# Minimum Initial Dilution Re-Evaluation Analysis of the San Elijo Ocean Outfall

4 November 2022

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# ABSTRACT:

This is a Minimum Initial Dilution Re-Evaluation Study to determine whether the proposed addition of brine from the City of Escondido membrane filtration reverse osmosis (MFRO) facility (currently under construction) could change the San Elijo Ocean Outfall (SEOO ) discharge characteristics sufficiently to affect the 237:1 initial dilution (parts seawater per parts effluent) that is currently assigned within National Pollutant Discharge Elimination System (NPDES) Permit Order Nos. R9-2018-0002 and R9-2018-0003, as originally mandated in Order No. R9-2005-0100. The study evaluates four (4) initial dilution scenarios that were posed to address the San Diego Regional Water Quality Control Board (RWQCB) requirements for the Initial Dilution Study and assess initial dilution for a potential range of future seasonal SEOO operating conditions. These scenarios are evaluated using two independent dilution models approved by the California State Water Resources Control Board (SWRCB), namely:

- Plumes 20 (UM3) and
- CORMIX v-12.

Order Nos. R9-2018-0002 and R9-2018-0003 assign an initial dilution of 237:1 to the SEOO discharge on the basis of initial dilution modeling performed by the RWQCB and SWRCB in 2005 using historic ocean density profiles from June 2003-December 2003, a maximum SEOO discharge flow of 23.25 mgd and an effluent salinity of 1.2 psu. Maximum anticipated future brine discharges to the SEOO are projected to result in only a slight increase in salinity to approximately 1.34 psu. By itself, such a small increase in salinity would have no discernible effect on SEOO initial dilution. Changes in SEOO discharge flows, on the other hand, may offer the potential for discernible effects on SEOO initial dilution. To evaluate this question, this study assesses a range of potential discharge flow and salinity scenarios, and the effect on SEOO initial dilution through a range of four seasonal oceanographic conditions, using observed seasonal SEOO ocean density (temperature/salinity) data collected during 2013-2014 by MTS, as approved by the RWQCB. Model Scenarios #1 and #2 assess initial dilutions associated with maximum flow/maximum brine conditions during winter and spring conditions, while Scenarios #3 and #4 assess minimum flow/maximum brine conditions during summer and fall conditions.

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# 1) Introduction

The National Pollutant Discharge Elimination System (NPDES) permits regulate wastewater discharges from the San Elijo Ocean Outfall (SEOO) into the Pacific Ocean. The Regional Water Quality Control Board (RWQCB), San Diego Region presently issues four (4) separate orders under the SEOO NPDES permit No. CA0107999, including:

- Order No. R9-2018-0002 regulates the City of Escondido discharge to the SEOO from the Hale Avenue Resource Recovery Facility (HARRF) and the proposed City of Escondido Membrane Filtration/Reverse Osmosis (MFRO) facility.
- Order No. R9-2018-0003 regulates the San Elijo Joint Powers Authority (SEJPA) discharge to the SEOO from the San Elijo Water Campus (SEWC), which includes secondary treated wastewater from the SEWC and reverse osmosis brine from the SEWC advanced water treatment facility.
- Order No. R9-2014-0094 (as amended) regulates the discharge of 0.07 mgd of reverse osmosis brine from the Stone Brewing Company to the SEOO.
- Order No. R9-2012-0015 (as amended) regulates the discharge of cooling tower blowdown brine to the SEOO from the Palomar Energy Center (PEC).

The proposed 2.0 mgd MFRO facility would generate approximately 0.5 mgd of brine that contains an estimated total dissolved solids concentration of 4500 mg/L (roughly 4.5 psu). Except for downtime for facility maintenance, the MFRO will operate on a year-round basis, including periods of wet weather. Order Nos. R9-2018-0002 and R9-2018-0003 require the City of Escondido and SEJPA to conduct a *Minimum Initial Dilution Re-Evaluation Study* to determine whether the proposed addition of brine from the City of Escondido MFRO facility (currently under construction) could change the SEOO discharge characteristics sufficiently to affect the 237:1 initial dilution (parts sea water per parts effluent) that is currently assigned within Order Nos. R9-2018-0002 and R9-2018-0003, as originally mandated in Order No. R9-2005-0100. This 237:1 assigned initial dilution was computed in 2005 by the State Water Resources Control Board (SWRCB) using the U.S. Environmental Protection Agency (EPA) Visual Plumes (UM3) model and the following input:

- a maximum permitted SEOO discharge flow of 23.25 million gallons per day (mgd),
- a combined SEOO discharge salinity concentration of 1.2 practical salinity units (psu),
- a combined SEOO discharge temperature of 22.5 degrees Centigrade, and
- ambient ocean density (temperature/salinity) data from February 2004 (deemed to represent average monthly conditions during the minimum month of the year).

Since the original 2005 minimum initial dilution analysis for the SEOO, the Visual Plumes (UM3) dilution model has undergone a series of upgrades, (cf. Frick, et al., 2010, & 2016), and the most recent upgrade

is now referred to as Plumes 20 (UM3). Since 2018, the SWRCB has favored the use of the Plumes 20 (UM3) model for dilution problems involving brine additions, as detailed in their 2018 guidance document. The SWRCB provides this guidance document and Plumes 20 (UM3) executable source code at its website:

https://www.waterboards.ca.gov/water_issues/programs/ocean/

However, Visual Plumes and Plumes 20 are not the only dilution models approved for use by the SWRCB for minimum initial dilution analyses. The expert system model CORMIX is approved by U.S. EPA in its beta testing of generation 2 & 3 dilution models, (cf. Baumgartner, et al. 1994, Frick et al., 2003), and has been used to establish the minimum initial dilution in NPDES permits for the Hyperion 1-Mile and 5-Mile Ocean Outfalls, (NPDES No. CA-0109991, Order No. R4-2017-0045), cf. RWQCB (2017), Walker (2016 & 2020). Since 2003, CORMIX has gone through a succession of 12 upgrades, and the latest version is CORMIX v-12, which is supported by and available from MixZon, Inc, cf. Doneker and Jirka, (1999 & 2022) In the following minimum initial dilution re-evaluation of the San Elijo Ocean Outfall (SEOO), the Plumes 20 (UM3) model was used as the primary analysis tool with cross-checks of suspected spurious results performed using CORMIX v-12.

# 2) Formulation of Dilution Scenarios

During periods of wet weather, SEOO flows may approach the maximum permitted flow of 23.25 mgd, but the MFRO brine discharge (along with brine discharges from the SEWC, PEC and Stone Brewing Company) will comprise a small percent of the total discharged flow. During summer periods of peak recycled water demand, SEOO discharge flows will be considerably lower as a significant majority of the HARRF and SEWC flow will be diverted to recycled water use. During such low flow periods, however, the SEOO discharge will be comprised of a higher percentage of brine and cooling tower blowdown, including:

- up to 0.5 mgd of reverse osmosis brine from the proposed City of Escondido MFRO facility (which will be operated on a continuous basis),
- up to 1.4 mgd of cooling tower blowdown from the PEC,
- up to 0.07 mgd of reverse osmosis brine from the Stone Brewing Company, and
- up to 0.2 mgd of reverse osmosis brine from SEWC advanced water treatment facility.

Near-maximum brine flows could also occur during periods of wet weather when the SEWC advanced water treatment facilities and the MFRO are operating to divert recycled water to storage and offload peak flow discharged to the SEOO.

A total of four (4) initial dilution scenarios were posed to address the San Diego RWQCB requirements for the Initial Dilution Study and assess initial dilution for a potential range of seasonal SEOO operating conditions. Model scenarios assessed a range of projected future SEOO discharge flows and SEOO brine flows and superimposed these discharge flows and discharge salinities on the seasonal oceanographic conditions that would likely occur during the periods associated with the discharge flow scenarios. **Table 1** summarizes the four (4) model scenarios which were based on assignments for discharge rates and salinities as listed in **Table 2**.

Model Scenarios #1 through #4 in **Table 1** were posed to assess projected seasonal initial dilutions using a range of projected SEOO flow and salinity conditions listed in Table 2 superimposed on observed seasonal SEOO ocean density (temperature/salinity) data collected during 2013-2014 by MTS, as approved by the RWQCB. Model Scenarios #1 and #2 assess initial dilutions associated with maximum flow/maximum brine conditions during winter and spring conditions, while Scenarios #3 and #4 would assess minimum flow/maximum brine conditions during summer and fall conditions. For these model runs, all density profiles from the 2013-2014 SEOO ocean density data base were utilized for Plumes 20 and CORMIX v-12 initial dilution modeling. From this ensemble of initial dilution modeling results, a representative worst-month minimum initial dilution result was determined from among the winter, spring, summer and fall seasonal operating periods with maximum brine additions.

**Table 1: Initial Dilution Model Scenarios SEOO Initial Dilution Study**

| Proposed Dilution Model Scenario | Flow Scenario | Ocean Density Profile | Combined SEOO Discharge Flow | Projected Salinity Concentration of Combined SEOO Discharge | Objective |
|---|---|---|---|---|---|
| #1 | Maximum SEOO discharge flow w/Maximum brine discharges [B] | Winter 2013-2014[D] | 23.25 mgd [A] | 1.34 psu [C] | Seasonally characterize projected SEOO initial dilutions for the projected range of discharge flow and salinity conditions |
| #2 | Maximum SEOO discharge flow w/Maximum brine discharges [B] | Spring 2013-2014[D] | 23.25 mgd [A] | 1.34 psu [C] | |
| #3 | Minimum SEOO discharge flow w/Maximum brine discharges [E] | Summer 2013-2014 [D] | 7.2 mgd [E] | 1.88 psu [F] | |
| #4 | Minimum SEOO discharge flow w/Maximum brine discharges [E] | Autumn 2013-2014 [D] | 7.2 mgd [E] | 1.88 psu [F] | |

**Table 1 Notes:**

A Maximum monthly average SEOO discharge flow permitted within Order Nos. R9-2018-0002 and R9-2018-0003. As documented within the Orders, this maximum SEOO discharge flow was used by the SWRCB in 2005 for purposes of computing the assigned SEOO initial dilution of 237:1.

B Maximum allowable SEOO discharge of 23.25 mgd with maximum allowable cooling tower discharge from the PEC and maximum brine discharges from Stone Brewing Company, the City of Escondido MFRO and the SEJPA SEWC advanced water treatment facility. See Table 2.

C Projected salinity of combined SEOO discharge during maximum 23.25 mgd discharge with maximum allowable brine discharges from the PEC, Stone Brewing Company, the City of Escondido MFRO, the SEJPA SEWC advanced water treatment facility. See Table 2.

D Ocean density profile from available 2013-2014 monthly density profiles that is selected by MBI as being representative of seasonal oceanographic conditions. This includes monthly density profiles from December 2013, January 2014 and February 2014 to characterize a range of typical winter conditions, monthly profiles for March through May 2014 to characterize spring conditions, monthly profiles for June through August 2014 to characterize summer conditions, and monthly profiles from September through November 2014 to characterize the range of typical fall conditions.

E Projected minimum SEOO discharge flows during times of peak recycled water demand. Includes maximum allowable brine discharges from the PEC, Stone Brewing Company, City of Escondido MFRO and SEJPA SEWC. See Table 2.

F Estimated salinity of the combined SEOO discharge during conditions of minimum SEOO discharge flows and maximum brine contributions. See Table 2.

**Table 2: Projected Discharge Flows and Salinities Maximum and Minimum SEOO Discharge Flows**

| Facility | Maximum SEOO Discharge Flows w/Maximum Brine Discharges Scenarios #1 and #2 | | Minimum SEOO Discharge Flows w/Maximum Brine Discharges Scenarios #3 and #4 | |
|---|---|---|---|---|
| | Discharge Flow | Projected Salinity Concentration | Discharge Flow | Projected Salinity Concentration |
| HARRF secondary effluent | 16.03 mgd [A] | 1.0 psu [B] | 5.0 mgd [C] | 1.0 psu [B] |
| MFRO reverse osmosis brine | 0.5 mgd [D] | 4.5 psu [D] | 0.5 mgd [D] | 4.5 psu [D] |
| Palomar Energy Center cooling tower discharge | 1.4 mgd [E] | 3.0 psu [E] | 1.4 mgd [E] | 3.0 psu [E] |
| Stone Brewing Company reverse osmosis brine discharge | 0.07 mgd [F] | 4.5 psu [F] | 0.07 mgd [F] | 4.5 psu [F] |
| SEWC secondary effluent | 5.15 [G] | 1.2 psu [G] | 0 [H] | --- |
| SEWC reverse osmosis brine | 0.2 [I] | 5.0 psu [I] | 0.2 [I] | 5.0 psu [I] |
| Combined SEOO Discharge | 23.25 [J] | 1.34 psu [K] | 7.17 mgd [L] | 1.88 psu [K] |

**Table 2 Notes:**

A RWQCB Order No. R9-2018-0002 limits the total discharge from HARRF, the Palomar Energy Center, MFRO and Stone Brewing to a monthly average flow of 18 mgd. The HARRF secondary effluent discharge would be limited to a monthly average of 16.03 mgd if other discharging facilities are contributing flows to the Escondido Land Outfall as shown above.

B Approximate HARRF secondary effluent salinity concentration. RWQCB Order No. R9-2010-0032 establishes a TDS effluent concentration limit of 1000 mg/L (approximately 1.0 psu) for HARRF recycled water.

