objectives for protection of human health - carcinogens							
Acrylonitrile	ug/L	0.10	20%	21%	24%	34%	25%
Aldrin[b]	ug/L	0.000022	–	–	–	–	–
Benzene	ug/L	5.9	<0.06%	<0.06%	<0.02%	<0.03%	<0.04%
Benzidine[b]	ug/L	0.000069	–	–	–	–	–
Beryllium	ug/L	0.033	14%	15%	3%	5%	9%

Constituent	Units	Ocean Plan Objective	Estimated Percentage of Ocean Plan Objective at Edge of ZID by Discharge Scenario[c]				
			1	2	3	4	5
Bis(2-chloroethyl)ether	ug/L	0.045	<60%	<66%	<6%	<16%	<38%
Bis(2-ethyl-hexyl)phthalate	ug/L	3.5	17%	19%	21%	29%	22%
Carbon tetrachloride	ug/L	0.90	0.4%	0.5%	0.5%	0.7%	0.6%
Chlordane	ug/L	0.000023	24%	27%	30%	42%	32%
Chlorodibromomethane	ug/L	8.6	0.2%	0.2%	0.3%	0.4%	0.3%
Chloroform	ug/L	130	0.2%	0.3%	0.3%	0.4%	0.3%
DDT	ug/L	0.00017	9%	10%	37%	62%	27%
1,4-Dichlorobenzene	ug/L	18	0.1%	0.1%	0.1%	0.1%	0.1%
3,3-Dichlorobenzidine[b]	ug/L	0.0081	–	–	–	–	–
1,2-Dichloroethane	ug/L	28	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
1,1-Dichloroethylene	ug/L	0.9	0.4%	0.4%	0.1%	0.2%	0.3%
Dichlorobromomethane	ug/L	6.2	0.3%	0.4%	0.4%	0.6%	0.4%
Dichloromethane (methylenechloride)	ug/L	450	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
1,3-dichloropropene	ug/L	8.9	0.05%	0.05%	0.06%	0.08%	0.06%
Dieldrin	ug/L	0.00004	10%	11%	15%	34%	15%
2,4-Dinitrotoluene	ug/L	2.6	<0.5%	<0.5%	<0.02%	<0.1%	<0.3%
1,2-Diphenylhydrazine (azobenzene)	ug/L	0.16	<17%	<18%	<2%	<5%	<11%
Halomethanes	ug/L	130	0.01%	0.01%	0.01%	0.01%	0.01%
Heptachlor[b]	ug/L	0.00005	–	–	<38%	<70%	–
Heptachlor Epoxide	ug/L	0.00002	2%	2%	3%	4%	3%
Hexachlorobenzene	ug/L	0.00021	0.3%	0.3%	0.3%	0.5%	0.4%
Hexachlorobutadiene	ug/L	14	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Hexachloroethane	ug/L	2.5	<0.6%	<0.6%	<0.1%	<0.2%	<0.4%
Isophorone	ug/L	730	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
N-Nitrosodimethylamine	ug/L	7.3	0.01%	0.01%	<0.01%	0.01%	0.01%
N-Nitrosodi-N-Propylamine	ug/L	0.38	0.13%	0.14%	0.01%	0.04%	0.08%
N-Nitrosodiphenylamine	ug/L	2.5	<0.6%	<0.7%	<0.1%	<0.2%	<0.4%
PAHs	ug/L	0.0088	5%	5%	6%	8%	6%
PCBs	ug/L	0.000019	27%	30%	33%	47%	35%
TCDD Equivalents	ug/L	3.9E-09	30%	33%	37%	52%	39%
1,1,2,2-Tetrachloroethane	ug/L	2.3	<0.1%	<0.2%	<0.04%	<0.1%	<0.1%
Tetrachloroethylene	ug/L	2.0	<0.2%	<0.2%	<0.05%	<0.1%	<0.1%
Toxaphene	ug/L	2.1E-04	26%	28%	31%	45%	33%
Trichloroethylene	ug/L	27	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
1,1,2-Trichloroethane	ug/L	9.4	<0.04%	<0.04%	<0.01%	<0.02%	<0.03%
2,4,6-Trichlorophenol	ug/L	0.29	<5%	<6%	<1%	<2%	<3%
Vinyl chloride	ug/L	36	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based the nature of the constituent. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives (see Section 3.4).

[b] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[c] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%).

3.4 Toxicity

The NPDES permit includes daily maximum effluent limitations for acute and chronic toxicity that are based on the current allowable D_m of 145. The acute toxicity effluent limitation is 4.7 TUa (acute toxicity units) and the chronic toxicity effluent limitation is 150 TUc (chronic toxicity units). The permit requires that toxicity testing be conducted twice per year, with one sample collected during the wet season when the discharge is primarily secondary effluent and once during the dry season when the discharge is primarily trucked brine waste. The MRWPCA ocean discharge has consistently complied with these toxicity limits (CCRWQCB, 2014).

Toxicity testing of RO concentrate generated by the pilot testing was conducted in support of the Proposed Project (Trussell Technologies, 2015). On April 9, 2014, a sample of RO concentrate was sent to Pacific EcoRisk for acute and chronic toxicity analysis. Based on these results (RO concentrate values presented in Table 1), the Proposed Project concentrate requires a minimum D_m of 16:1 and 99:1 for acute and chronic toxicity, respectively, to meet the Ocean Plan objectives. These D_m values were compared to predicted D_m values for the discharge of concentrate only from the Proposed Project's full-scale AWT Facility and the discharge of concentrate combined with secondary effluent from the RTP. The minimum dilution modeled for the various Proposed Project discharge scenarios was 137:1, which is when the secondary effluent discharge is at the maximum possible flow under the current port configuration (FlowScience, 2014). Given that the lowest expected D_m value for the various Proposed Project ocean discharge scenarios is greater than the required dilution factor for compliance with the Ocean Plan toxicity objectives, this sample illustrates that the discharge scenarios would comply with Ocean Plan objectives.

4 Conclusions

The purpose of the analysis documented in this technical memorandum was to assess the ability of the Proposed Project to comply with the Ocean Plan objectives. Trussell Tech used a conservative approach to estimate the water qualities of the RTP secondary effluent, RO concentrate, and hauled brine waste for the Proposed Project. These water quality data were then combined for various discharge scenarios, and a concentration at the edge of the ZID was calculated for each constituent and scenario. Compliance assessments could not be made for selected constituents, as noted, due to analytical limitations, but this is a typical occurrence for these Ocean Plan constituents. Based on the data, assumptions, modeling, and analytical methodology presented in this technical memorandum, the Proposed Project would comply with the Ocean Plan objectives.

5 References

Central Coast Regional Water Quality Control Board (CCRWQCB), 2014. Waste Discharge Requirements for the Monterey Regional Water Pollution Control Agency Regional Treatment Plant.

FlowScience, 2014. "MRWPCA GWR Discharge Dilution Analysis FSI 144082." Technical Memorandum to Robert Holden, MRWPCA. 8 Nov.

NRC, 1993. "Managing Wastewater in Coastal Urban Areas". National Academy Press, Washington, D.C.

State Water Resources Control Board, California Environmental Protection Agency (SWRCB), 2012. *California Ocean Plan: Water Quality Control Plan, Ocean Waters of California*.

Trussell Technologies, Inc. (2014). *Pure Water Monterey Groundwater Recharge Project: Advanced Water Treatment Facility Piloting. Draft Report, Prepared for the MRWPCA and the MPWMD. Dec.*

Trussell Technologies, Inc. (2015). "AWT Facility Pilot-Scale RO Concentrate Toxicity Testing." *Communication, Prepared for Bob Holden, MRWPCA. Feb.*

Appendix C

Trussell Technologies, Inc (Trussell Tech), 2015b. "Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant." *Technical Memorandum prepared for MRWPCA and MPWMD*. March.

Addendum Report to Ocean Plan Compliance Assessment Reports: Monterey Peninsula Water Supply Project, Pure Water Monterey Groundwater Replenishment Project, and the Monterey Peninsula Water Supply Project Variant

Addendum Report

April 17th 2015

Prepared for:

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Addendum Report to Ocean Plan Compliance Assessment Reports: Monterey Peninsula Water Supply Project, Pure Water Monterey Groundwater Replenishment Project, and the Monterey Peninsula Water Supply Project Variant

Addendum Report

April 17th 2015

Prepared By:

Trussell Technologies, Inc.
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Table of Contents

1 Introduction 2
2 Modeling Update Results 3
2.1 Updated Results for the MPWSP 3
2.2 Updated Results for the Variant Project 4
2.3 Updated Results for the GWR Project 6
3 Conclusions 8
4 References 10
Appendix A – Updated Ocean Discharge Modeling Results 11
Appendix B – Estimated Concentrations of All Ocean Plan Constituents 14

1 Introduction

Trussell Technologies, Inc. (Trussell Tech) previously prepared two Technical Memoranda to assess compliance of the following three proposed projects with the California Ocean Plan (SWRCB, 2012):

1. **Monterey Peninsula Water Supply Project ("MPWSP")**, which would include a seawater desalination plant capable of producing 9.6 million gallons per day (mgd) of drinking water (Ocean Plan compliance assessment described in Trussell Tech, 2015b).
2. **Pure Water Monterey Groundwater Replenishment Project ("GWR Project"),** which would include an Advanced Water Treatment facility ("AWT Facility") capable of producing an average flow of 3.3 mgd of highly purified recycled water for injection into the Seaside Groundwater Basin (Ocean Plan compliance assessment described in Trussell Tech, 2015a). The AWT Facility source water would be secondary treated wastewater ("secondary effluent") from the Monterey Regional Water Pollution Control Agency's (MRWPCA's) Regional Treatment Plant (RTP).
3. **Monterey Peninsula Water Supply Project Variant or "Variant Project"**, which would be a combination of a smaller seawater desalination plant capable of producing 6.4 mgd of drinking water along with the GWR Project (Ocean Plan compliance assessment described in Trussell Tech, 2015b).