C Assumes a HARRF inflow of 14 mgd, less 9 mgd flow diverted to the HARRF tertiary treatment facility.

D When operating at capacity, the City of Escondido MFRO facility reverse osmosis discharge is projected at 0.5 mgd with a total dissolved solids concentration of 4500 mg/L (approximately 4.5 psu).

E RWQCB Order No. R9-2012-0015 (as amended) limits cooling tower blowdown flows from the Palomar Energy Center to 1.4 mgd. Discharge TDS concentrations vary but are typically on the order of 3000 mg/L (approximately 3.0 psu).

F RWQCB Order No. R9-2014-0094 (as amended) limits the Stone Brewing Company reverse osmosis brine discharge to 0.07 mgd. Estimated salinity is approximately 4.5 psu.

G Maximum allowable monthly average SEJPA discharge to the SEOO is 5.25 mgd. When SEWC reverse osmosis facilities are operating and contributing 0.2 mgd of brine, SEWC secondary effluent discharges to the SEOO would be limited to a monthly average of 5.05 mgd. Such a 5.05 mgd flow would be rare and limited to extended periods of wet weather, as typical SEWC inflows are on the order of 3 mgd.

H SEJPA utilizes virtually 100 percent of its available recycled water supply during periods of peak irrigation demand.

I When operating at full capacity, the SEWC reverse osmosis facility generates approximately 0.2 mgd of brine with a salinity concentration of roughly 5.0 psu.

J Maximum allowable monthly average SEOO discharge flow per RWQCB Order Nos. R9-2018-0002 and R9-2018-0003.

K Estimated salinity of the combined SEOO discharge flow the above-listed facility flows and salinities.

L SEOO outfall flow assuming a HARRF influent flow of 14 mgd, 9 mgd of HARRF effluent diverted to recycled water production and brine/residuals discharges of 2.17 mgd.

# 3) Dilution Model Parameter Assignments and Dilution Output

The Visual Plumes (UM3) dilution model originally used to determine the minimum initial dilution of 237:1 in Order No. R9-2005-0100 utilizes nearly the same set of input parameters as the updated UM3 model, Plumes 20 with some minor exceptions. Therefore, the original 2005 Visual Plumes parameter assignments are adopted for Plumes 20 modeling of all four (4) scenarios in **Table 1**. Those parameter assignments are lifted from Appendix G of RWQCB, (2005) as follows:

- **Port diameter**: 2 inches. Section 1-3 of the Report of Waste Discharge for the San Elijo Water Reclamation Facility (RWD)
- **Port elevation:** 0.0 feet. Section 3-3 of the Report of Waste Discharge for the Hale Avenue Resource Recovery Facility indicates that the outfall lies on the ocean floor.
- **Vertical angle:** -5.0 degrees. Table 3-2 of the Report of Waste Discharge for the Hale Avenue Resource Recovery Facility.
- **Horizontal angle:** 0.0 degrees. The model does not have input abilities for a diffuser with ports facing various directions. A single direction for all ports was assigned. This will result in a conservative dilution factor.
- **Number of ports**: 200 ports per Section 1-3 of RWD
- **Port spacing**: 6 feet. Section 1-3 of RWD indicates that there are 100 ports on each side of the diffuser. The section also indicates that the ports are spaced every 12 feet. To account for two ports every 12 feet, the port spacing was entered as 6 ft, instead of the actual 12 feet (which would otherwise double the length of the diffuser).
- **Acute mix zone**: Not relevant, value does not affect dilution factor as defined by the SWRCB.
- **Chronic mix zone**: Not relevant, value does not affect dilution factor as defined by the SWRCB.
- **Port depth:** 140 feet. The 2003 and 2013-2014 density profile data bases were collected at monitoring station A-0.5-S where the local water depth is 140 ft. Note, the original 2005 Visual Plumes (UM3) modeling assumed a port depth of 148, (per Appendix G of RWQCB, 2005), which is the maximum depth of the SEOO diffuser.
- **Effluent flow**: 23.25 mgd. The total combined permitted flow from the San Elijo Water Reclamation Facility (5.25 mgd) and the Hale Avenue Resource Recovery Facility (18.0 mgd). Note that the actual capacity of the SEOO is 25.5 mgd.
- **Effluent salinity**: 1.2 psu - The most conservative value was selected from Table 2-3 of the Report of Waste Discharge for the Hale Avenue Resource Recovery Facility.
- **Effluent temperature:** 22.5 °C The most conservative value was selected from Table 2-4 of the Report of Waste Discharge for the Hale A venue Resource Recovery Facility.

- **Effluent concentration**: Not relevant, input does not affect dilution factor.
- **Ambient data**: Monthly ambient data submitted to the Regional Water Quality Control Board for the SEOO (monitoring station AO.5S - closest to the diffuser) for the time frame between June 2003 through December 2003 was entered. The most conservative month was used to determine the minimum initial dilution factor (July 2003).
- **Far-field diffusion coefficient** - 0.0003 $m^{0.67}/s^2$ - recommended in the Visual Plumes manual as a conservative value.
- **Special Settings Tab, Farfield Diffusivity Option:** 4/3 Power Diffusivity was chosen based on the fact that the discharge is occurring in open water.
- **Special Settings Tab, Diffuser Port Contraction Coefficient**: 0.61 based on the use of cylindrical ports in the diffuser.
- **Special Settings Tab, Standard Light Adsorption Coefficient:** 0.16 is recommended in the Visual Plumes manual as a conservative value.

Regarding model output, the Plumes 20 initial dilution output variable is "*Dilutn*" while CORMIX v12 uses the symbol *"S"* to represent initial dilution. Both of these initial dilution output variables are *mixing ratios*, which represent the ratio of the total parts of a water sample per parts effluent contained in that sample. However the relevant dilution metric under the Ocean Plan is initial *dilution factor*, "*Dm*," which is defined as parts seawater per parts effluent, (Appendix I, SWRCB, 2018). Mixing ratios, *Dilutn* and *S*, are related to initial dilution factor, *Dm,* by the following:

$$D_m = Dilutn - 1 = S - 1 \quad (1)$$

# 4) Plumes 20 Initial Dilution Results for Discharge Scenario #1: Maximum Discharge With Maximum Brine Additions for Winter Density Profiles

Initial dilution solutions for Scenario #1 using both Plumes 20 and CORMIX v-12 are plotted in **Figure 4.1**. These solutions are based on maximum allowable SEOO discharge of 23.25 mgd, containing maximum allowable cooling tower discharge from the PEC and maximum brine discharges from Stone Brewing Company, the City of Escondido MFRO and the SEJPA SEWC advanced water treatment facility, resulting in a discharge salinity of 1.34 psu. These discharge inputs are applied to the monthly water column density profiles in **Appendix A** for winter conditions from December 2013 through February 2014. Print-outs of the Plumes 20 and CORMIX-v12 maximum brine additions solution files for each of these three winter months are found in **Appendix B** along with graphical outputs of the individual initial dilution factors, Dm, as a function of depth. Inspection of **Figure 4.1** reveals that the Plumes 20 solutions surpass the NPDES-assigned minimum initial dilution of Dm = 237 using the density profiles for the months of December 2013 (when Dm = 325.2) and January 2014, (when Dm = 341.6). However, Plumes 20 predicts the assent of the plume is arrested very close to the seabed at a depth of 114.7 ft with the February 2014 density profiles, where initial dilution reaches only Dm = 76.85. Inspection of the density profile for February 2014 in **Appendix A** is extremely unusual, with an approximately isothermal/isohaline distribution between the seabed and the sea surface, as if the entire water column were a single-layer, homogeneous water mass. The mean water column density of the February 2014 density profile was $\langle \rho \rangle =$ 1.02480 g/cm$^3$ with a standard deviation of only $\sigma =$ 0.00003 g/cm$^3$ between the seabed and sea surface, essentially indicating a uniform water mass. Furthermore, the February 2014 density profile is only weakly stable with the density at the seabed exceeding that at the sea surface by only 0.00005 g/cm$^3$. This fact provokes the hypothesis that the extremely marginal stability of February 2014 density profile may have induced a numerical instability within the Plumes 20 code, causing it to truncate the initial dilution computational sequence at a depth of 114.7 ft (only 25.3 ft above the bottom), where initial dilution had only reached 76.85:1. To test this hypothesis, the CORMIX v-12 expert system model (which is immune to numerical instability) ran Scenario #3 on the February 2014 density profile using a mean water column density of $\langle \rho \rangle =$ 1,024.8 kg/m$^3$ , (equivalent to 1.02480 g/cm$^3$). The CORMIX v-12 prediction file for February 2014, (cf. Section B.3 in **Appendix B**) indicates that initial dilution reached Dm = 379.9 at a depth of 46.2 ft. This result appears more sensible and is in line with the other Scenario #1 initial dilution results obtained with Plumes 20 using the December 2013 and January 2014 density profiles that displayed mean temperatures and salinities comparable to those of the February 2014 density profile.

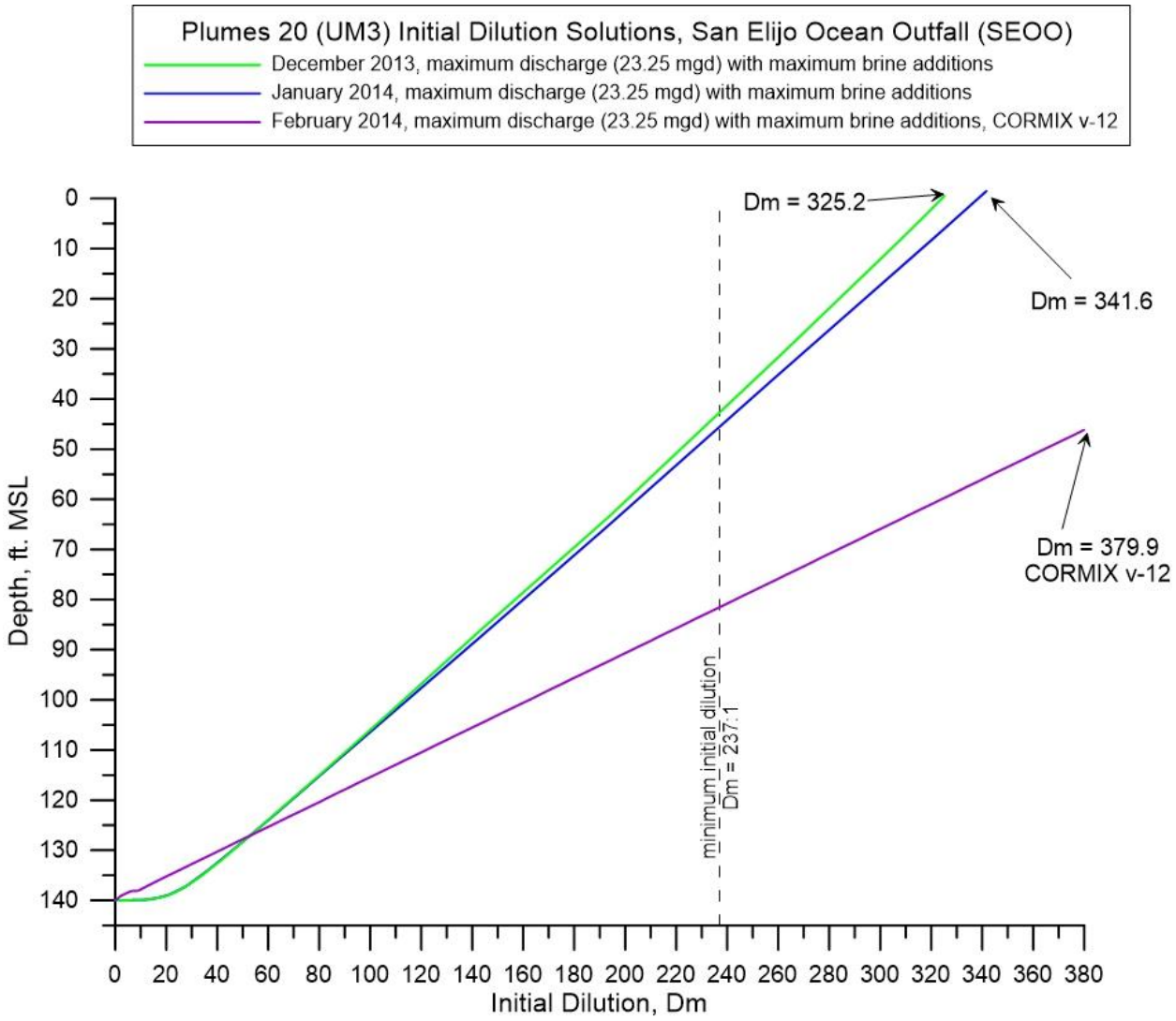



**Figure 4.1:** Plumes 20 and CORMIX v-12 initial dilution solutions for Scenario #1 based on maximum allowable SEOO discharge of 23.25 mgd with maximum allowable cooling tower discharge from the PEC and maximum brine discharges from Stone Brewing Company, the City of Escondido MFRO and the SEJPA SEWC advanced water treatment facility applied to the monthly water column density profiles in **Appendix A** under winter conditions from December 2013 through February 2014. The CORMIX v-12 solution for February 2014 oceanographic conditions is shown above, as the nearly homogeneous nature of ocean density throughout the depth profile that existed during February 2014 caused the Plumes 20 simulation to truncate prior to converging on an appropriate initial dilution solution.