Both the proposed desalination facility and the proposed AWT Facility would employ reverse osmosis (RO) membranes to purify the waters, and as a result, both projects would produce RO concentrate waste streams that would be disposed through the existing MRWPCA ocean outfall: the RO concentrate from the desalination facility ("Desal Brine"), and the RO concentrate from the AWT Facility ("GWR Concentrate"). Additional details regarding the project backgrounds, assessment methodologies, results, and conclusions for discharge of these waste streams are described in the previous Technical Memoranda (Trussell Tech, 2015a and 2015b).

The Ocean Plan objectives are to be met after initial dilution of the discharge in the ocean. The initial dilution occurs in an area known as the zone of initial dilution (ZID). The extent of dilution in the ZID is quantified and referred to as the minimum probable initial dilution (D_m). The water quality objectives established in the Ocean Plan are adjusted by the D_m to derive the National Pollutant Discharge Elimination System (NPDES) permit limits for a treated wastewater discharge prior to ocean dilution.

Part of the methodology for estimating the concentration of a constituent for the Ocean Plan is estimating the D_m based on ocean modeling. FlowScience, Inc. ("FlowScience") conducted modeling of mixing in the ocean for various discharge scenarios related to the proposed projects to determine D_m values for the key discharge scenarios. Recently, additional modeling by FlowScience (FlowScience, 2015) was performed to (1) update the number of currently open discharge ports in the MRWPCA ocean outfall from 120 to 130 open ports, (2) update the GWR RO concentrate flow from 0.73 to 0.94 mgd and account for the hauled brine[1] for the MPWSP

[1] The hauled brine is waste that is trucked to the RTP and blended with secondary effluent prior to being discharged. The maximum anticipated flow of this stream is 0.1 mgd (blend of brine and secondary effluent).

and Variant Project discharge scenarios, and (3) model additional key discharge scenarios that were missing from the initial ocean modeling for the MPWSP and Variant Project.

The purpose of this Addendum Report is to provide an understanding of the impact of the updated ocean discharge modeling on the previous Ocean Plan compliance assessments for the various proposed projects.

2 Modeling Update Results

FlowScience performed additional ocean discharge modeling for key discharge scenarios (see Appendix A) and Trussell Tech used these modeling results to perform an updated analysis of Ocean Plan compliance for the various proposed projects. Results from these analyses are presented in the following subsections: the MPWSP in Section 2.1; the Variant Project in Section 2.2; and the GWR Project in Section 2.3. Note that the results for the GWR Project in Section 2.3 are also applicable to the Variant Project. Not all previously modeled scenarios were repeated; the scenarios selected for updating were chosen to demonstrate the impact of the updated model input parameters (*i.e.*, number of open ports, inclusion of the hauled waste flow, and GWR Concentrate flow update). In addition, some new scenarios were added to ensure that the worst-case discharge conditions were considered for all of the proposed projects.

2.1 Updated Results for the MPWSP

The following discharge scenarios related to the MPWSP were modeled using 130 open ports for the MRWPCA ocean outfall:

1. **Desal Brine with no secondary effluent (*updated scenario*):** The maximum influence of the Desal Brine on the overall discharge (*i.e.*, no secondary effluent discharged) would be when there is no secondary effluent discharged. This scenario would be representative of conditions when demand for recycled water is highest (*e.g.*, during summer months), and all of the RTP secondary effluent is recycled through the Salinas Valley Reclamation Project (SVRP) for agricultural irrigation. The hauled waste is also included in this discharge scenario.
2. **Desal Brine with moderate secondary effluent flow (*new scenario*):** Desal Brine discharged with a relatively moderate secondary effluent flow that results in a plume with slightly negative buoyancy. This scenario represents times when demand for recycled water is low or the secondary effluent flow is low, and there is excess secondary effluent that is discharged to the ocean.

The updated D_m values for these two discharge scenarios are provided in Table 1. The net impact of using 130 open ports and including the hauled waste was a slight increase (approximately 6%) in the amount of dilution associated with ocean mixing. This confirms that previously modeled MPWSP discharge scenarios with Desal Brine included in Trussell 2015b were conservative (*i.e.* the previous analysis slightly over-estimated the ZID concentration for the Ocean Plan constituents).

Table 1 – Updated minimum probable dilution (D_m) values for select MPWSP discharge scenarios

No.	Discharge Scenario (Ocean Condition)	Discharge flows (mgd)			Previously Reported D_m (120 ports)[a]	Updated D_m (130 ports)
		Secondary effluent	Hauled Waste	Desal Brine		
1	Desal Brine with no secondary effluent flow (Davidson)	0	0.1	13.98	16	17
2	Desal Brine with moderate secondary effluent flow (Davidson)	9	0.1	13.98	n/a [b]	22

[a] The previously reported D_m was used in the analysis presented in Trussell 2015b, and was determined with the assumption that 120 ports on the outfall were open and did not consider the hauled waste flow.
[b] Not applicable, as Discharge Scenario 2, consisting of Desal Brine and a moderate secondary effluent flow, was not previously modeled.

The D_m values reported in Table 1 were used to assess the Ocean Plan compliance for MPWSP Scenarios 1 and 2 using the same methodology and water quality assumptions previously described (Trussell, 2015b). The estimated concentrations at the edge of the ZID for constituents that are expected to exceed the Ocean Plan objective are provided in Table 2. A new exceedance was identified in MPWSP Scenario 2, where the ammonia concentration at the edge of the ZID was predicted to exceed the 6-month median Ocean Plan objective. A list of estimated concentrations for these two scenarios for all Ocean Plan constituents is provided in Appendix B (Table A1).

Table 2 - Predicted concentration at the edge of the ZID expressed for constituents of interest in the MPWSP as both a concentration and percentage of Ocean Plan Objective [a]

Constituent	Units	Ocean Plan Objective	MPWSP Ocean Discharge Scenario			
			Estimated Concentration at Edge of ZID		Estimated Percentage of Ocean Plan objective at Edge of ZID	
			1	2	1	2
Ammonia (as N) – 6-mo median	ug/L	600	19	626	3%	104%
PCBs	ug/L	1.9E-05	1.2E-04	6.7E-05	609%	351%

[a] Red shading indicates constituent is expected to exceed the ocean plan objective for that discharge scenario.

2.2 Updated Results for the Variant Project

The following discharge scenarios related to the Variant Project were modeled using 130 open ports for the MRWPCA ocean outfall:

1. **Desal Brine without secondary effluent or GWR Concentrate (*updated scenario*):** Desal Brine discharged without secondary effluent or GWR Concentrate. This scenario would be representative of conditions when the smaller (6.4 mgd) desalination facility is in operation, but the AWT Facility is not operating (*e.g.*, offline for maintenance), and all of the secondary effluent is recycled through the SVRP (*e.g.*, during high irrigation water demand summer months). The hauled waste is also included in this discharge scenario.
2. **Desal Brine with moderate secondary effluent flow and no GWR concentrate (*new scenario*):** Desal Brine discharged with a relatively moderate secondary effluent flow, but no GWR Concentrate, which results in a plume with slightly negative buoyancy. This

scenario represents times when demand for recycled water is low or the secondary effluent flow is low, and there is excess secondary effluent that is discharged to the ocean. The hauled waste is also included in this discharge scenario.

3. **Desal Brine with GWR Concentrate and no secondary effluent (*updated scenario*):** Desal Brine discharged with GWR Concentrate and no secondary effluent. This scenario would be representative of the condition where both the desalination facility and the AWT Facility are in operation, and there is the highest demand for recycled water through the SVRP (*e.g.*, during summer months). The hauled waste is also included in this discharge scenario.
4. **Desal Brine with GWR Concentrate and a moderate secondary effluent flow (*new scenario*):** Desal Brine discharged with GWR Concentrate and a relatively moderate secondary effluent flow that results in a plume with slightly negative buoyancy. This scenario represents times when both the desalination facility and the AWT Facility are operating, but demand for recycled water is low and there is excess secondary effluent discharged to the ocean. The hauled waste is also included in this discharge scenario.

- **Variant conditions with no Desal Brine contribution**: All scenarios described for the GWR Project are also applicable to the Variant Project. See Section 2.3 for these additional scenarios.

The updated D_m values for these two discharge scenarios are provided in Table 3. Similar to the MPWSP modeling, the net impact of using 130 open ports, including the hauled waste, and using a GWR concentrate flow of 0.94 mgd (instead of 0.73 mgd) was a slight increase (approximately 6%) in the amount of dilution associated with the ocean mixing for the Variant Project discharge scenarios. This confirms that previously modeled Variant discharge scenarios with Desal Brine included in Trussell 2015b were conservative (*i.e.* the previous analysis slightly over-estimated the ZID concentration for the Ocean Plan constituents).