# 5) Plumes 20 Initial Dilution Results for Discharge Scenario #2: Maximum Discharge With Maximum Brine Additions for Spring Density Profiles

Initial dilution solutions for Scenario #2 using the Plumes 20 dilution model are plotted in **Figure 5.1**. These solutions are based on maximum allowable SEOO discharge of 23.25 mgd, containing maximum allowable cooling tower discharge from the PEC and maximum brine discharges from Stone Brewing Company, the City of Escondido MFRO and the SEJPA SEWC advanced water treatment facility resulting in a discharge salinity of 1.34 psu. These discharge inputs are applied to the monthly water column density profiles in **Appendix A** for spring conditions from March through May 2014. Print-outs of the Plumes 20 maximum brine additions solution files for each of these three spring months are found in **Appendix C** along with graphical outputs of the individual initial dilution factors, Dm, as a function of depth. Inspection of **Figure 5.1** reveals that the Plumes 20 solution for Scenario #2 during March 2014 achieves an initial dilution of Dm = 237 at a depth of 24.4 ft, which is consistent with the minimum initial dilution of 237:1 assigned within Order Nos. R9-2018-0002 and R9-2018-0003. Frick and Roberts, (2016). All the remaining Plumes 20 solutions for Scenario #2 surpass the certified minimum initial dilution of 237:1 using the density profiles for the months of April 2014 (when Dm = 326.8) and May 2014, (when Dm = 278.2). With the April 2014 density profiles, the plume comes close to broaching the sea surface when initial dilution is arrested at a depth of 2.46 ft., (cf. Section C.2 in **Appendix C**).

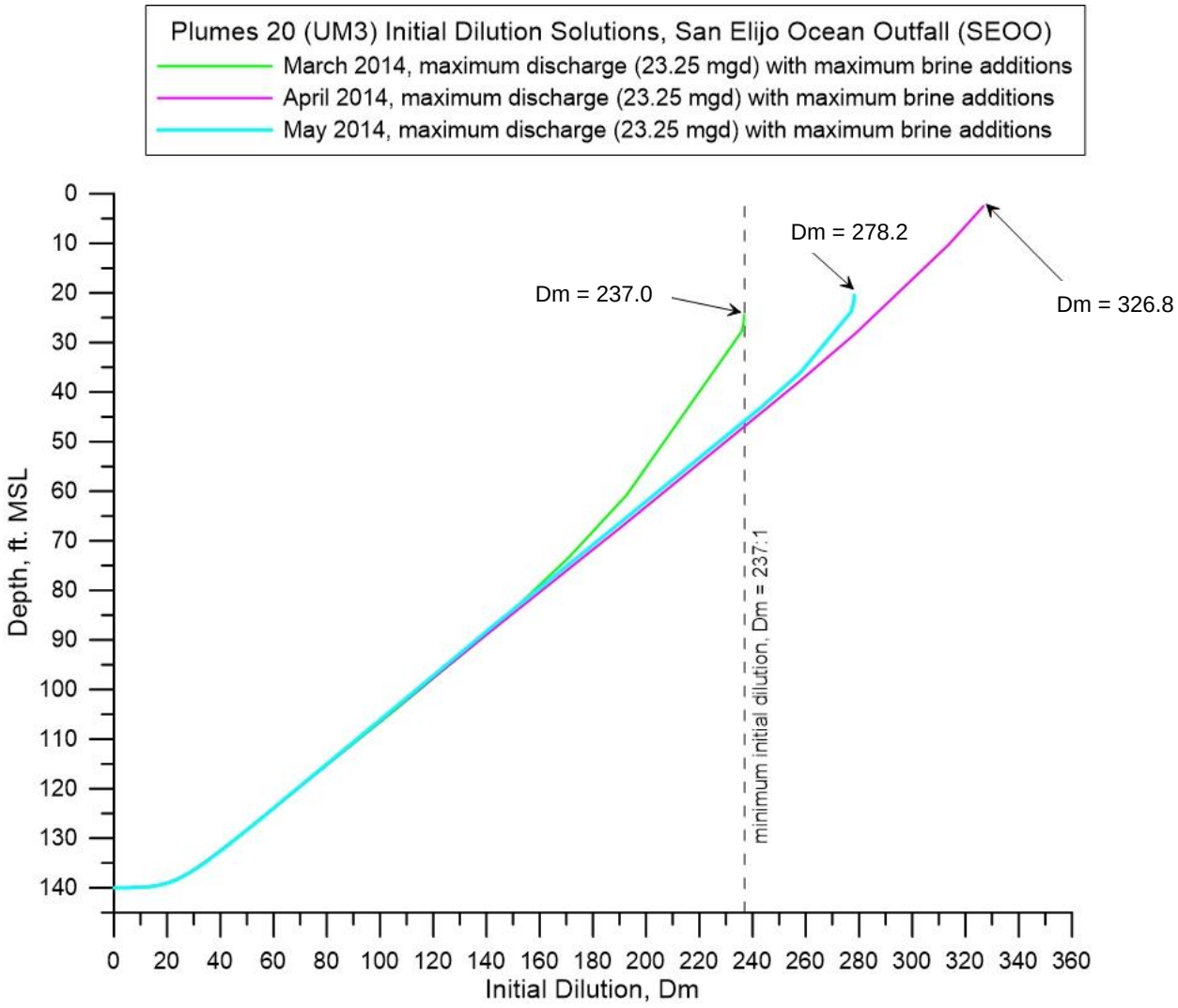



**Figure 5.1:** Plumes 20 initial dilution solutions for Scenario #2 based on maximum allowable SEOO discharge of 23.25 mgd with maximum allowable cooling tower discharge from the PEC and maximum brine discharges from Stone Brewing Company, the City of Escondido MFRO and the SEJPA SEWC advanced water treatment facility applied to the monthly water column density profiles in **Appendix A** under spring conditions from March 2014 through May 2014.

# 6) Plumes 20 Initial Dilution Results for Discharge Scenario #3: Minimum Discharge With Maximum Brine Additions for Summer Density Profiles

Initial dilution solutions for Scenario #3 using the Plumes 20 dilution model are plotted in **Figure 6.1**. These solutions are based on historic minimum SEOO discharge of 7.2 mgd, containing maximum allowable cooling tower discharge from the PEC and maximum brine discharges from Stone Brewing Company, the City of Escondido MFRO and the SEJPA SEWC advanced water treatment facility, resulting in a discharge salinity of 1.88 psu. These discharge inputs are applied to the monthly water column density profiles in **Appendix A** for summer conditions from June through August 2014. Print-outs of the Plumes 20 maximum brine additions solution files for each of these three summer months are found in **Appendix D** along with graphical outputs of the individual initial dilution factors, Dm, as a function of depth. All the Plumes 20 solutions for Scenario #3 significantly exceed the minimum initial dilution of 237:1 assigned within Order Nos. R9-2018-0002 and R9-2018-0003, reaching Dm = 523.7 at a depth of 28.1 ft during June 2014; falling somewhat to Dm = 452.8 at a depth of 37.4 ft during July 2014, and declining further to Dm = 422.6 at a depth of 46.8 ft during August 2014. The steady decline in initial dilution throughout the summer months is due to progressive warming and deepening of the surface mixed layer, (cf. density profiles for June-August 2014 in **Appendix A**), which in turn arrests the ascent of the plume at deeper depths, causing initial dilution to stop closer to the bottom as the summer wears on.

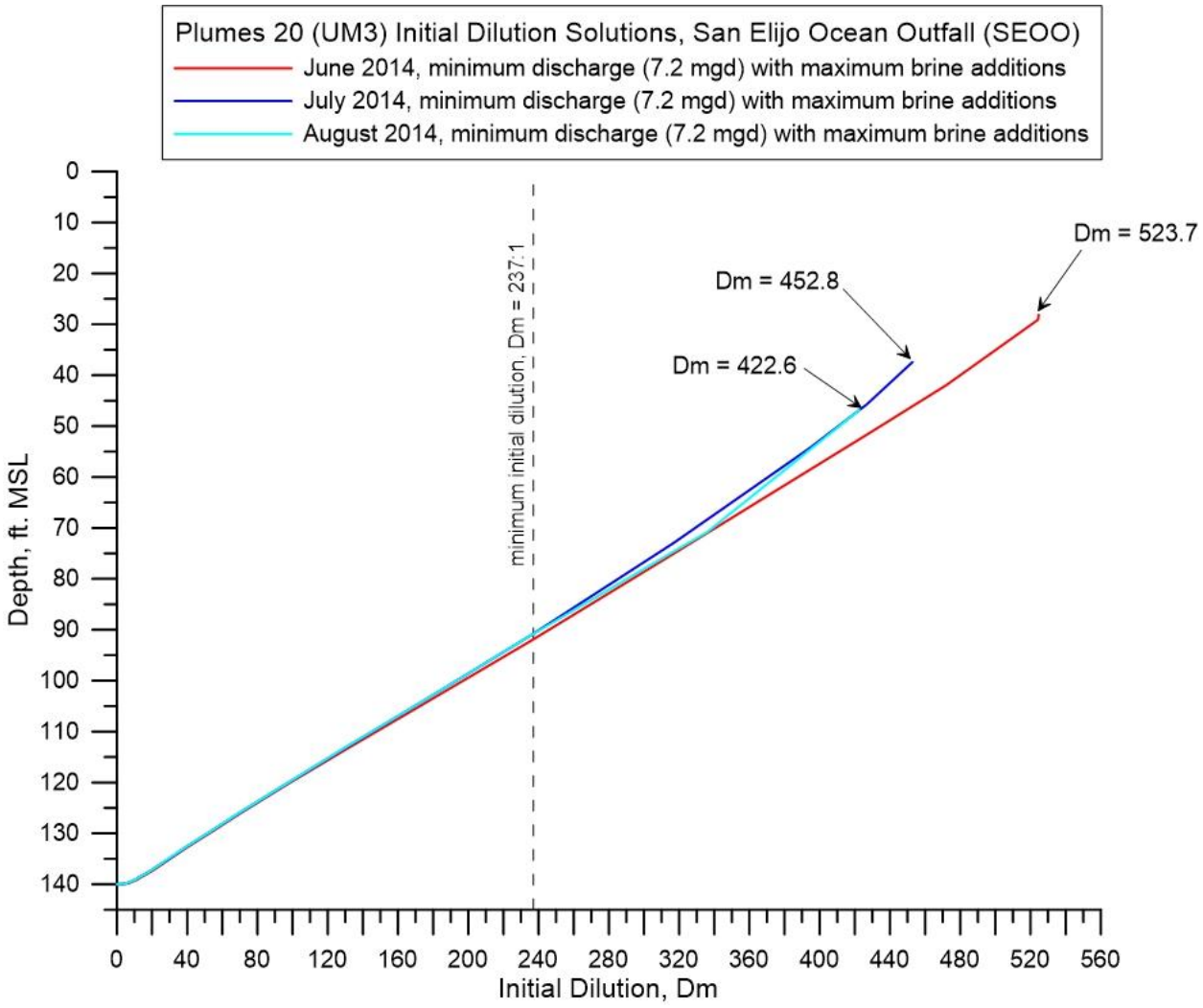



**Figure 6.1:** Plumes 20 initial dilution solutions for Scenario #3 based on historic minimum SEOO discharge of 7.2 mgd with maximum allowable cooling tower discharge from the PEC and maximum brine discharges from Stone Brewing Company, the City of Escondido MFRO and the SEJPA SEWC advanced water treatment facility, resulting in a discharge salinity of 1.88 psu. These discharge inputs are applied to the monthly water column density profiles in **Appendix A** under summer conditions from June 2014 through August 2014.

# 7) Plumes 20 Initial Dilution Results for Discharge Scenario #4: Minimum Discharge With Maximum Brine Additions for Autumn Density Profiles

Initial dilution solutions for Scenario #4 using the Plumes 20 dilution model are plotted in **Figure 7.1**. These solutions are based on maximum allowable SEOO discharge of 7.2 mgd, containing maximum allowable cooling tower discharge from the PEC and maximum brine discharges from Stone Brewing Company, the City of Escondido MFRO and the SEJPA SEWC advanced water treatment facility, resulting in a discharge salinity of 1.88 psu. These discharge inputs are applied to the monthly water column density profiles in **Appendix A** for autumn conditions from September and October 2014 and November 2013. Print-outs of the Plumes 20 maximum brine additions solution files for each of these three autumn months are found in **Appendix E** along with graphical outputs of the individual initial dilution factors, Dm, as a function of depth. All the Plumes 20 solutions for Scenario #4 result in initial dilutions that are significantly higher than the minimum initial dilution of 237:1 assigned in Order Nos. R9-2018-0002 and R9-2018-0003. Simulated Scenario #4 initial dilutions reach Dm = 509.9 at a depth of 33.1 ft during September 2014; dropping to Dm = 298.5 at a depth of 70.6 ft during October 2014, while during the previous November 2013 initial dilution reached Dm = 510.7 at a depth of 24.2 ft.