Table 3 – Updated minimum probable dilution (D_m) values for select MPWSP discharge scenarios

No.	Discharge Scenario (Ocean Condition)	Discharge flows (mgd)				Previously Reported D_m (120 ports)[a]	Updated D_m (130 ports)
		Secondary effluent	Hauled Waste	GWR Concentrate	Desal Brine		
1	Desal Brine with no secondary effluent and no GWR Conc. (Upwelling)	0	0.1	0	8.99	15	16
2	Desal Brine with moderate secondary effluent flow and no GWR Conc. (Davidson)	5.8	0.1	0	8.99	n/a [b]	22
3	Desal Brine and GWR Conc. with no secondary effluent flow (Upwelling)	0	0.1	0.94	8.99	17	18
4	Desal Brine and GWR Conc. with moderate secondary effluent flow (Upwelling)	5.3	0.1	0.94	8.99	n/a [b]	24

[a] The previously reported D_m was used in the analysis presented in Trussell 2015b, and was performed with 120 open ports on the outfall, did not consider the hauled waste flow, and assumed a GWR Concentrate flow of 0.73 instead of 0.94 mgd.
[b] Not applicable, as Discharge Scenarios 2 and 4, with moderate secondary effluent flows, were not previously modeled.

The D_m values reported in Table 3 were used to assess the Ocean Plan compliance for Variant Project Scenarios 1 through 4 using the same methodology and water quality assumptions previously described (Trussell, 2015b). The estimated concentrations at the edge of the ZID for constituents that are expected to exceed the Ocean Plan objective are provided in Table 4. For the updated scenarios (Variant Project Scenarios 1 and 3), the changes to the underlying modeling parameters increased the amount of dilution in the ocean mixing, thus the resulting ZID concentrations decreased slightly. For the new scenarios (Variant Project Scenarios 2 and 4), ammonia was identified as an exceedance in Variant Scenario 2 when there is no GWR Concentrate in the combined discharge. This had not been shown in the previous analysis. A list of estimated concentrations for these four scenarios for all Ocean Plan constituents is provided in Appendix B (Table A2).

Table 4 - Predicted concentration at the edge of the ZID expressed for constituents of interest in the MPWSP as both a concentration and percentage of Ocean Plan Objective [a]

Constituent	Units	Ocean Plan Objective	Variant Project Ocean Discharge Scenario							
			Estimated Concentration at Edge of ZID				Estimated Percentage of Ocean Plan objective at Edge of ZID			
			1	2	3	4	1	2	3	4
Objectives for protection of marine aquatic life										
Copper	ug/L	3	2.1	2.4	2.7	2.7	70%	81%	91%	90%
Ammonia (as N) – 6-mo median	ug/L	600	29	629	968	985	4.8%	105%	161%	164%
Objectives for protection of human health - carcinogens										
Chlordane	ug/L	2.3E-05	1.2E-05	1.8E-05	2.9E-05	2.4E-05	52%	77%	125%	106%
DDT	ug/L	1.7E-04	4.6E-05	3.9E-05	2.1E-04	1.2E-04	27%	23%	122%	70%
PCBs	ug/L	1.9E-05	1.2E-04	6.7E-05	1.2E-04	6.7E-05	643%	351%	614%	355%
TCDD Equivalents	ug/L	3.9E-09	1.0E-10	2.7E-09	4.1E-09	4.2E-09	2.6%	68%	104%	107%
Toxaphene	ug/L	2.1E-04	8.0E-05	1.6E-04	2.5E-04	2.2E-04	38%	74%	119%	106%

[a] Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the Ocean Plan objective for that discharge scenario.

2.3 Updated Results for the GWR Project

The proposed Variant Project is inclusive of the proposed GWR Project, such that the analysis in this section is also part of the Variant Project. The following discharge scenarios related to the GWR Project were modeled using 130 open ports for the MRWPCA ocean outfall:

1. **Maximum Flow under Current Port Configuration (*updated scenario*):** the maximum flow that can be discharged with the current port configuration (130 of the 172 ports open). The Oceanic ocean condition was used as it represents the worst-case dilution for this flow scenario. This scenario was chosen because it represents the maximum secondary effluent flow under existing diffuser conditions.
2. **Minimum Secondary effluent Flow - Oceanic/Upwelling (*updated scenario*):** the maximum influence of the GWR Concentrate on the ocean discharge under Oceanic and Upwelling ocean conditions (*i.e.*, no secondary effluent discharged). The Oceanic ocean condition was used as it represents less dilution for this flow scenario compared to the Upwelling condition.

3. **Minimum Secondary effluent Flow – Davidson (*updated scenario*):** the maximum influence of the GWR Concentrate on the ocean discharge under Davidson ocean condition (*i.e.*, the minimum secondary effluent flow). Observed historic secondary effluent flows generally exceed 0.4 mgd during Davidson oceanic conditions. Additional source waters would be brought into the RTP if necessary to maintain the 0.4 mgd minimum.
4. **Low Secondary effluent Flow (*updated scenario*):** conditions with a relatively low secondary effluent flow of 3 mgd when the GWR Concentrate has a greater influence on the water quality than in Scenarios 1, but where the D_m is reduced due to the higher overall discharge flow (*i.e.*, compared to Scenarios 2 and 3). The Davidson ocean condition was used as it represents the worst-case dilution for this flow scenario.
5. **Moderate Secondary effluent Flow (*new scenario*):** conditions with a relatively moderate secondary effluent flow of 8 mgd when the GWR Concentrate has a greater influence on the water quality than in Scenario 1, but where the ocean dilution is reduced due to the higher overall discharge flow (*i.e.*, compared to Scenarios 2 through 4). The Davidson ocean condition was used as it represents the worst-case dilution for this flow scenario.

The updated D_m values for these five discharge scenarios are provided in Table 5. Similar to the modeling for the MPWSP and Variant Project, the impact of using 130 open ports was a slight increase (approximately 4%) in the amount of dilution associated with the ocean mixing for the GWR Project discharge scenarios. This confirms that previously modeled GWR Project discharge scenarios included in Trussell 2015a were conservative (*i.e.* the previous analysis slightly over-estimated the ZID concentration for the Ocean Plan constituents).

Table 5 – Updated minimum probable dilution (D_m) values for select MPWSP discharge scenarios

No.	Discharge Scenario (Ocean Condition)	Discharge flows (mgd)			Previously Reported D_m (120 ports)[a]	Updated D_m (130 ports)
		Secondary effluent	Hauled Waste	GWR Concentrate		
1	Maximum flow with GWR Concentrate with current port configuration (Oceanic)	23.7	0.1	0.94	137	142
2	GWR Concentrate with no secondary effluent (Oceanic)	0	0.1	0.94	523	540
3	GWR Concentrate with minimum secondary effluent flow (Davidson)	0.4	0.1	0.94	285	295
4	GWR Concentrate with low secondary effluent flow (Davidson)	3	0.1	0.94	201	208
5	GWR Concentrate with moderate secondary effluent flow (Davidson)	8	0.1	0.94	n/a [b]	228

[a] The previously reported D_m was used in the analysis presented in Trussell 2015a, and was performed with 120 open ports on the outfall.
[b] Not applicable, as Discharge Scenarios 5, with 8 mgd of secondary effluent flow, was not previously modeled.

The D_m values reported in Table 5 were used to assess Ocean Plan compliance for GWR Project Scenarios 1 through 5 using the same methodology and water quality assumptions previously described (Trussell, 2015a). For the updated scenarios (GWR Project Scenarios 1 through 4), the changes to the underlying modeling parameters increased the amount of dilution from ocean mixing. Thus, as previously shown, none of the GWR Project scenarios resulted in an estimated exceedance of the Ocean Plan objectives. For the new scenario (GWR Project Scenario 5), it was estimated that none of the Ocean Plan objectives would be exceeded. Tables with the estimated Ocean Plan constituent concentrations at the edge of the ZID for the GWR Project discharge Scenarios 1 through 5 are provided in Appendix B as concentrations (Table A3) and as a percentage of the Ocean Plan objective (Table A4).

3 Conclusions

Additional modeling of the ocean discharges of various scenarios for the MPWSP, Variant Project, and GWR project were performed, including updating previous modeling to reflect changes in the baseline assumptions and key discharge scenarios that were absent from the previous analyses. Two primary conclusions can be drawn from these efforts: (1) all conclusions from the previously modeled discharge conditions remain the same, and (2) ammonia was identified as a potential exceedance for both the MPWSP and the Variant Project when the Desal Brine is discharged with a moderate flow of secondary effluent.

For the updated scenarios, three changes were made with respect to modeling of the ocean discharge: (1) there are currently 130 open discharge ports, which is more than the 120 ports used in the previous analysis; (2) for the MPWSP and Variant Project scenarios, the hauled waste flow was added; and (3) for the Variant Project scenarios, a GWR Concentrate flow 0.94 mgd was used instead of 0.73 mgd. In all cases, the impact of making these changes to the ocean mixing was minor and resulted in slightly greater dilution of the ocean discharges and thus slightly lower concentrations of constituents at the edge of the ZID. These changes were minimal and do not alter the previous conclusions.

Results from the newly modeled scenarios have implications with respect to Ocean Plan compliance. Previously, two types of exceedance were identified: (1) exceedance of PCBs for discharges with a high fraction of Desal Brine flow, and (2) exceedance of several parameters (ammonia, chlordane, DDT, PCBs, TCDD equivalents, and toxaphene) when discharging Desal Brine and GWR Concentrate with little or no secondary effluent. In this most recent analysis, a third type of exceedance was identified—when the discharge contains both the Desal Brine and a moderate secondary effluent flow there may be an exceedance of the Ocean Plan 6-month median objective for ammonia. This type of exceedance was shown for both the MPWSP (Scenario 2) and the Variant Projects (Scenarios 2 and 4) and is a result of the combination of having high ammonia in the treated wastewater with the high salinity (i.e., higher density) of the Desal Brine.