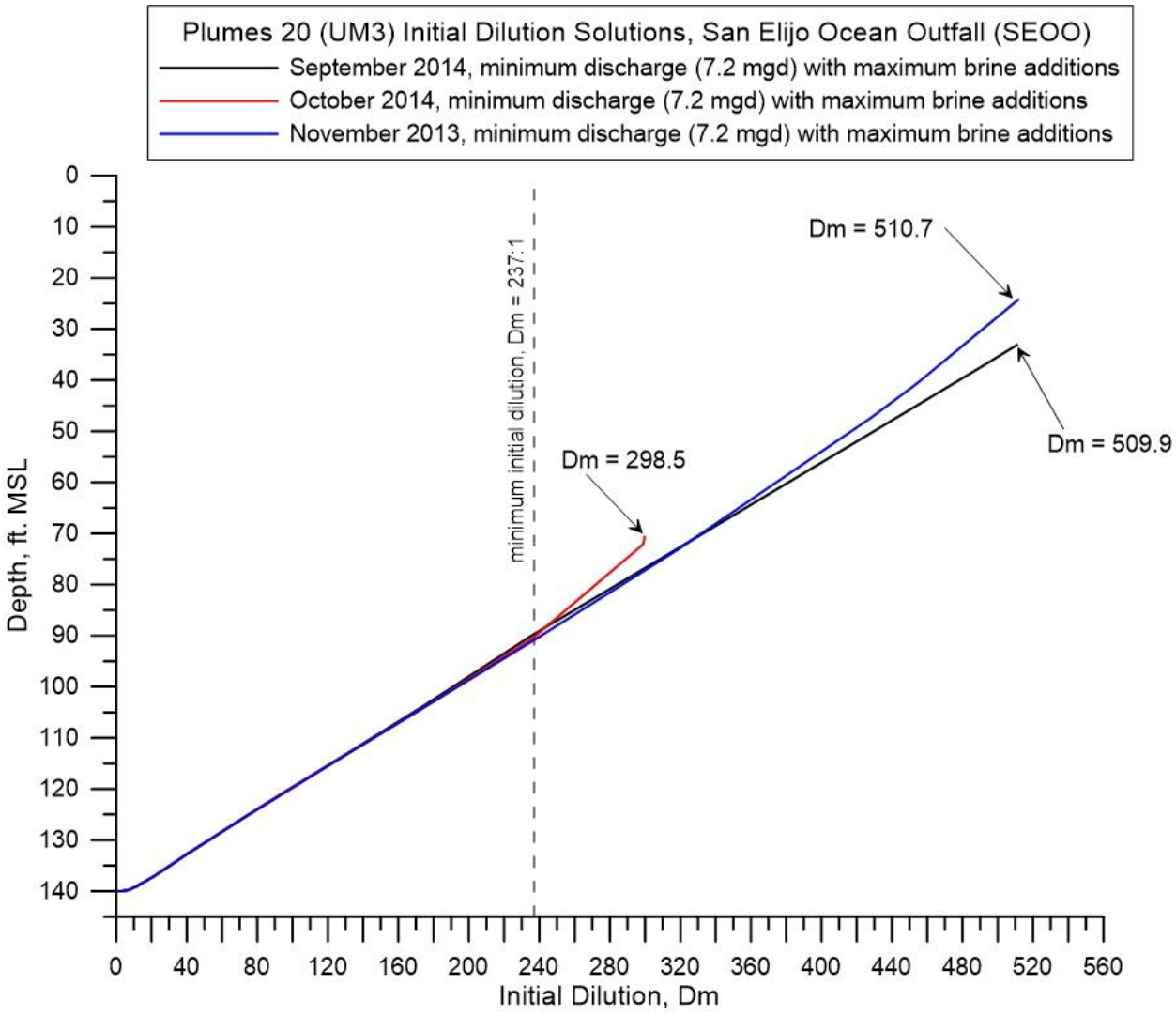



**Figure 7.1:** Plumes 20 initial dilution solutions for Scenario #4 based on historic minimum SEOO discharge of 7.2 mgd with maximum allowable cooling tower discharge from the PEC and maximum brine discharges from Stone Brewing Company, the City of Escondido MFRO and the SEJPA SEWC advanced water treatment facility applied to the monthly water column density profiles in **Appendix A** under autumn conditions from September 2014 through November 2014.

# 8) Conclusions

**Table 3** summarizes the initial dilution simulations presented herein. Initial dilution modeling of Scenarios #1 and #2 demonstrate that MFRO operations, brine discharges, and other potential SEOO discharge operations will not result in a reduction in SEOO dilution during periods of maximum discharge flows, which would occur in winter or spring oceanographic conditions. Under winter conditions and maximum SEOO discharge flows (Scenario #1), SEOO initial dilutions are projected to exceed 325:1. Worst case conditions under maximum discharge flows (represented by Model Scenario #2) would occur during spring months (e.g., March 2014 density conditions) when the SEOO initial dilution is projected at 237:1 (the value currently assigned to the SEOO to represent maximum discharge conditions and minimum initial dilution). Initial dilutions during other spring months are projected to exceed 278:1 (see **Figure 5.1**).

Discharge conditions (e.g., reduced SEOO discharge flows but higher brine contributions) during periods of significant recycled water demand are projected to result in a significant improvement in SEOO initial dilution. As shown in **Figure 6.1**, Scenario #3 summer discharge conditions are projected to result in SEOO initial dilutions that exceed 422:1. During fall conditions (Scenario #4), SEOO initial dilutions are projected to exceed 298:1.

On the basis of these modeling results, it is concluded that no change to the presently assigned SEOO minimum month initial dilution of 237:1 is warranted. SEOO initial dilution is projected to remain higher than the NPDES assigned value throughout the projected range of SEOO discharge flows, discharge salinities, and seasonal oceanographic conditions.

**Table 3: Summary of Initial Dilution Simulations**

| Model Scenario | Simulated SEOO Discharge Flow Conditions | Simulated Ocean Density Profile | Projected Initial Dilution |
|---|---|---|---|
| Baseline Condition Determined by RWQCB/SWRCB Modeling[A] | Maximum SEOO discharge flow | 2003-2004 | 237:1[A] |
| Scenario #1 | Maximum SEOO discharge flow w/Maximum brine discharges | December 2013 | 325:1[B,C] |
| | | January 2014 | 342:1[B,C] |
| | | February 2014 | 380:1[B,C] |
| Scenario #2 | Maximum SEOO discharge flow w/Maximum brine discharges | March 2013 | 237:1[C,E,F] |
| | | April 2013 | 327:1[C,E] |
| | | May 2013 | 278:1[C,E] |
| Scenario #3 | Minimum SEOO discharge flow w/Maximum brine discharges | June 2014 | 524:1[C,G] |
| | | July 2014 | 453:1[C,G] |
| | | August 2014 | 423:1[C,G] |
| Scenario #4 | Minimum SEOO discharge flow w/Maximum brine discharges | September 2014 | 510:1[C,H] |
| | | October 2014 | 298:1[C,H] |
| | | November 2013 | 511:1[C,H] |

A As documented in Order No. R9-2005-0139 and R9-2005-0100. This 237:1 initial dilution value has been carried over and applied to the SEOO discharges regulated under RWQCB Order Nos. R9-2018-0002 and R9-2018-0003.

B See **Figure 4-1**.

C Solution from Plumes 20 initial dilution simulation.

D Solution from CORMIX v-12, as Plumes 20 failed to properly converge on a realistic solution due to an unusual oceanographic conditions (constant ocean density throughout all depths).

E See **Figure 5-1**.

F The April 2013 oceanographic, discharge flow, and discharge salinity conditions are representative of "minimum average month" conditions similar to those used by the RWQCB/SWRCB to assign the 237:1 initial dilution within Order Nos. R9-2018-0002 and R9-2018-0003.

G See **Figure 6-1**.

H See **Figure 7-1**.

# 9) References:

Baumgartner, D. J., Frick, W. E., and Roberts, P. J. W. (1994). "Dilution Models for Effluent Discharges (Third Edition)." U.S. Environmental Protection Agency, Office of Research and Development, EPA/600/R-94/086

Deser, C., Alexander, M., Xie, S., and A. Phillips, 2010. "Sea Surface Temperature Variability: Patterns and Mechanisms". *Annual Review of Marine Science*. 2 (1): 115 143, doi:10.1146/annurev-marine-120408-151453. PMID 21141660

Doneker, R. L., and Jirka, G. H. (1999). "Discussion of mixing of inclined dense jets" by Roberts, P. J. W., Ferrier, A., and Daviero, G." (1997)." J. Hydraul. Eng., 125(3), 317–319.

Doneker, R. L. and Jirka, G. H., 2022, "CORMIX User Manual." MixZon, Portland, Oregon. Updated February 2022.

Frick, W.E., Roberts, P., Davis, L., Keyes, J., Baumgartner, D., George, K., 2003, "Dilution models for effluent discharges, Forth Addition", U.S. Environmental Protection Agency, Standards and Applied Science Division Office of Science and Technology, 148 pp.

Frick, W., Ahmed, A., George, K., Laputz, A., Pelletie, G., and Roberts, P. (2010). "On Visual Plumes and Associated Applications." MWWD 2010 6th International Conference on Marine Waste Water Discharges and Coastal Environment, C. Avanzini, ed. Langkawi, Malaysia.

Frick, W. E., and Roberts, P. J. W., 2016, "Visual Plumes 2016: An Updated Public-Domain Plume Model Suite." Proc., International Symposium on Outfall Systems, ISOS2016, IWA. 10 - 13 May 2016

Jenkins, S., A. and M. Shatila, 2019, "Plumes UM3 Dilution Modeling Assessment of the San Juan Creek Ocean Outfall", submitted to South Orange County Wastewater Authority, submitted by Michael Baker International, San Diego, 101 pp

Qiu, B., Niklas S., and S. Chen, 2007, "Coupled Decadal Variability in the North Pacific: An Observationally Constrained Idealized Model". *Journal of Climate*. 20 (14): 360220. doi:10.1175/JCLI4190.1

RWQCB, 2005, Waste Discharge Requirements for the San Elijo Joint Powers Authority, San Elijo Water Reclamation Facility Discharge to the Pacific Ocean via the San Elijo Ocean Outfall, NPDES No. CA0I07999; Order No. R9-2005-0100, California Regional Water Quality Control Board, San Diego Region, 108 pp.

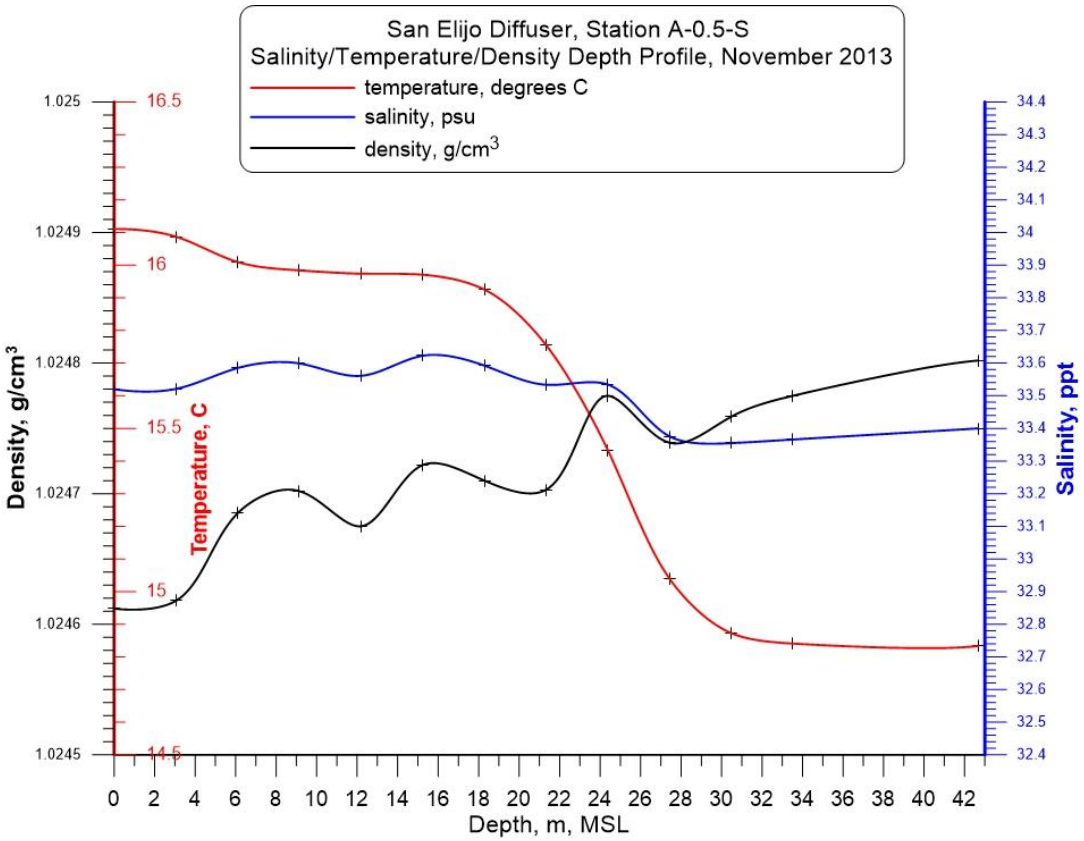
RWQCB, 2017, California Regional Water Quality Control Board, Los Angeles Region, "Waste Discharge Requirements and National Pollution Discharge Elimination System Permit for City of Los Angeles Hyperion Treatment Plant Discharge to the Pacific Ocean," NPDES No. CA-0109991, Order No. R4-2017-0045, 180 pp.

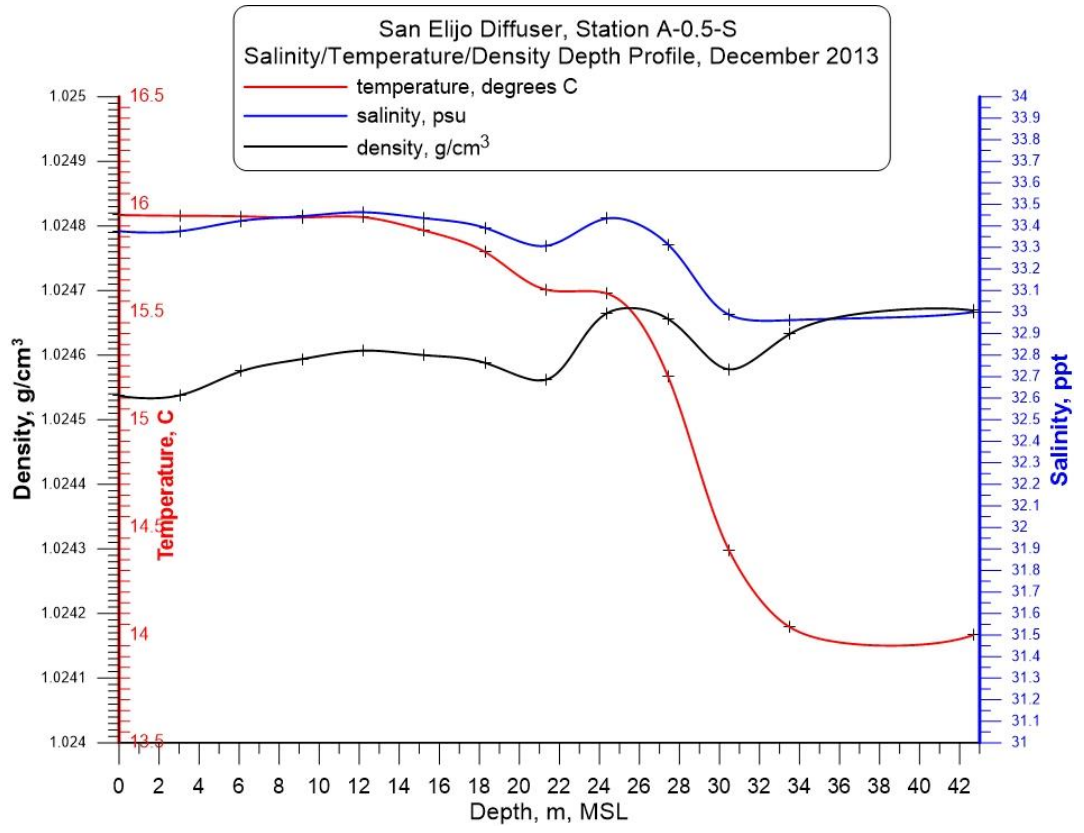
RWQCB, 2018, Waste Discharge Requirements for the San Elijo Joint Powers Authority, San Elijo Water Reclamation Facility Discharge to the Pacific Ocean through the San Elijo Ocean Outfall, NPDES No. CA0107999; Order No. R9-2018-0003, California Regional Water Quality Control Board, San Diego Region, 132 pp.

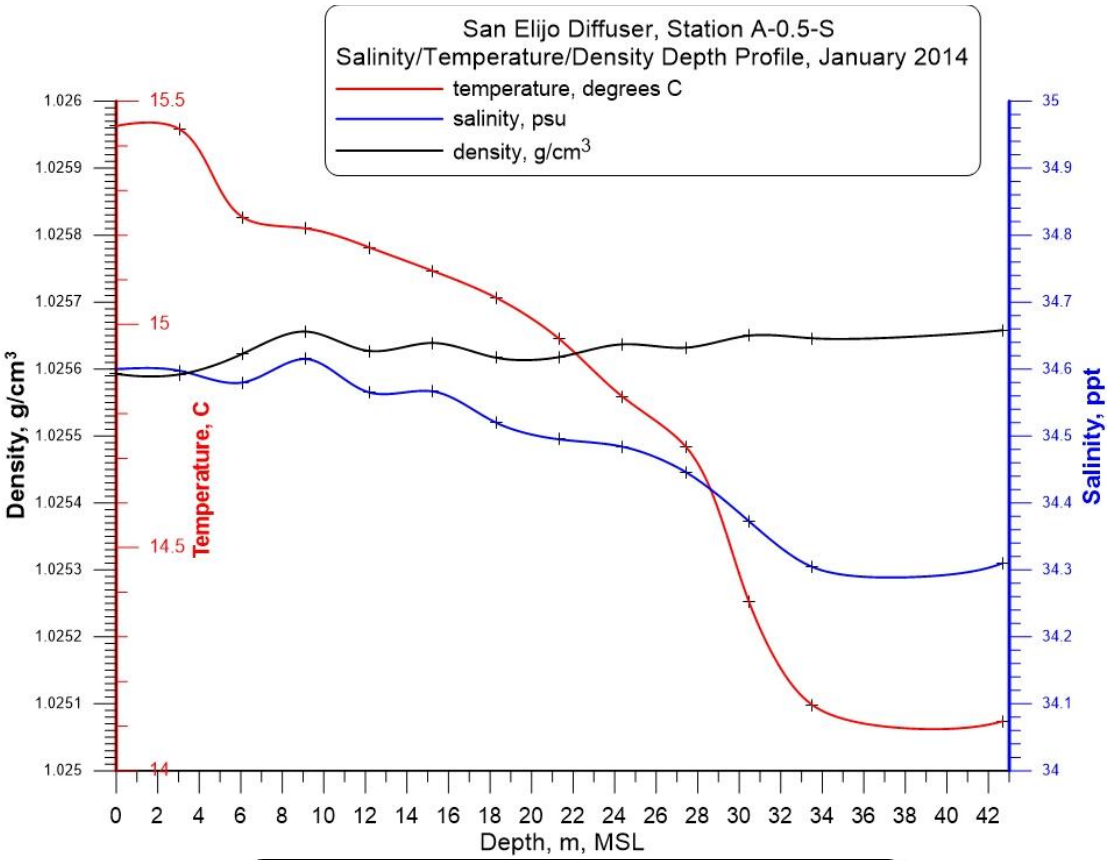
Walker, L., 2016, “Hyperion Water Reclamation Plant 5-Mile Outfall Dilution Study," submitted to Los Angeles Regional Water Quality Control Board, April, 2016, 40 pp

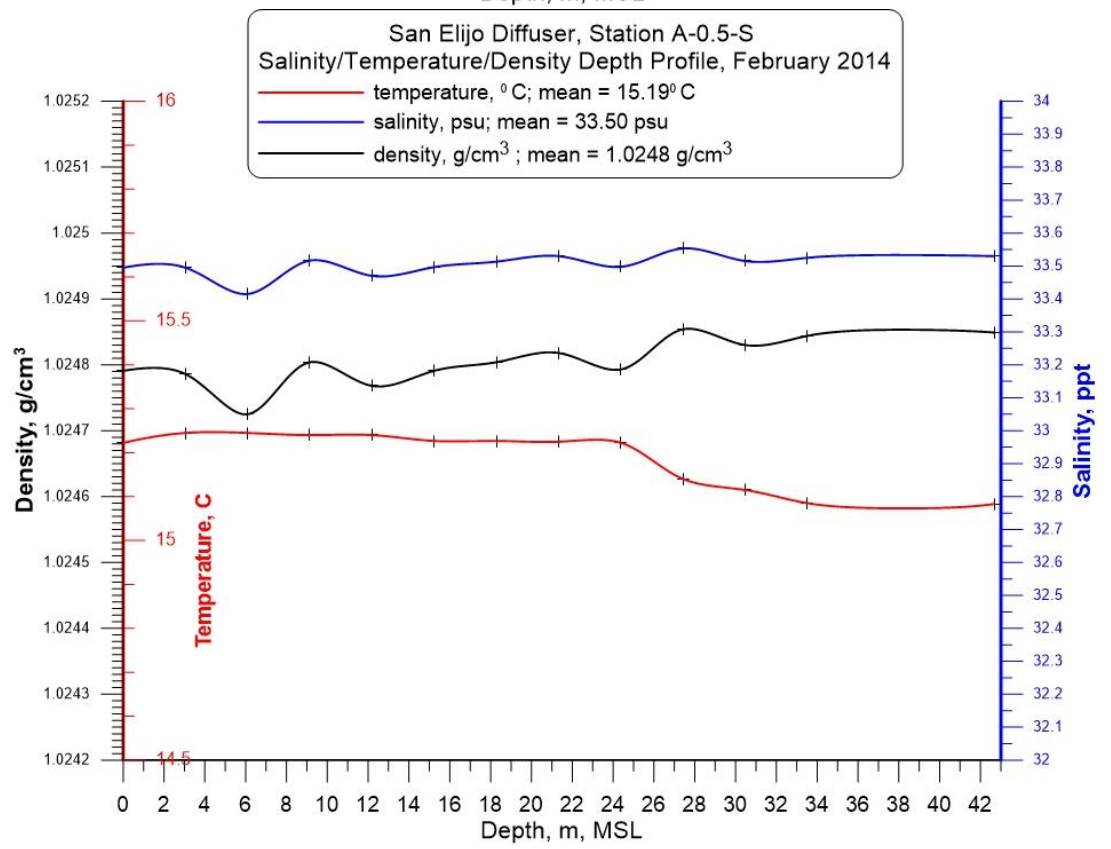
Walker, L., 2020, “HWRP Recycle Scenarios Compliance Assessment," submitted to Los Angeles Department of Sanitation, 24 September, 2020, 19 pp

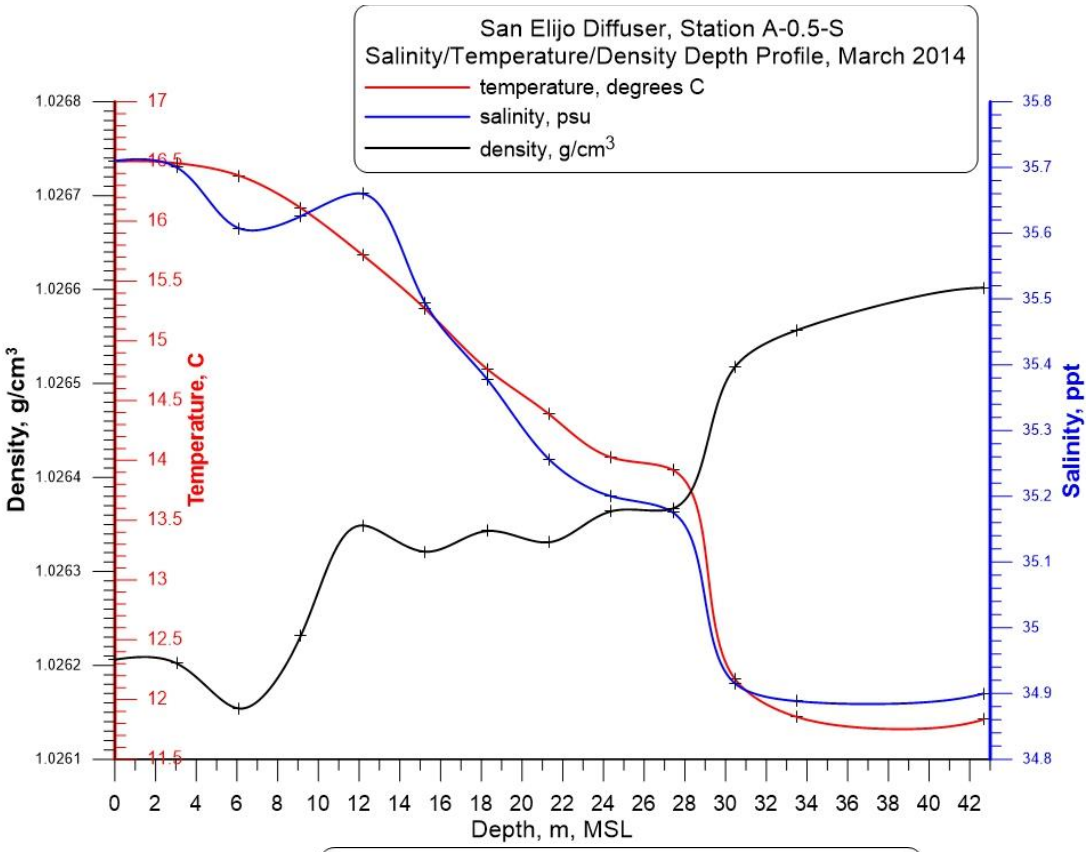
# APPENDIX A:
# Temperature-Salinity-Density Profiles Used in the Updated SEOO Minimum Initial Dilution Study based on Monthly Water Column Monitoring from November 2013 Through October 2014