As previously shown, ammonia is not an issue when discharging secondary effluent and GWR Concentrate without Desal Brine, or when the dense Desal Brine[2] is discharged with sufficient secondary effluent, such that the combined discharge results in a rising plume with relatively

[2] Compared to the ambient seawater (33,000 to 34,000 mg/L of TDS), the Desal Brine is denser (~57,500 mg/L of TDS) and when discharged on its own would sink, whereas the secondary effluent (~1,000 mg/L of TDS) and GWR Concentrate (~5,000 mg/L) are relatively light and would rise when discharged. In the combined discharge, the secondary effluent and GWR Concentrate would dilute the salinity of the desalination brine and thus reduce the density. With sufficient dilution, the combined discharge would be less dense than the ambient ocean water, resulting in a rising plume with more dilution in the ZID.

high ocean mixing in the ZID. This potential Ocean Plan exceedance emerges when there is *not* sufficient secondary effluent to dilute the Desal Brine, and thus the combined discharge is denser than the ambient seawater. This negatively buoyant discharge sinks, resulting in relatively low mixing in the ZID. Similarly, as previously shown, ammonia is not an issue when the Desal Brine is discharged with a low secondary effluent flow, where even though there is relatively low ocean mixing in the ZID, the ammonia concentration in the discharge is less because the secondary effluent is a smaller fraction of the overall combined discharge. The worst-case scenario occurs near the point where the Desal Brine is discharged with the highest flow of secondary effluent that still results in a sinking plume. This secondary effluent flow ends up being a moderate flow: approximately 9 mgd when combined with the Desal Brine from the MPWSP or 5.3 mgd of Desal Brine in the case of the Variant Project.

It should be noted that ammonia was already identified as a potential exceedance (along with several other constituents) when the Desal Brine is discharged with the GWR Concentrate with little or no secondary effluent; however, as illustrated by the Variant Scenario 4, these exceedances also apply when there is a moderate flow of secondary effluent (approximately 5.3 mgd).

4 References

FlowScience, 2015. "Results of dilution analysis FSI 144082". *Transmittal from Gang Zhao*. April 17, 2015 (see Appendix A)

State Water Resources Control Board, California Environmental Protection Agency (SWRCB), 2012. *California Ocean Plan: Water Quality Control Plan, Ocean Waters of California*.

Trussell Technologies, Inc (Trussell Tech), 2015a. "Ocean Plan Compliance Assessment for the Pure Water Monterey Groundwater Replenishment Project." *Technical Memorandum prepared for MRWPCA and MPWMD*. Feb.

Trussell Technologies, Inc (Trussell Tech), 2015b. "Ocean Plan Compliance Assessment for the Monterey Peninsula Water Supply Project and Project Variant." *Technical Memorandum prepared for MRWPCA*. March.

Appendix A – Updated Ocean Discharge Modeling Results

FlowScience, 2015. "Results of dilution analysis FSI 144082". *Transmittal from Gang Zhao*. April 17, 2015

Flow Science Incorporated
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(626) 304-1134 FAX (626) 304-9427

Transmittal Letter

To:	Gordon Williams Ph.D., PE. Trussell Technologies Inc.	Subject:	Results of dilution analysis FSI 144082
From:	Gang Zhao Ph.D., PE. Flow Science Inc.	Date:	April 17, 2015

Dear Dr. Williams,

Please find attached the Excel® spreadsheet containing results of the latest round of dilution analyses for effluent discharged through the Monterey Regional Water Pollution Control Agency's ocean outfall. The method used in the Visual Plumes (VP) model is capable of handling slightly negatively buoyant conditions and produces reasonable results. In addition, the VP model results are conservative for the slightly negatively buoyant scenarios in that the VP predicted dilution ratios are lower than those obtained from the semi-empirical method. Therefore, the semi-empirical method was not used for all slightly negatively buoyant scenarios.

Please feel free to contact me if you have any questions.

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MPWSP, Variant Project, and GWR Project Discharge Scenarios Update
From: Flow Science Inc. (FSI 144082)

Scenario Description		Flow (mgd)					Combined TDS (mg/L)	Combined Temp (°C)	Ocean Condition			Number of Open Discharge Ports	VP			Semi-EMP		
		RTP Secondary Effluent	Hauled Waste	GWR Concentrate	Desal Brine	Total Discharge Flow (MGD)			Davidson	Upwelling	Oceanic		Plume diam. (inch)	Min. Dilution	Horiz. Distance from port (ft)	Plume diam. (inch)	Min. Dilution	Horiz. Distance from port (ft)
MPWSP Scenarios (Large desal)																		
M.1	Desal Brine with no WW flow	0	0.1		13.98	**14.08**	58,101	11.7		X		130				37	17	12
M.2	Desal Brine with Moderate WW flow	9	0.1		13.98	**23.08**	35,254	14.9	X			130	84	22	17			
M.3	Desal Brine with Moderate WW flow	9.5	0.1		13.98	**23.58**	34,523	15.0	X			130	90	23	18	84	34	9
M.4	Desal Brine with Moderate WW flow	10	0.1		13.98	**24.08**	33,823	15.1	X			130	100	25	20			
M.5	Desal Brine with Moderate WW flow	12	0.1		13.98	**26.08**	31,290	15.5	X			130	192	54	41			
MPWSP Variant Scenarios (Small desal + AWT Facility RO Conc.)																		
Var.1	Desal Brine with no WW and no GWR flow	0	0.1	0	8.99	**9.09**	58,029	10.0		X		130				32	16	10
Var.2	Desal Brine with Moderate WW flow	5.8	0.1	0	8.99	**14.89**	35,353	14.9	X			130	79	22	16			
Var.3	Desal Brine with Moderate WW flow	6.2	0.1	0	8.99	**15.29**	34,457	15.1	X			130	89	25	18	82	37	9
Var.4	Desal Brine with Moderate WW flow	6.7	0.1	0	8.99	**15.79**	33,401	15.2	X			130	172	51	36			
Var.5	Desal Brine and GWR Conc. with no WW flow	0	0.1	0.94	8.99	**10.03**	53,135	10.9		X		130				35	18	11
Var.6	Desal Brine and GWR Conc. with moderate WW flow	5.3	0.1	0.94	8.99	**15.33**	35,145	14.1		X		130	86	24	18			
Var.7	Desal Brine and GWR Conc. with moderate WW flow	5.6	0.1	0.94	8.99	**15.63**	34,491	14.2		X		130	99	28	20			
Var.8	Desal Brine and GWR Conc. with moderate WW flow	9	0.1	0.94	8.99	**19.03**	28,133	16.0	X			130	161	56	33			
Variant (when no Brine and GWR Only)																		
GWR.1	Minimum wastewater flow (Oceanic/Upwelling)	0	0.1	0.94		**1.04**	9,088	20.0			X	130	124	540	6			
GWR.2	Minimum wastewater flow (Davidson)	0.4	0.1	0.94		**1.44**	6,869	20.0	X			130	128	295	6			
GWR.3	Minimum wastewater flow (Oceanic)	0.4	0.1	0.94		**1.44**	6,869	20.0			X	130	126	454	6			
GWR.4	Low wastewater flow	3	0.1	0.94		**4.04**	3,156	20.0	X			130	136	208	10			
GWR.5	Moderate Wastewater flow	8	0.1	0.94		**9.04**	2,019	20.0	X			130	208	228	17			
GWR.6	Max flow under current port configuration	23.7	0.1	0.94		**24.74**	1,436	20.0			X	130	200	142	26			

Appendix B – Estimated Concentrations of All Ocean Plan Constituents

Table A1 – MPWSP complete list of Ocean Plan constituents at the edge of the ZID as estimated concentration and as a percentage of the Ocean Plan objective [a]