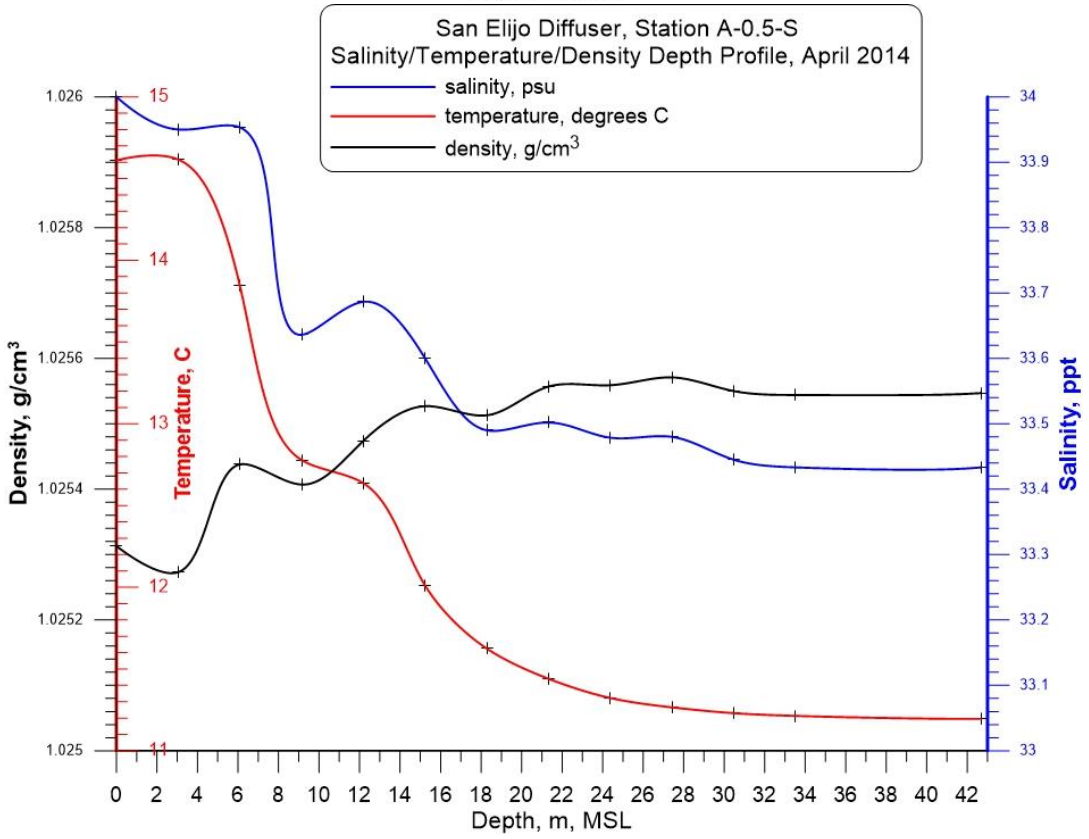

San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, November 2013
temperature, degrees C
salinity, psu
density, g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL

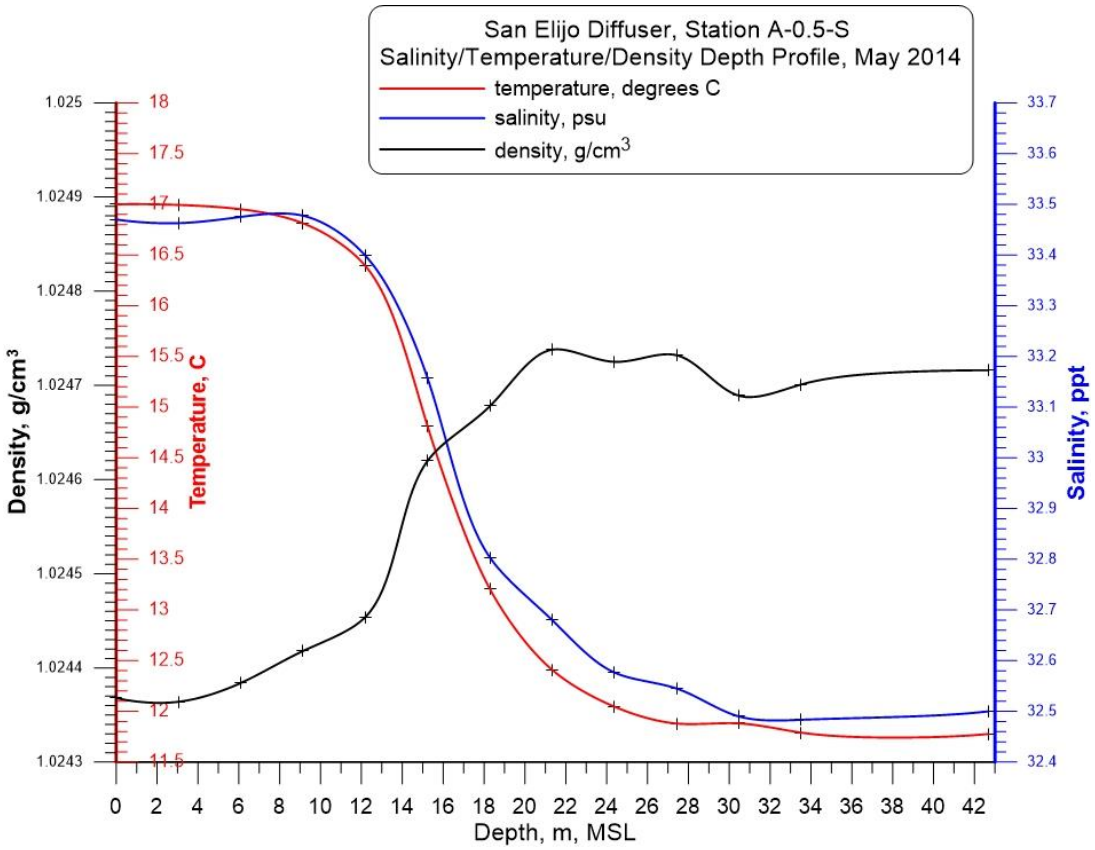

San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, December 2013
temperature, degrees C
salinity, psu
density, g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL

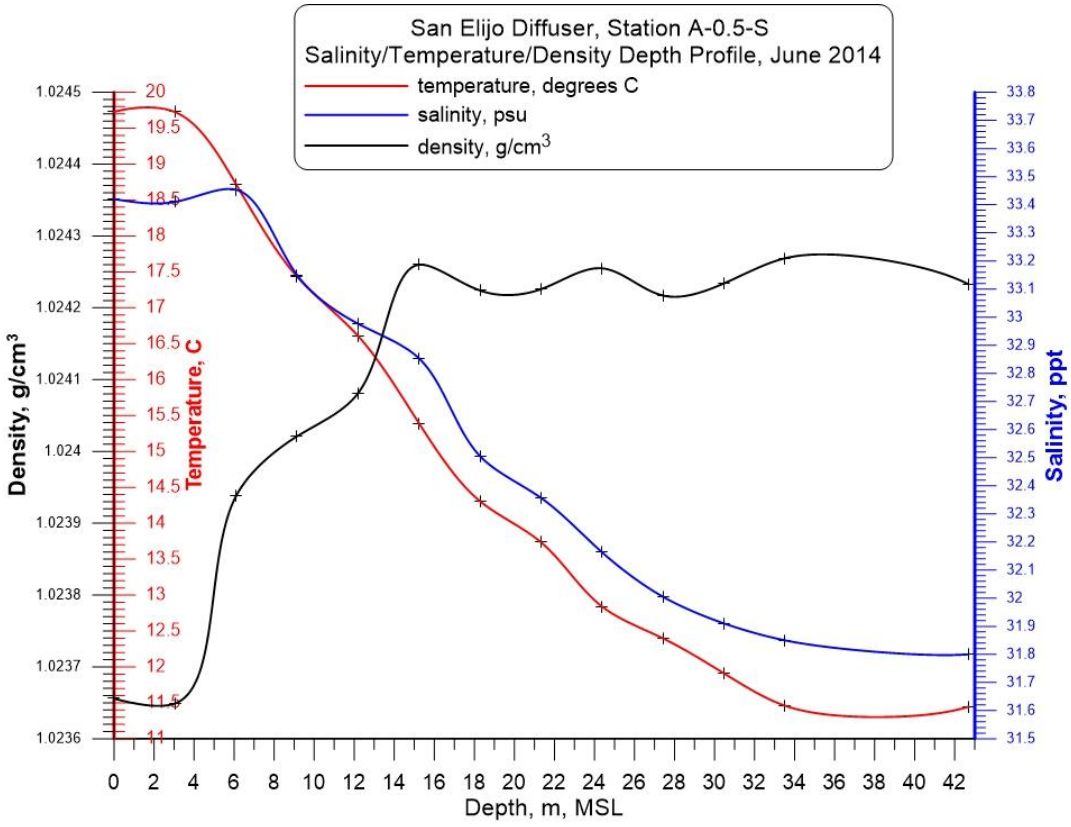

San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, January 2014
temperature, degrees C
salinity, psu
density, g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL

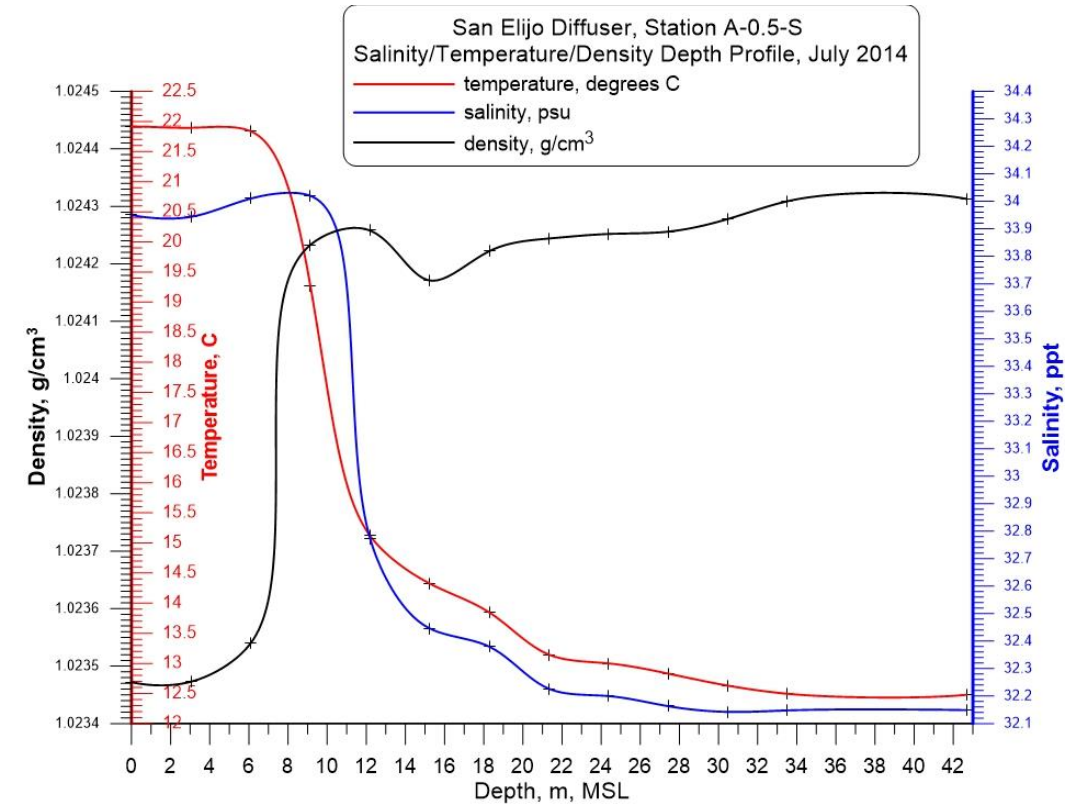

San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, February 2014
temperature, ⁰C; mean = 15.19⁰C
salinity, psu; mean = 33.50 psu
density, g/cm3 ; mean = 1.0248 g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL

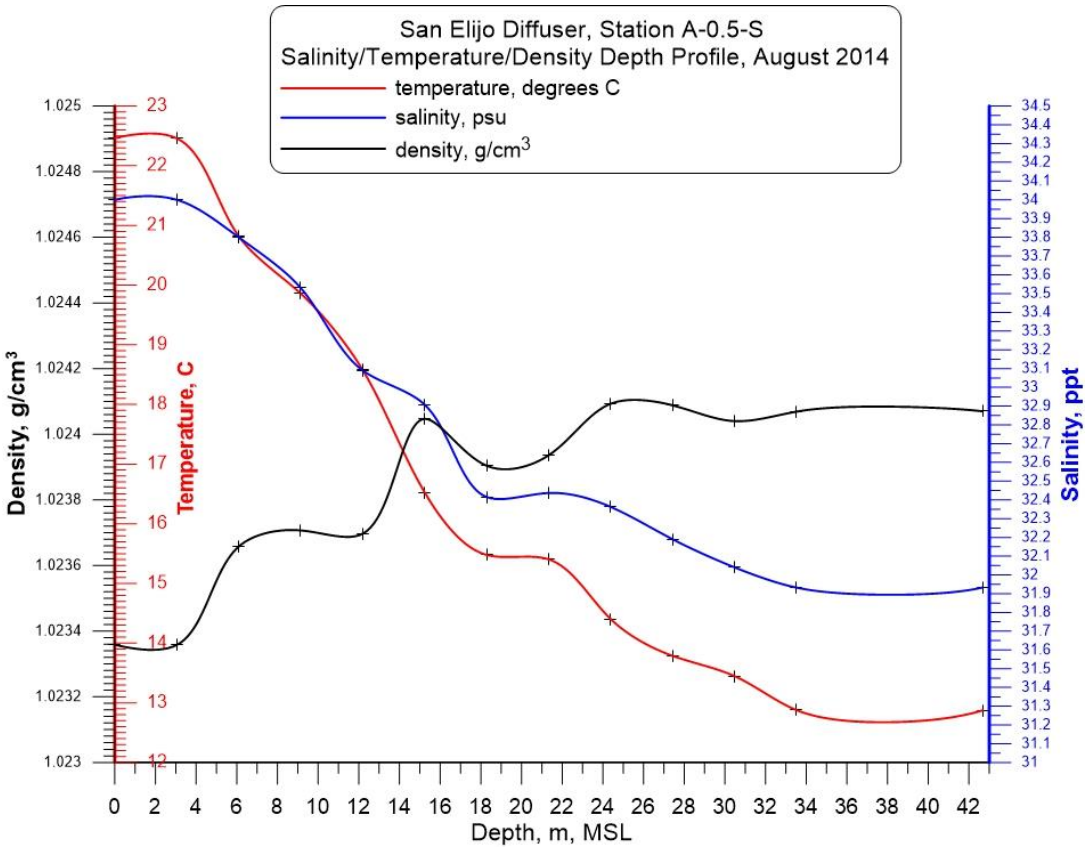

San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, March 2014
temperature, degrees C
salinity, psu
density, g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL

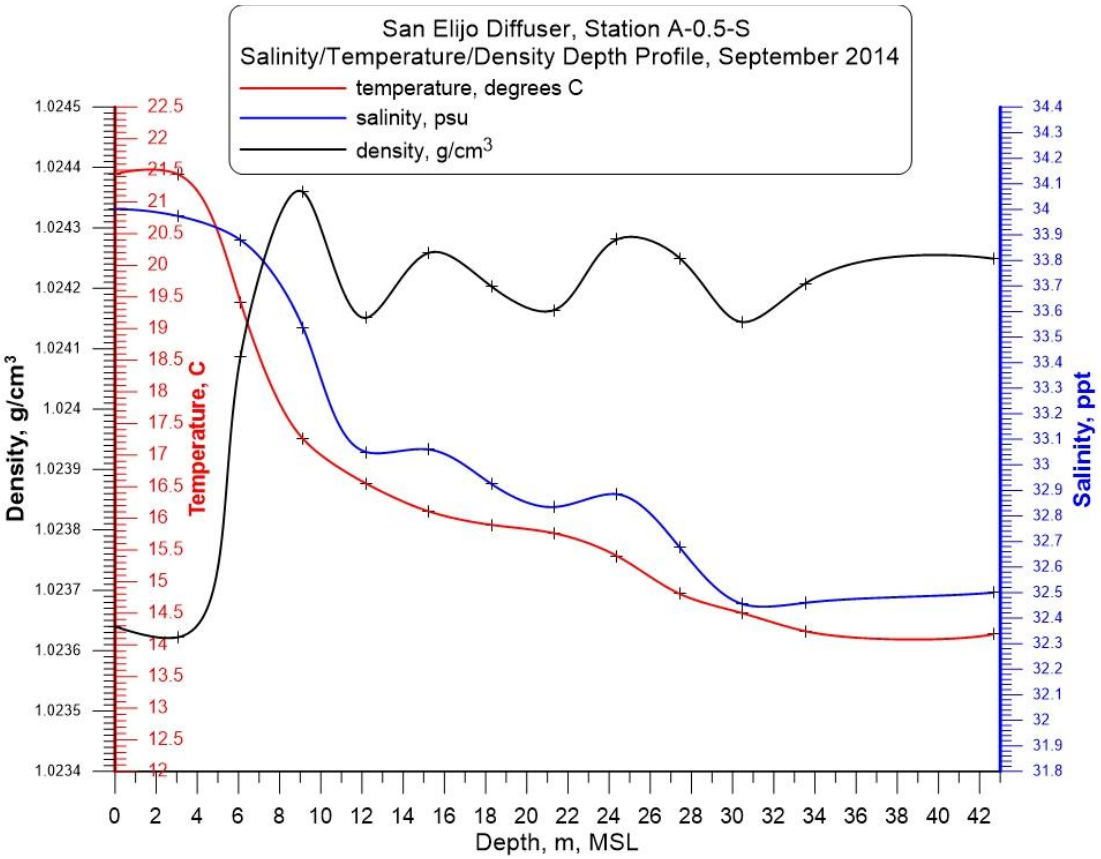

San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, April 2014
salinity, psu
temperature, degrees C
density, g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL

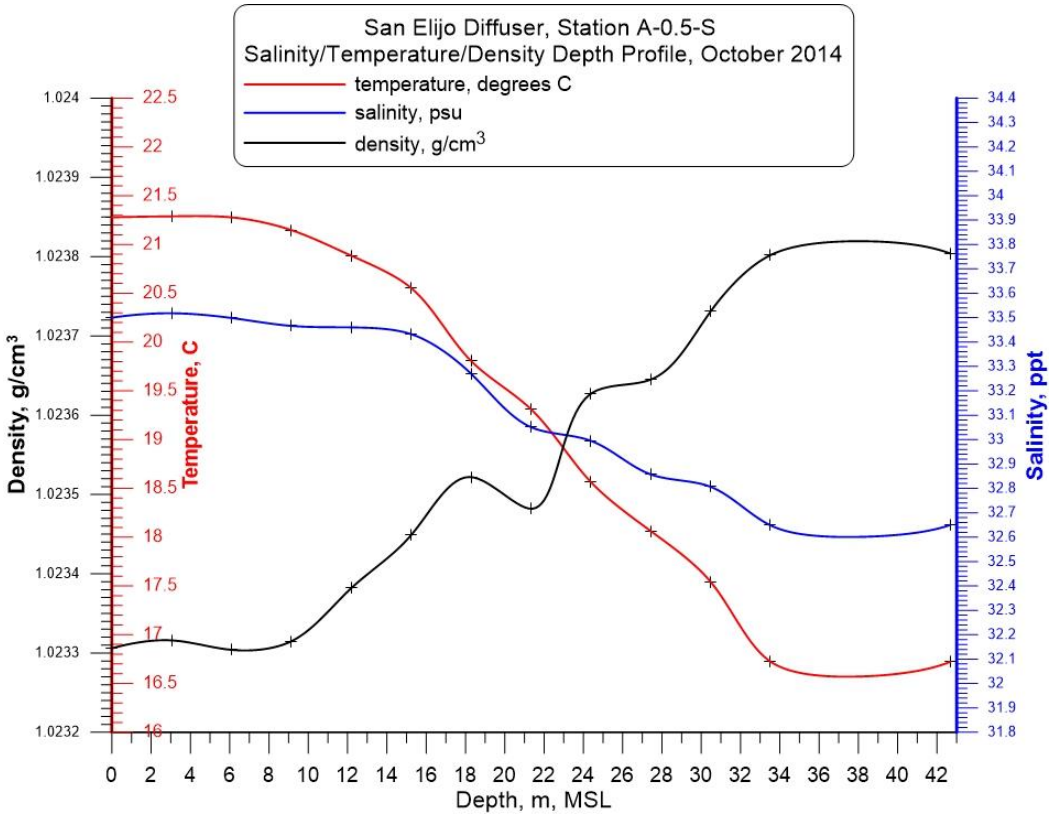

San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, May 2014
temperature, degrees C
salinity, psu
density, g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL


San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, June 2014
temperature, degrees C
salinity, psu
density, g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL


San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, July 2014
temperature, degrees C
salinity, psu
density, g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL


San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, August 2014
temperature, degrees C
salinity, psu
density, g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL


San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, September 2014
temperature, degrees C
salinity, psu
density, g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL


San Elijo Diffuser, Station A-0.5-S
Salinity/Temperature/Density Depth Profile, October 2014
temperature, degrees C
salinity, psu
density, g/cm3
Density, g/cm3
Temperature, C
Salinity, ppt
Depth, m, MSL

# APPENDIX B:
# Plumes 20 Initial Dilution Results for Discharge Scenario #1: Maximum Discharge Rate (23.25 mgd) with Maximum Brine Additions based on Winter Density Profiles from December 2013 Through February 2014

## B.1 Maximum SEOO Discharge with Maximum Brine Additions for December 2013 Density Profiles

Project "C:\Plumes20\Max-SEOO_Dec2013_Max-Brine_v2" memo
Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Medium
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 0.61
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 15
Maximum dilution reported 10000
Text output format : Standard
Max vertical reversals : to max rise or fall

/ UM3. 8/19/2022 1:15:14 PM
Case 1; ambient file C:\Plumes20\Max-SEOO_Dec2013_Max-Brine_v2.001.db; Diffuser table record 1
Ambient Table:

| Depth | Amb-cur | Amb-dir | Amb-sal | Amb-tem | Amb-pol | Decay | Far-spd | Far-dir | Disprsn | Density |
|---|---|---|---|---|---|---|---|---|---|---|
| m | m/s | deg | psu | C | kg/kg | s-1 | m/s | deg | m0.67/s2 | sigma-T |
| 0.0 | 0.0 | 0.0 | 33.38 | 15.95 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.53331 |
| 3.048 | 0.0 | 0.0 | 33.38 | 15.95 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.53421 |
| 6.096 | 0.0 | 0.0 | 33.42 | 15.94 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.57148 |
| 9.143 | 0.0 | 0.0 | 33.45 | 15.94 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.58970 |
| 12.19 | 0.0 | 0.0 | 33.46 | 15.94 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.60306 |
| 15.24 | 0.0 | 0.0 | 33.44 | 15.88 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.59631 |
| 18.29 | 0.0 | 0.0 | 33.39 | 15.78 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.58401 |
| 21.33 | 0.0 | 0.0 | 33.31 | 15.60 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.55858 |
| 24.38 | 0.0 | 0.0 | 33.44 | 15.59 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.66083 |
| 27.43 | 0.0 | 0.0 | 33.31 | 15.20 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.65221 |
| 30.48 | 0.0 | 0.0 | 32.99 | 14.39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.57462 |
| 33.53 | 0.0 | 0.0 | 32.96 | 14.04 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.62988 |
| 36.57 | 0.0 | 0.0 | 32.96 | 14.04 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.62988 |
| 39.62 | 0.0 | 0.0 | 33.00 | 14.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.66660 |
| 42.67 | 0.0 | 0.0 | 33.00 | 14.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.66660 |

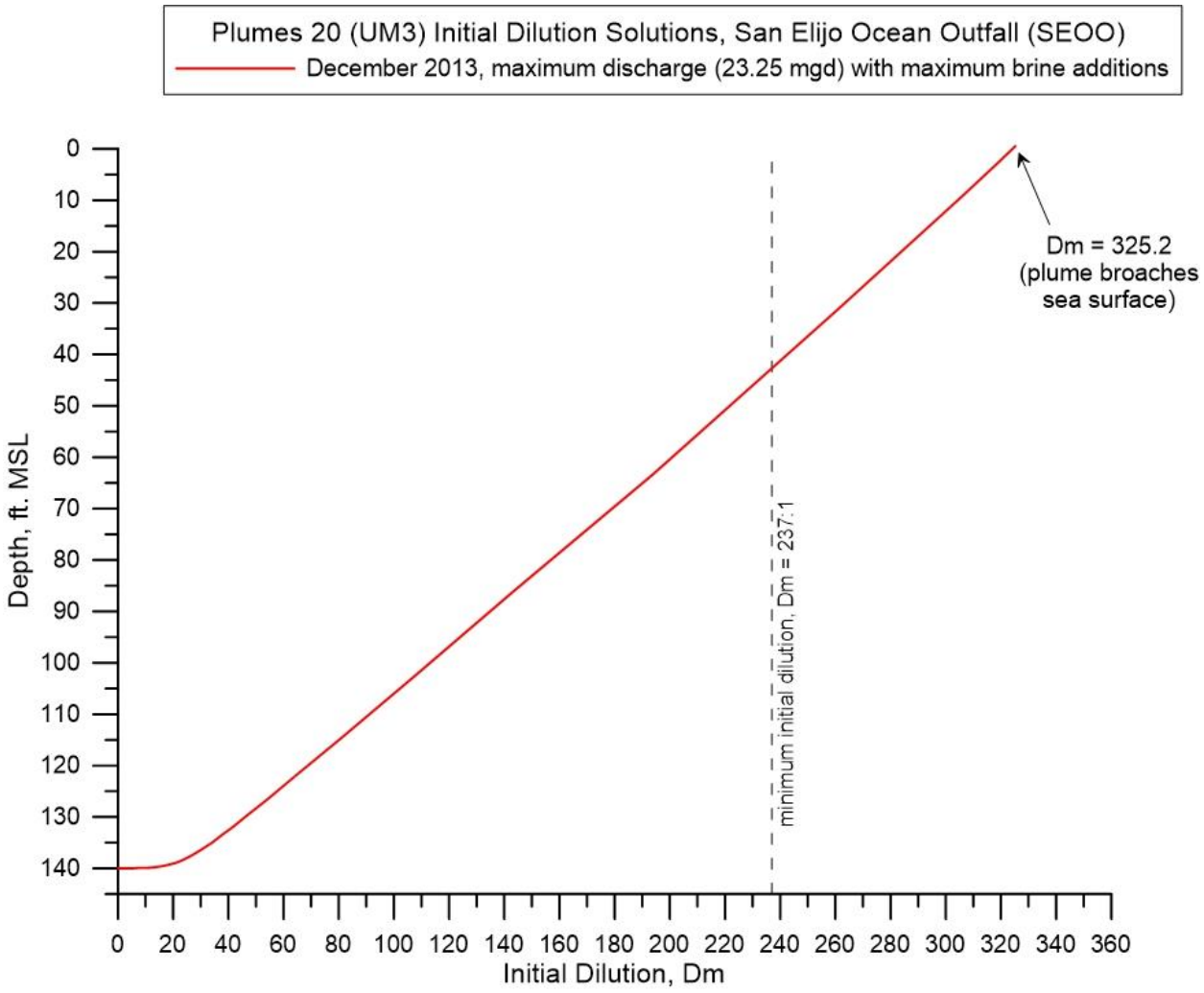
Diffuser table:

| P-dia | Ver angl | H-Angle | SourceX | SourceY | Ports | MZ-dis | Isoplth | P-depth | Ttl-flo | Eff-sal | Temp | Polutnt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in) | (deg) | (deg) | (m) | (m) | () | (m) | (concent) | (ft) | (MGD) | (psu) | (C) | (ppb) |
| 2.0000 | 0.0 | 0.0 | 0.0 | 0.0 | 200.00 | 2000.0 | 0.0 | 140.00 | 23.250 | 1.3400 | 22.500 | 1200.0 |