Constituent	Units	Ocean Plan Objective	MPWSP Ocean Discharge Scenario			
			Estimated Concentration at Edge of ZID		Estimated Percentage of Ocean Plan objective at Edge of ZID	
			1	2	1	2
Objectives for protection of marine aquatic life						
Arsenic	ug/L	8	4.9	4.6	62%	58%
Cadmium	ug/L	1	0.44	0.23	44%	23%
Chromium (Hexavalent)	ug/L	2	0.051	0.058	2.6%	2.9%
Copper	ug/L	3	2.1	2.2	69%	72%
Lead	ug/L	2	0.35	0.18	18%	8.8%
Mercury	ug/L	0.04	0.021	0.013	53%	33%
Nickel	ug/L	5	0.48	0.32	10%	6.3%
Selenium	ug/L	15	3.1	1.5	20%	10%
Silver	ug/L	0.7	0.15	0.16	22%	23%
Zinc	ug/L	20	9.5	8.9	47%	45%
Cyanide	ug/L	1	0.49	0.36	49%	36%
Total Chlorine Residual [d]	ug/L	2	--	--	–	–
Ammonia (as N) - 6-mo median	ug/L	600	19	626	3.2%	104%
Ammonia (as N) - Daily Max	ug/L	2,400	24	842	1.0%	35%
Acute Toxicity [b]	TUa	0.3				
Chronic Toxicity [b]	TUc	1				
Phenolic Compounds (non-chlorinated)	ug/L	30	0.027	1.2	0.09%	3.9%
Chlorinated Phenolics	ug/L	1	<0.0079	<0.34	<0.8%	<34%
Endosulfan	ug/L	0.009	9.6E-06	2.6E-04	0.1%	2.9%
Endrin	ug/L	0.002	1.6E-06	2.1E-06	0.08%	0.1%
HCH (Hexachlorocyclohexane)	ug/L	0.004	5.1E-05	6.0E-04	1.3%	15%
Radioactivity (Gross Beta) [b]	pci/L	–				
Radioactivity (Gross Alpha) [b]	pci/L	–				
Objectives for protection of human health – non carcinogens						
Acrolein	ug/L	220	<0.0020	<0.086	<0.01%	<0.04%
Antimony	ug/L	1200	0.91	0.45	0.08%	0.04%
Bis (2-chloroethoxy) methane	ug/L	4.4	<2.0E-04	<0.0086	<0.01%	<0.2%
Bis (2-chloroisopropyl) ether	ug/L	1200	<2.0E-04	<0.0086	<0.01%	<0.01%
Chlorobenzene	ug/L	570	<2.0E-04	<0.0086	<0.01%	<0.01%
Chromium (III)	ug/L	190000	5.9	2.9	<0.01%	<0.01%
Di-n-butyl phthalate	ug/L	3500	<0.0020	<0.086	<0.01%	<0.01%
Dichlorobenzenes	ug/L	5100	6.3E-04	0.027	<0.01%	<0.01%
Diethyl phthalate	ug/L	33000	<0.0020	<0.086	<0.01%	<0.01%
Dimethyl phthalate	ug/L	820000	<7.9E-04	<0.034	<0.01%	<0.01%
4,6-dinitro-2-methylphenol	ug/L	220	<2.0E-04	<0.0086	<0.01%	<0.01%
2,4-Dinitrophenol	ug/L	4.0	<2.0E-04	<0.0086	<0.01%	<0.2%
Ethylbenzene	ug/L	4100	<2.0E-04	<0.0086	<0.01%	<0.01%
Fluoranthene	ug/L	15	1.0E-04	4.9E-05	<0.01%	0.00%
Hexachlorocyclopentadiene	ug/L	58	<2.0E-04	<0.0086	<0.01%	<0.01%
Nitrobenzene	ug/L	4.9	<2.0E-04	<0.0086	<0.01%	<0.2%
Thallium	ug/L	2	<0.094	<0.053	<4.7%	<2.7%
Toluene	ug/L	85000	<0.050	<0.032	<0.01%	<0.0%
Tributyltin	ug/L	0.0014	<2.0E-05	<8.6E-04	<1.4%	<61%
1,1,1-Trichloroethane	ug/L	540000	<0.050	<0.032	<0.01%	<0.01%
Objectives for protection of human health - carcinogens						
Acrylonitrile	ug/L	0.10	<7.9E-04	<0.034	<0.8%	<34%

Constituent	Units	Ocean Plan Objective	MPWSP Ocean Discharge Scenario			
			Estimated Concentration at Edge of ZID		Estimated Percentage of Ocean Plan objective at Edge of ZID	
			1	2	1	2
Aldrin [c]	ug/L	0.000022	<2.0E-05	<8.6E-04	–	–
Benzene	ug/L	5.9	<0.050	<0.032	<0.8%	<0.5%
Benzidine [c]	ug/L	0.000069	<2.0E-04	<0.0086	–	–
Beryllium	ug/L	0.033	2.1E-06	0.0085	<0.01%	26%
Bis(2-chloroethyl)ether	ug/L	0.045	<2.0E-04	<0.0086	<0.4%	<19%
Bis(2-ethyl-hexyl)phthalate	ug/L	3.5	0.086	1.4	2.5%	39%
Carbon tetrachloride	ug/L	0.90	<0.028	<0.022	<3.1%	<2.4%
Chlordane	ug/L	0.000023	1.1E-05	1.8E-05	48%	77%
Chlorodibromomethane	ug/L	8.6	<2.0E-04	<0.0086	<0.01%	<0.10%
Chloroform	ug/L	130	7.9E-04	0.034	<0.01%	0.03%
DDT	ug/L	0.00017	3.1E-05	3.3E-05	18%	20%
1,4-Dichlorobenzene	ug/L	18	0.050	0.051	0.3%	0.3%
3,3-Dichlorobenzidine	ug/L	0.0081	<9.9E-06	<4.3E-04	<0.1%	<5.3%
1,2-Dichloroethane	ug/L	28	<0.050	<0.032	<0.2%	<0.1%
1,1-Dichloroethylene	ug/L	0.9	0.050	0.032	5.5%	3.6%
Dichlorobromomethane	ug/L	6.2	<2.0E-04	<0.0086	<0.01%	<0.1%
Dichloromethane	ug/L	450	0.050	0.033	0.01%	<0.01%
1,3-dichloropropene	ug/L	8.9	<0.050	<0.032	<0.6%	<0.4%
Dieldrin	ug/L	0.00004	5.0E-06	1.1E-05	13%	27%
2,4-Dinitrotoluene	ug/L	2.6	<7.9E-04	<0.034	<0.03%	<1.3%
1,2-Diphenylhydrazine (azobenzene)	ug/L	0.16	<2.0E-04	<0.0086	<0.1%	<5.4%
Halomethanes	ug/L	130	2.9E-04	0.0093	<0.01%	<0.01%
Heptachlor	ug/L	0.00005	4.8E-07	2.3E-07	1.0%	0.5%
Heptachlor Epoxide	ug/L	0.00002	2.3E-08	1.0E-06	0.1%	5.1%
Hexachlorobenzene	ug/L	0.00021	3.1E-08	1.3E-06	0.01%	0.6%
Hexachlorobutadiene	ug/L	14	3.6E-09	1.5E-07	<0.01%	<0.01%
Hexachloroethane	ug/L	2.5	<2.0E-04	<0.0086	<0.01%	<0.3%
Isophorone	ug/L	730	<2.0E-04	<0.0086	<0.01%	<0.01%
N-Nitrosodimethylamine	ug/L	7.3	1.7E-04	3.7E-04	<0.01%	<0.01%
N-Nitrosodi-N-Propylamine	ug/L	0.38	2.0E-04	0.0014	0.05%	0.4%
N-Nitrosodiphenylamine	ug/L	2.5	<2.0E-04	<0.0086	<0.01%	<0.3%
PAHs	ug/L	0.0088	6.8E-04	0.0012	7.7%	14%
PCBs	ug/L	0.000019	1.2E-04	6.7E-05	609%	351%
TCDD Equivalents	ug/L	3.9E-09	6.0E-11	2.6E-09	1.5%	67%
1,1,2,2-Tetrachloroethane	ug/L	2.3	<0.050	<0.032	<2.2%	<1.4%
Tetrachloroethylene	ug/L	2.0	<0.050	<0.032	<2.5%	<1.6%
Toxaphene	ug/L	2.1E-04	7.5E-05	1.6E-04	35%	74%
Trichloroethylene	ug/L	27	<0.050	<0.032	<0.2%	<0.1%
1,1,2-Trichloroethane	ug/L	9.4	<0.050	<0.032	<0.5%	<0.3%
2,4,6-Trichlorophenol	ug/L	0.29	<2.0E-04	<0.0086	<0.07%	<3.0%
Vinyl chloride	ug/L	36	<0.028	<0.022	<0.08%	<0.06%

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%). Also, shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of the constituent. These constituents were measured for the secondary effluent and those concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.

Table A2 – Variant Project list of predicted concentrations of Ocean Plan constituents at the edge of the ZID as a concentration and as a percentage of the Ocean Plan objective [a]

Constituent	Units	Ocean Plan Objective	Variant Project Ocean Discharge Scenario							
			Estimated Concentration at Edge of ZID				Estimated Percentage of Ocean Plan objective at Edge of ZID			
			1	2	3	4	1	2	3	4
Objectives for protection of marine aquatic life										
Arsenic	ug/L	8	5.1	4.6	4.7	4.4	63%	58%	59%	55%
Cadmium	ug/L	1	0.46	0.23	0.41	0.22	46%	23%	41%	22%
Chromium (Hexavalent)	ug/L	2	0.084	0.083	0.14	0.11	4.2%	4.2%	6.9%	5.3%
Copper	ug/L	3	2.1	2.4	2.7	2.7	70%	81%	91%	90%
Lead	ug/L	2	0.37	0.18	0.32	0.17	19%	9.1%	16%	8.6%
Mercury	ug/L	0.04	0.022	0.014	0.021	0.014	56%	35%	54%	36%
Nickel	ug/L	5	0.51	0.45	0.75	0.56	10%	9.0%	15%	11%
Selenium	ug/L	15	3.3	1.6	2.8	1.5	22%	10.5%	19%	10%
Silver	ug/L	0.7	0.16	0.18	0.16	0.18	22%	26%	22%	25%
Zinc	ug/L	20	9.6	9.4	10.5	9.8	48%	47%	53%	49%
Cyanide	ug/L	1	0.53	0.36	0.62	0.41	53%	36%	62%	41%
Total Chlorine Residual [d]	ug/L	2	--	--	--	--	--	--	–	–
Ammonia (as N); 6-mo median	ug/L	600	29	629	968	985	4.8%	105%	161%	164%
Ammonia (as N); Daily Max	ug/L	2,400	37	846	1302	1325	1.5%	35%	54%	55%
Acute Toxicity [b]	TUa	0.3								
Chronic Toxicity [b]	TUc	1								
Phenolic Compounds (non-chlorinated)	ug/L	30	0.045	1.2	1.8	1.9	0.1%	4.0%	6.1%	6.2%
Chlorinated Phenolics	ug/L	1	<0.013	<0.34	<0.11	<0.33	<1.3%	<34%	<11%	<33%
Endosulfan	ug/L	0.009	3.5E-05	8.3E-04	0.0013	0.0013	0.4%	9.2%	14%	14%
Endrin	ug/L	0.002	1.7E-06	2.1E-06	3.4E-06	2.8E-06	0.08%	0.10%	0.2%	0.1%
HCH (Hexachlorocyclohexane)	ug/L	0.004	7.8E-05	0.0010	0.0016	0.0016	2.0%	26%	40%	41%
Radioactivity (Gross Beta) [b]	pci/L	–	5.1	4.6	4.7	4.4	63%	58%	59%	55%
Radioactivity (Gross Alpha) [b]	pci/L	–	0.46	0.23	0.41	0.22	46%	23%	41%	22%
Objectives for protection of human health – non carcinogens										
Acrolein	ug/L	220	0.0058	0.16	0.24	0.24	<0.01%	0.07%	0.1%	0.1%
Antimony	ug/L	1200	0.96	0.45	0.80	0.41	0.08%	0.04%	0.07%	0.03%
Bis (2-chloroethoxy) methane	ug/L	4.4	<0.0027	<0.072	<0.0071	<0.062	<0.06%	<1.64%	<0.2%	<1.40%
Bis (2-chloroisopropyl) ether	ug/L	1200	<0.0027	<0.072	<0.0071	<0.062	<0.01%	<0.01%	<0.01%	<0.01%
Chlorobenzene	ug/L	570	<3.2E-04	<0.0086	<0.0027	<0.0083	<0.01%	<0.01%	<0.01%	<0.01%
Chromium (III)	ug/L	190000	6.3	3.0	5.3	2.7	<0.01%	<0.01%	<0.01%	<0.01%
Di-n-butyl phthalate	ug/L	3500	<0.0045	<0.12	<0.0086	<0.10	<0.01%	<0.01%	<0.01%	<0.01%
Dichlorobenzenes	ug/L	5100	0.0010	0.028	0.042	0.043	<0.01%	<0.01%	<0.01%	<0.01%
Diethyl phthalate	ug/L	33000	<0.0032	<0.086	<0.0076	<0.073	<0.01%	<0.01%	<0.01%	<0.01%
Dimethyl phthalate	ug/L	820000	<0.0013	<0.034	<0.0035	<0.029	<0.01%	<0.01%	<0.01%	<0.01%
4,6-dinitro-2-methylphenol	ug/L	220	<0.013	<0.34	<0.035	<0.29	<0.01%	<0.2%	<0.02%	<0.1%
2,4-Dinitrophenol	ug/L	4.0	<0.0084	<0.22	<0.031	<0.20	<0.2%	<5.6%	<0.8%	<4.9%
Ethylbenzene	ug/L	4100	<3.2E-04	<0.0086	<0.0027	<0.0083	<0.01%	<0.01%	<0.01%	<0.01%
Fluoranthene	ug/L	15	1.1E-04	4.9E-05	5.8E-04	2.9E-04	<0.01%	<0.01%	<0.01%	0.05%
Hexachlorocyclopentadiene	ug/L	58	<3.2E-04	<0.0086	<5.1E-04	<0.0072	<0.01%	<0.01%	<0.01%	<0.01%
Nitrobenzene	ug/L	4.9	<0.0015	<0.040	<0.0061	<0.035	<0.03%	<0.8%	<0.1%	<0.7%
Thallium	ug/L	2	0.10	0.057	0.10	0.059	5.0%	2.8%	4.9%	2.9%
Toluene	ug/L	85000	<0.053	<0.032	<0.045	<0.029	<0.01%	<0.01%	<0.01%	<0.01%
Tributyltin	ug/L	0.0014	<3.2E-05	<8.6E-04	<1.2E-04	<7.5E-04	<2.3%	<62%	<8.9%	<54%
1,1,1-Trichloroethane	ug/L	540000	<0.053	<0.032	<0.045	<0.029	<0.01%	<0.01%	<0.01%	<0.01%
Objectives for protection of human health - carcinogens										
Acrylonitrile	ug/L	0.10	0.0016	0.044	0.067	0.069	1.6%	44%	67%	69%
Aldrin [c]	ug/L	0.000022	<4.5E-06	<1.2E-04	<5.3E-05	<1.2E-04	<21%	–	–	–
Benzene	ug/L	5.9	<0.053	<0.032	<0.045	<0.029	<0.9%	<0.5%	<0.8%	<0.5%
Benzidine [c]	ug/L	0.000069	<0.013	<0.34	<0.011	<0.28	–	–	–	–

Constituent	Units	Ocean Plan Objective	Variant Project Ocean Discharge Scenario							
			Estimated Concentration at Edge of ZID				Estimated Percentage of Ocean Plan objective at Edge of ZID			
			1	2	3	4	1	2	3	4
Beryllium	ug/L	0.033	3.4E-06	1.5E-06	0.0025	0.0012	0.01%	<0.0%	7.5%	3.7%
Bis(2-chloroethyl)ether [c]	ug/L	0.045	<0.0027	<0.072	<0.0071	<0.062	<6.0%	–	<16%	–
Bis(2-ethyl-hexyl)phthalate	ug/L	3.5	0.11	1.4	2.1	2.1	3.1%	39%	60%	61%
Carbon tetrachloride	ug/L	0.90	0.029	0.022	0.037	0.025	3.3%	2.4%	4.1%	2.8%
Chlordane	ug/L	0.000023	1.2E-05	1.8E-05	2.9E-05	2.4E-05	52%	77%	125%	106%
Chlorodibromomethane	ug/L	8.6	0.0016	0.042	0.065	0.066	0.02%	0.5%	0.8%	0.8%
Chloroform	ug/L	130	0.025	0.67	1.0	1.0	0.02%	0.5%	0.8%	0.8%
DDT	ug/L	0.00017	4.6E-05	3.9E-05	2.1E-04	1.2E-04	27%	23%	122%	70%
1,4-Dichlorobenzene	ug/L	18	0.053	0.051	0.085	0.064	0.3%	0.3%	0.5%	0.4%
3,3-Dichlorobenzidine [c]	ug/L	0.0081	<0.012	<0.33	<0.020	<0.27	–	–	–	–
1,2-Dichloroethane	ug/L	28	<0.053	<0.032	<0.045	<0.029	<0.2%	<0.1%	<0.2%	<0.1%
1,1-Dichloroethylene	ug/L	0.9	0.053	0.032	0.045	0.029	5.9%	3.6%	5.0%	3.3%
Dichlorobromomethane	ug/L	6.2	0.0017	0.045	0.069	0.071	0.03%	0.7%	1.1%	1.1%
Dichloromethane	ug/L	450	0.053	0.035	0.060	0.038	0.01%	<0.0%	0.01%	<0.01%
1,3-dichloropropene	ug/L	8.9	0.053	0.033	0.057	0.036	0.6%	0.4%	0.6%	0.4%
Dieldrin	ug/L	0.00004	8.7E-06	1.2E-05	2.2E-05	1.8E-05	22%	31%	54%	44%
2,4-Dinitrotoluene	ug/L	2.6	<0.0013	<0.034	<0.0015	<0.028	<0.05%	<1.3%	<0.06%	<1.1%
1,2-Diphenylhydrazine	ug/L	0.16	<0.0027	<0.072	<0.0071	<0.062	<1.7%	<45%	<4.5%	<39%
Halomethanes	ug/L	130	9.2E-04	0.025	0.038	0.038	<0.01%	0.02%	0.03%	0.03%
Heptachlor	ug/L	0.00005	5.0E-07	2.3E-07	4.1E-07	2.0E-07	1.0%	0.5%	0.8%	0.4%
Heptachlor Epoxide	ug/L	0.00002	3.8E-08	1.0E-06	1.6E-06	1.6E-06	0.2%	5.1%	7.8%	8.0%
Hexachlorobenzene	ug/L	0.00021	5.0E-08	1.3E-06	2.1E-06	2.1E-06	0.02%	0.6%	1.0%	1.0%
Hexachlorobutadiene	ug/L	14	5.8E-09	1.6E-07	2.4E-07	2.4E-07	<0.01%	<0.01%	<0.01%	<0.01%
Hexachloroethane	ug/L	2.5	<0.0015	<0.040	<0.0037	<0.034	<0.06%	<1.6%	<0.1%	<1.3%
Isophorone	ug/L	730	<3.2E-04	<0.0086	<0.0027	<0.0083	<0.01%	<0.01%	<0.01%	<0.01%
N-Nitrosodimethylamine	ug/L	7.3	2.4E-04	0.0017	9.3E-04	0.0018	<0.01%	0.02%	0.01%	0.02%
N-Nitrosodi-N-Propylamine	ug/L	0.38	2.2E-04	0.0014	2.8E-04	0.0012	0.06%	0.4%	0.07%	0.3%
N-Nitrosodiphenylamine	ug/L	2.5	<0.0015	<0.040	<0.0061	<0.035	<0.06%	<1.6%	<0.2%	<1.4%
PAHs	ug/L	0.0088	7.3E-04	0.0012	0.0020	0.0017	8.3%	14%	22%	19%
PCBs	ug/L	0.000019	1.2E-04	6.7E-05	1.2E-04	6.7E-05	643%	351%	614%	355%
TCDD Equivalents	ug/L	3.9E-09	1.0E-10	2.7E-09	4.1E-09	4.2E-09	2.6%	68%	104%	107%
1,1,2,2-Tetrachloroethane	ug/L	2.3	<0.053	<0.032	<0.045	<0.029	<2.3%	<1.4%	<2.0%	<1.3%
Tetrachloroethylene	ug/L	2.0	<0.053	<0.032	<0.045	<0.029	<2.6%	<1.6%	<2.3%	<1.5%
Toxaphene	ug/L	2.1E-04	8.0E-05	1.6E-04	2.5E-04	2.2E-04	38%	74%	119%	106%
Trichloroethylene	ug/L	27	<0.053	<0.032	<0.045	<0.029	<0.2%	<0.1%	<0.2%	<0.1%
1,1,2-Trichloroethane	ug/L	9.4	<0.053	<0.032	<0.045	<0.029	<0.6%	<0.3%	<0.5%	<0.3%
2,4,6-Trichlorophenol	ug/L	0.29	<0.0015	<0.040	<0.0061	<0.035	<0.5%	<14%	<2.1%	<12%
Vinyl chloride	ug/L	36	<0.029	<0.022	<0.026	<0.020	<0.08%	<0.06%	<0.07%	<0.06%

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%). Also, Shading indicates constituent is expected to be greater than 80 percent (orange shading) or exceed (red shading) the ocean plan objective for that discharge scenario.

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of the constituent. These constituents were measured individually for the secondary effluent and GWR concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.

Table A3 – GWR Project complete list of predicted concentrations of Ocean Plan constituents at the edge of the ZID for updated scenarios

Constituent	Units	Ocean Plan Objective	Estimated Concentration at Edge of ZID by Discharge Scenario				
			1	2	3	4	5
Objectives for protection of marine aquatic life							
Arsenic	ug/L	8	3.3	3.0	3.1	3.2	3.2
Cadmium	ug/L	1	0.010	0.011	0.016	0.012	0.0077
Chromium (Hexavalent)	ug/L	2	0.025	0.046	0.064	0.040	0.023
Copper	ug/L	3	2.2	2.2	2.3	2.2	2.2
Lead	ug/L	2	0.0066	0.0073	0.010	0.0078	0.0051
Mercury	ug/L	0.04	0.0057	0.0059	0.0062	0.0059	0.0056
Nickel	ug/L	5	0.11	0.12	0.17	0.12	0.083
Selenium	ug/L	15	0.055	0.071	0.10	0.070	0.045
Silver	ug/L	0.7	<0.17	<0.16	<0.16	<0.17	<0.17
Zinc	ug/L	20	8.3	8.4	8.6	8.4	8.3
Cyanide	ug/L	1	0.060	0.072	0.10	0.073	0.047
Total Chlorine Residual [c]	ug/L	2	–	–	–	–	–
Ammonia (as N) - 6-mo median	ug/L	600	295	326	465	346	230
Ammonia (as N) - Daily Max	ug/L	2,400	398	439	626	466	309
Acute Toxicity [a]	TUa	0.3					
Chronic Toxicity [a]	TUc	1					
Phenolic Compounds (non-chlorinated)	ug/L	30	0.56	0.62	0.88	0.66	0.44
Chlorinated Phenolics	ug/L	1	<0.14	<0.037	<0.068	<0.10	<0.087
Endosulfan	ug/L	0.009	3.9E-04	4.3E-04	6.1E-04	4.6E-04	3.0E-04
Endrin	ug/L	0.002	6.4E-07	7.1E-07	1.0E-06	7.5E-07	5.0E-07
HCH (Hexachlorocyclohexane)	ug/L	0.004	4.8E-04	5.4E-04	7.6E-04	5.7E-04	3.8E-04
Radioactivity (Gross Beta) [a]	pci/L	–					
Radioactivity (Gross Alpha) [a]	pci/L	–					
Objectives for protection of human health – non-carcinogens							
Acrolein	ug/L	220	0.073	0.081	0.12	0.086	0.057
Antimony	ug/L	1200	0.0064	0.0071	0.010	0.0075	0.0050
Bis (2-chloroethoxy) methane	ug/L	4.4	<0.028	<0.0024	<0.0071	<0.017	<0.017
Bis (2-chloroisopropyl) ether	ug/L	1200	<0.028	<0.0024	<0.0071	<0.017	<0.017
Chlorobenzene	ug/L	570	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022
Chromium (III)	ug/L	190000	0.061	0.079	0.11	0.079	0.050
Di-n-butyl phthalate	ug/L	3500	<0.047	<0.0029	<0.010	<0.027	<0.028
Dichlorobenzenes	ug/L	5100	0.013	0.014	0.020	0.015	0.010
Diethyl phthalate	ug/L	33000	<0.034	<0.0026	<0.0081	<0.019	<0.020
Dimethyl phthalate	ug/L	820000	<0.014	<0.0012	<0.0034	<0.0079	<0.0081
4,6-dinitro-2-methylphenol	ug/L	220	<0.14	<0.012	<0.034	<0.079	<0.081
2,4-Dinitrophenol	ug/L	4.0	<0.089	<0.011	<0.026	<0.053	<0.053
Ethylbenzene	ug/L	4100	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022
Fluoranthene	ug/L	15	<0.0034	<2.6E-04	<8.1E-04	<0.002	<0.002
Hexachlorocyclopentadiene	ug/L	58	<0.0034	<1.7E-04	<7.0E-04	<0.0019	<0.0020
Nitrobenzene	ug/L	4.9	<0.016	<0.0021	<0.0049	<0.010	<0.0095
Thallium	ug/L	2	0.0056	0.0062	0.0089	0.0066	0.0044
Toluene	ug/L	85000	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022
Tributyltin	ug/L	0.0014	<3.4E-04	<4.2E-05	<1.0E-04	<2.1E-04	<2.0E-04
1,1,1-Trichloroethane	ug/L	540000	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022
Objectives for protection of human health - carcinogens							
Acrylonitrile	ug/L	0.10	0.021	0.023	0.033	0.024	0.016
Aldrin [b]	ug/L	0.000022	<5.0E-05	<1.8E-05	<3.0E-05	<3.7E-05	<3.2E-05
Benzene	ug/L	5.9	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022
Benzidine [b]	ug/L	0.000069	<0.13	<0.0036	<0.023	<0.073	<0.078
Beryllium	ug/L	0.033	0.0047	8.4E-04	0.0018	0.0030	0.0029
Bis(2-chloroethyl)ether	ug/L	0.045	<0.028	<0.0024	<0.0071	<0.017	<0.017

Constituent	Units	Ocean Plan Objective	Estimated Concentration at Edge of ZID by Discharge Scenario				
			1	2	3	4	5
Bis(2-ethyl-hexyl)phthalate	ug/L	3.5	0.63	0.70	1.0	0.74	0.49
Carbon tetrachloride	ug/L	0.90	0.0041	0.0045	0.0064	0.0048	0.0032
Chlordane	ug/L	0.000023	6.0E-06	6.6E-06	9.4E-06	7.0E-06	4.6E-06
Chlorodibromomethane	ug/L	8.6	0.020	0.022	0.031	0.023	0.015
Chloroform	ug/L	130	0.31	0.35	0.50	0.37	0.24
DDT	ug/L	0.00017	1.7E-05	6.2E-05	8.2E-05	4.5E-05	2.1E-05
1,4-Dichlorobenzene	ug/L	18	0.013	0.014	0.020	0.015	0.010
3,3-Dichlorobenzidine [b]	ug/L	0.0081	<0.13	<0.0067	<0.027	<0.072	<0.075
1,2-Dichloroethane	ug/L	28	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022
1,1-Dichloroethylene	ug/L	0.9	0.0035	9.2E-04	0.0017	0.0024	0.0022
Dichlorobromomethane	ug/L	6.2	0.021	0.023	0.033	0.025	0.017
Dichloromethane	ug/L	450	0.0052	0.0058	0.0082	0.0061	0.0041
1,3-dichloropropene	ug/L	8.9	0.0046	0.0050	0.0072	0.0053	0.0035
Dieldrin	ug/L	0.00004	4.3E-06	5.9E-06	8.2E-06	5.7E-06	3.5E-06
2,4-Dinitrotoluene	ug/L	2.6	<0.013	<5.2E-04	<0.0026	<0.0074	<0.0079
1,2-Diphenylhydrazine	ug/L	0.16	<0.028	<0.0024	<0.0071	<0.017	<0.017
Halomethanes	ug/L	130	0.012	0.013	0.018	0.014	0.0090
Heptachlor [b]	ug/L	0.00005	<7.0E-05	<1.8E-05	<3.4E-05	<4.8E-05	<4.4E-05
Heptachlor Epoxide	ug/L	0.00002	4.8E-07	5.3E-07	7.5E-07	5.6E-07	3.7E-07
Hexachlorobenzene	ug/L	0.00021	6.3E-07	7.0E-07	1.0E-06	7.4E-07	4.9E-07
Hexachlorobutadiene	ug/L	14	7.3E-08	8.1E-08	1.2E-07	8.6E-08	5.7E-08
Hexachloroethane	ug/L	2.5	<0.016	<0.0012	<0.0038	<0.0090	<0.0092
Isophorone	ug/L	730	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022
N-Nitrosodimethylamine	ug/L	7.3	6.9E-04	2.7E-04	4.4E-04	5.2E-04	4.5E-04
N-Nitrosodi-N-Propylamine	ug/L	0.38	5.2E-04	4.5E-05	1.3E-04	3.0E-04	3.1E-04
N-Nitrosodiphenylamine	ug/L	2.5	<0.016	<0.0021	<0.0049	<0.010	<0.0095
PAHs	ug/L	0.0088	4.3E-04	4.7E-04	6.8E-04	5.0E-04	3.3E-04
PCBs	ug/L	0.000019	5.5E-06	6.1E-06	8.7E-06	6.5E-06	4.3E-06
TCDD Equivalents	ug/L	3.9E-09	1.2E-09	1.4E-09	2.0E-09	1.5E-09	9.7E-10
1,1,2,2-Tetrachloroethane	ug/L	2.3	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022
Tetrachloroethylene	ug/L	2.0	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022
Toxaphene	ug/L	2.1E-04	5.8E-05	6.4E-05	9.1E-05	6.7E-05	4.5E-05
Trichloroethylene	ug/L	27	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022
1,1,2-Trichloroethane	ug/L	9.4	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022
2,4,6-Trichlorophenol	ug/L	0.29	<0.016	<0.0021	<0.0049	<0.010	<0.0095
Vinyl chloride	ug/L	36	<0.0035	<9.2E-04	<0.0017	<0.0024	<0.0022

[a] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of these constituents. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[b] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[c] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.

Table A4 – GWR Project complete list of predicted concentrations of Ocean Plan constituents at the edge of the ZID as a percentage of the Ocean Plan objective for updated scenarios [a]

Constituent	Units	Ocean Plan Objective	Estimated Concentration at Edge of ZID by Discharge Scenario				
			1	2	3	4	5
Objectives for protection of marine aquatic life							
Arsenic	ug/L	8	41%	38%	38%	40%	40%
Cadmium	ug/L	1	1.0%	1.1%	1.6%	1.2%	0.8%
Chromium (Hexavalent)	ug/L	2	1.3%	2.3%	3.2%	2.0%	1.1%
Copper	ug/L	3	73%	74%	78%	75%	72%
Lead	ug/L	2	0.3%	0.4%	0.5%	0.4%	0.3%
Mercury	ug/L	0.04	14%	15%	16%	15%	14%
Nickel	ug/L	5	2.1%	2.4%	3.3%	2.5%	1.7%
Selenium	ug/L	15	0.4%	0.5%	1%	0.5%	0.3%
Silver	ug/L	0.7	<24%	<23%	<23%	<24%	<24%
Zinc	ug/L	20	42%	42%	43%	42%	41%
Cyanide	ug/L	1	6.0%	7.2%	10%	7.3%	4.7%
Total Chlorine Residual [d]	ug/L	2	–	–	–	–	–
Ammonia (as N) - 6-mo median	ug/L	600	49%	54%	78%	58%	38%
Ammonia (as N) - Daily Max	ug/L	2,400	17%	18%	26%	19%	13%
Acute Toxicity [b]	TUa	0.3					
Chronic Toxicity [b]	TUc	1					
Phenolic Compounds (non-chlorinated)	ug/L	30	1.9%	2.1%	2.9%	2.2%	1.5%
Chlorinated Phenolics	ug/L	1	<14%	<3.7%	<6.8%	<9.6%	<8.7%
Endosulfan	ug/L	0.009	4.3%	4.8%	6.8%	5.1%	3.4%
Endrin	ug/L	0.002	0.03%	0.04%	0.05%	0.04%	0.02%
HCH (Hexachlorocyclohexane)	ug/L	0.004	12%	13%	19%	14%	9%
Radioactivity (Gross Beta) [b]	pci/L	–					
Radioactivity (Gross Alpha) [b]	pci/L	–					
Objectives for protection of human health – non-carcinogens							
Acrolein	ug/L	220	0.03%	0.04%	0.05%	0.04%	0.03%
Antimony	ug/L	1200	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Bis (2-chloroethoxy) methane	ug/L	4.4	<0.6%	<0.05%	<0.2%	<0.4%	<0.4%
Bis (2-chloroisopropyl) ether	ug/L	1200	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Chlorobenzene	ug/L	570	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Chromium (III)	ug/L	190000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Di-n-butyl phthalate	ug/L	3500	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Dichlorobenzenes	ug/L	5100	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Diethyl phthalate	ug/L	33000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Dimethyl phthalate	ug/L	820000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
4,6-dinitro-2-methylphenol	ug/L	220	<0.06%	<0.01%	<0.02%	<0.04%	<0.04%
2,4-Dinitrophenol	ug/L	4.0	<2.2%	<0.3%	<0.7%	<1.3%	<1.3%
Ethylbenzene	ug/L	4100	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Fluoranthene	ug/L	15	<0.02%	<0.01%	<0.01%	<0.01%	<0.01%
Hexachlorocyclopentadiene	ug/L	58	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Nitrobenzene	ug/L	4.9	<0.3%	<0.04%	<0.1%	<0.2%	<0.2%
Thallium	ug/L	2	0.3%	0.3%	0.4%	0.3%	0.2%
Toluene	ug/L	85000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Tributyltin	ug/L	0.0014	<24%	<3.0%	<7.3%	<15%	<15%
1,1,1-Trichloroethane	ug/L	540000	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Objectives for protection of human health - carcinogens							
Acrylonitrile	ug/L	0.10	21%	23%	33%	24%	16%
Aldrin [c]	ug/L	0.000022	–	–	–	–	–
Benzene	ug/L	5.9	<0.06%	<0.02%	<0.03%	<0.04%	<0.04%
Benzidine [c]	ug/L	0.000069	–	–	–	–	–
Beryllium	ug/L	0.033	0.4%	2.5%	3.3%	1.7%	0.7%
Bis(2-chloroethyl)ether	ug/L	0.045	<63%	<5.4%	<16%	<37%	<38%
Bis(2-ethyl-hexyl)phthalate	ug/L	3.5	18%	20%	28%	21%	14%

Constituent	Units	Ocean Plan Objective	Estimated Concentration at Edge of ZID by Discharge Scenario				
			1	2	3	4	5
Carbon tetrachloride	ug/L	0.90	0.5%	0.5%	0.7%	0.5%	0.4%
Chlordane	ug/L	0.000023	26%	29%	41%	30%	20%
Chlorodibromomethane	ug/L	8.6	0.2%	0.3%	0.4%	0.3%	0.2%
Chloroform	ug/L	130	0.2%	0.3%	0.4%	0.3%	0.2%
DDT	ug/L	0.00017	10%	36%	49%	26%	12%
1,4-Dichlorobenzene	ug/L	18	0.07%	0.08%	0.1%	0.08%	0.06%
3,3-Dichlorobenzidine [c]	ug/L	0.0081	–	–	–	–	–
1,2-Dichloroethane	ug/L	28	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
1,1-Dichloroethylene	ug/L	0.9	0.4%	0.1%	0.2%	0.3%	0.2%
Dichlorobromomethane	ug/L	6.2	0.3%	0.4%	0.5%	0.4%	0.3%
Dichloromethane	ug/L	450	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
1,3-dichloropropene	ug/L	8.9	0.05%	0.06%	0.08%	0.06%	0.04%
Dieldrin	ug/L	0.00004	11%	15%	21%	14%	8.9%
2,4-Dinitrotoluene	ug/L	2.6	<0.5%	<0.02%	<0.10%	<0.3%	<0.3%
1,2-Diphenylhydrazine	ug/L	0.16	<18%	<1.5%	<4.5%	<10%	<11%
Halomethanes	ug/L	130	<0.01%	<0.01%	0.01%	0.01%	<0.01%
Heptachlor [c]	ug/L	0.00005	–	<37%	<68%	–	–
Heptachlor Epoxide	ug/L	0.00002	2.4%	2.6%	3.8%	2.8%	1.9%
Hexachlorobenzene	ug/L	0.00021	0.3%	0.3%	0.5%	0.4%	0.2%
Hexachlorobutadiene	ug/L	14	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
Hexachloroethane	ug/L	2.5	<0.6%	<0.05%	<0.2%	<0.4%	<0.4%
Isophorone	ug/L	730	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
N-Nitrosodimethylamine	ug/L	7.3	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
N-Nitrosodi-N-Propylamine	ug/L	0.38	0.1%	0.01%	0.03%	0.08%	0.08%
N-Nitrosodiphenylamine	ug/L	2.5	<0.6%	<0.08%	<0.2%	<0.4%	<0.4%
PAHs	ug/L	0.0088	4.9%	5.4%	7.7%	5.7%	3.8%
PCBs	ug/L	0.000019	29%	32%	46%	34%	23%
TCDD Equivalents	ug/L	3.9E-09	32%	35%	50%	38%	25%
1,1,2,2-Tetrachloroethane	ug/L	2.3	<0.2%	<0.04%	<0.07%	<0.1%	<0.09%
Tetrachloroethylene	ug/L	2.0	<0.2%	<0.05%	<0.08%	<0.1%	<0.1%
Toxaphene	ug/L	2.1E-04	27%	30%	43%	32%	21%
Trichloroethylene	ug/L	27	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%
1,1,2-Trichloroethane	ug/L	9.4	<0.04%	<0.01%	<0.02%	<0.03%	<0.02%
2,4,6-Trichlorophenol	ug/L	0.29	<5.4%	<0.7%	<1.7%	<3.3%	<3.3%
Vinyl chloride	ug/L	36	<0.01%	<0.01%	<0.01%	<0.01%	<0.01%

[a] Note that if the percentage as determined by using the MRL was less than 0.01 percent, then a minimum value is shown as "<0.01%" (*e.g.*, if the MRL indicated the value was <0.000001%, for simplicity, it is displayed as <0.01%).

[b] Calculating flow-weighted averages for toxicity (acute and chronic) and radioactivity (gross beta and gross alpha) is not appropriate based on the nature of these constituents. These constituents were measured individually for the secondary effluent and RO concentrate, and these individual concentrations would comply with the Ocean Plan objectives.

[c] All observed values from all data sources were below the MRL, and the flow-weighted average of the MRLs is higher than the Ocean Plan objective. No compliance conclusions can be drawn for these constituents.

[d] For total chlorine residual, any waste streams containing a free-chlorine residual would be dechlorinated prior to discharge.