Simulation:
Froude No: 40.98; Strat No: 4.78E-6; Spcg No: 14.05; k: 4.12E+5; eff den (sigmaT) -1.267032; eff vel 4.119(m/s);
Current is very small, flow regime may be transient.

| Step | Depth (ft) | Amb-cur (m/s) | P-dia (in) | Eff-sal (psu) | Density (sigmaT) | Dilutn () | x-posn (m) | y-posn (m) | Iso dia (m) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 140.0 | 1.000E-5 | 1.562 | 1.340 | -1.26703 | 1.000 | 0.0 | 0.0 | 0.03968; | |
| 1 | 140.0 | 0.0 | 1.656 | 4.928 | 1.67149 | 1.125 | 0.036 | 0.0 | 0.04207; | bottom hit; |
| 15 | 140.0 | 0.0 | 2.292 | 11.73 | 7.22767 | 1.476 | 0.150 | 0.0 | 0.05822; | |
| 30 | 140.0 | 0.0 | 3.078 | 17.19 | 11.6947 | 1.977 | 0.312 | 0.0 | 0.07818; | |
| 45 | 140.0 | 0.0 | 4.136 | 21.25 | 15.0168 | 2.652 | 0.531 | 0.0 | 0.1050; | |
| 60 | 140.0 | 0.0 | 5.559 | 24.27 | 17.4889 | 3.561 | 0.827 | 0.0 | 0.1412; | |
| 75 | 140.0 | 0.0 | 7.475 | 26.52 | 19.3286 | 4.784 | 1.225 | 0.0 | 0.1899; | |
| 90 | 140.0 | 0.0 | 10.05 | 28.18 | 20.6975 | 6.430 | 1.761 | 0.0 | 0.2553; | |
| 105 | 139.9 | 0.0 | 13.51 | 29.42 | 21.7158 | 8.645 | 2.481 | 0.0 | 0.3433; | |
| 120 | 139.9 | 0.0 | 18.15 | 30.34 | 22.4731 | 11.63 | 3.449 | 0.0 | 0.4611; | |
| 130 | 139.8 | 0.0 | 21.97 | 30.81 | 22.8571 | 14.09 | 4.244 | 0.0 | 0.5580; | merging; |
| 135 | 139.7 | 0.0 | 23.70 | 30.96 | 22.9863 | 15.17 | 4.621 | 0.0 | 0.6019; | |
| 150 | 139.5 | 0.0 | 27.92 | 31.26 | 23.2333 | 17.79 | 5.645 | 0.0 | 0.7091; | |
| 165 | 139.2 | 0.0 | 31.46 | 31.45 | 23.3910 | 19.99 | 6.574 | 0.0 | 0.7991; | |
| 180 | 138.9 | 0.0 | 34.63 | 31.60 | 23.5078 | 22.00 | 7.454 | 0.0 | 0.8796; | |
| 195 | 138.5 | 0.0 | 37.56 | 31.71 | 23.6018 | 23.94 | 8.309 | 0.0 | 0.9541; | |
| 210 | 138.0 | 0.0 | 40.35 | 31.81 | 23.6822 | 25.90 | 9.159 | 0.0 | 1.0250; | |
| 225 | 137.4 | 0.0 | 43.07 | 31.89 | 23.7539 | 27.93 | 10.02 | 0.0 | 1.0940; | |
| 240 | 136.7 | 0.0 | 45.79 | 31.97 | 23.8203 | 30.12 | 10.91 | 0.0 | 1.1630; | |
| 255 | 135.9 | 0.0 | 48.59 | 32.05 | 23.8837 | 32.56 | 11.84 | 0.0 | 1.2341; | |
| 270 | 134.9 | 0.0 | 51.57 | 32.13 | 23.9456 | 35.35 | 12.83 | 0.0 | 1.3100; | |
| 285 | 133.5 | 0.0 | 54.91 | 32.20 | 24.0074 | 38.67 | 13.90 | 0.0 | 1.3946; | |
| 300 | 131.9 | 0.0 | 58.82 | 32.28 | 24.0704 | 42.75 | 15.08 | 0.0 | 1.4939; | |
| 315 | 129.6 | 0.0 | 63.67 | 32.36 | 24.1353 | 47.97 | 16.41 | 0.0 | 1.6171; | |
| 330 | 126.6 | 0.0 | 70.20 | 32.44 | 24.2028 | 55.04 | 17.95 | 0.0 | 1.7830; | |
| 345 | 122.0 | 0.0 | 79.90 | 32.52 | 24.2726 | 65.30 | 19.82 | 0.0 | 2.0295; | |
| 360 | 114.9 | 0.0 | 95.71 | 32.61 | 24.3435 | 81.35 | 22.17 | 0.0 | 2.4311; | |
| 375 | 103.0 | 0.0 | 122.3 | 32.70 | 24.4116 | 107.6 | 25.13 | 0.0 | 3.1071; | |
| 390 | 85.86 | 0.0 | 162.4 | 32.81 | 24.4636 | 144.8 | 28.36 | 0.0 | 4.1259; | |
| 405 | 63.31 | 0.0 | 215.0 | 32.95 | 24.5049 | 194.9 | 31.43 | 0.0 | 5.4622; | |
| 420 | 31.02 | 0.0 | 302.1 | 33.07 | 24.5289 | 262.3 | 34.88 | 0.0 | 7.6726; | |
| 428 | 9.040 | 0.0 | 363.6 | 33.12 | 24.5366 | 307.3 | 36.81 | 0.0 | 9.2357; | matched energy |
| 430 | 2.776 | 0.0 | 387.9 | 33.13 | 24.5368 | 319.8 | 37.34 | 0.0 | 9.8520; | trap level; |
| 431 | -0.542 | 0.0 | 402.5 | 33.14 | 24.5369 | 326.2 | 37.62 | 0.0 | 10.225; | surface; |

Horiz plane projections in effluent direction: radius(m): 0.0; CL(m): 11.467
Lmz(m): 11.467
forced entrain 1 0.0 42.84 10.22 0.0842
Rate sec-1 0.0 dy-1 0.0 kt: 0.0 Amb Sal 33.3750
;
1:15:14 PM. amb fills: 4


Plumes 20 (UM3) Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
December 2013, maximum discharge (23.25 mgd) with maximum brine additions
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
Initial Dilution, Dm
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
minimum initial dilution, Dm = 237.1
Dm = 325.2
(plume broaches
sea surface)

## B.2 Maximum SEOO Discharge with Maximum Brine Additions for January 2014 Density Profiles

Project "C:\Plumes20\Max-SEOO_Jan2014_Max-Brine"
memo

Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Medium
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 0.61
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 15
Maximum dilution reported 10000
Text output format : Standard
Max vertical reversals : to max rise or fall

/ UM3. 8/19/2022 11:52:11 AM
Case 1; ambient file C:\Plumes20\Max-SEOO_Jan2014_Max-Brine.001.db; Diffuser table record 1:

Ambient Table:

| Depth | Amb-cur | Amb-dir | Amb-sal | Amb-tem | Amb-pol | Decay | Far-spd | Far-dir | Disprsn | Density |
|---|---|---|---|---|---|---|---|---|---|---|
| m | m/s | deg | psu | C | kg/kg | s-1 | m/s | deg | m0.67/s2 | sigma-T |
| 0.0 | 0.0 | 0.0 | 34.60 | 15.44 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.58725 |
| 3.048 | 0.0 | 0.0 | 34.60 | 15.44 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.58650 |
| 6.096 | 0.0 | 0.0 | 34.58 | 15.24 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.61719 |
| 9.143 | 0.0 | 0.0 | 34.62 | 15.21 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.64963 |
| 12.19 | 0.0 | 0.0 | 34.56 | 15.17 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.62068 |
| 15.24 | 0.0 | 0.0 | 34.57 | 15.12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.63290 |
| 18.29 | 0.0 | 0.0 | 34.52 | 15.06 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.61071 |
| 21.33 | 0.0 | 0.0 | 34.49 | 14.97 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.61184 |
| 24.38 | 0.0 | 0.0 | 34.48 | 14.84 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.63150 |
| 27.43 | 0.0 | 0.0 | 34.45 | 14.73 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.62653 |
| 30.48 | 0.0 | 0.0 | 34.37 | 14.38 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.64443 |
| 33.53 | 0.0 | 0.0 | 34.30 | 14.15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.64074 |
| 36.57 | 0.0 | 0.0 | 34.30 | 14.15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.64074 |
| 39.62 | 0.0 | 0.0 | 34.31 | 14.11 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.65294 |
| 42.67 | 0.0 | 0.0 | 34.31 | 14.11 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.65294 |

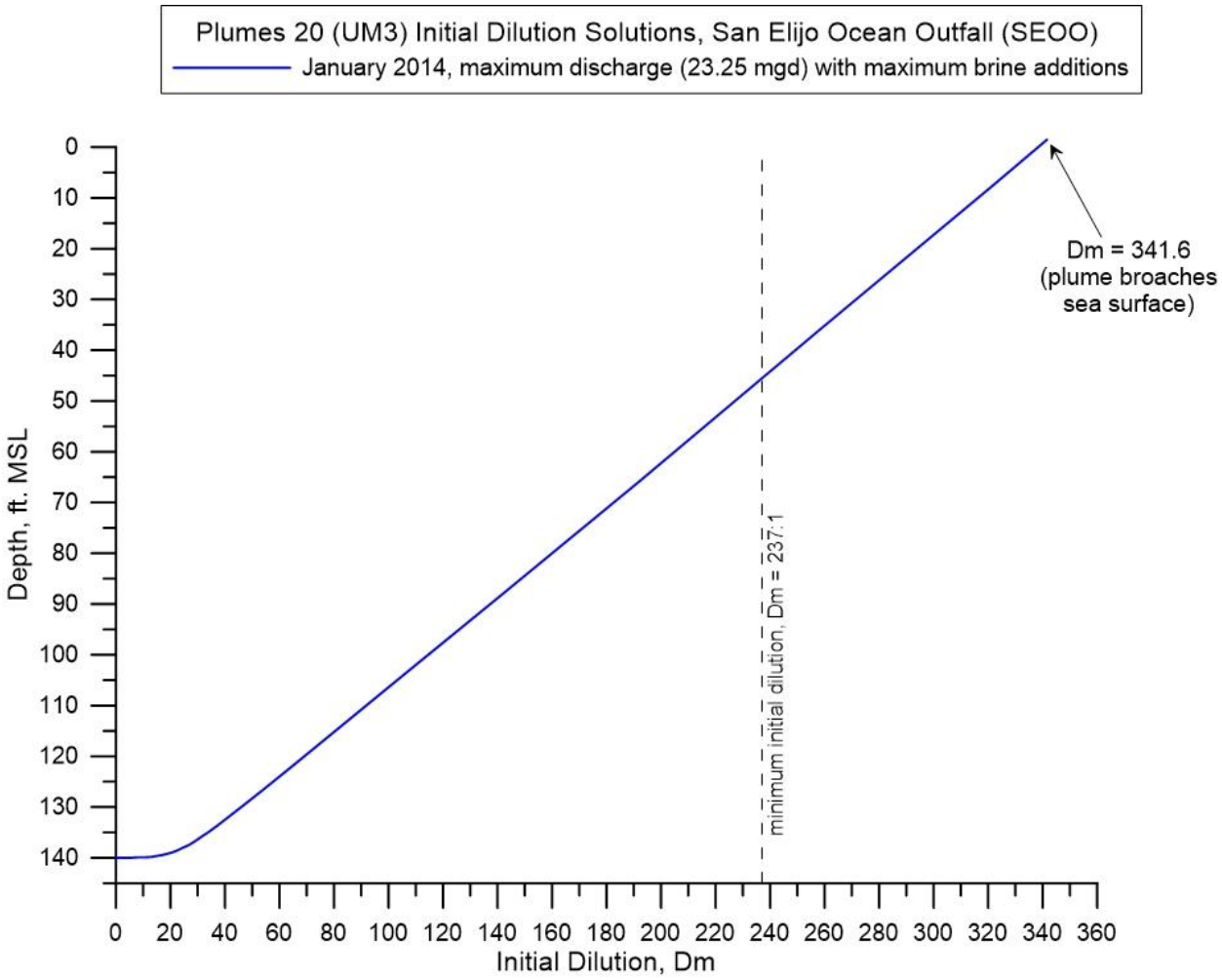
Diffuser table:

| P-dia | Ver angl | H-Angle | SourceX | SourceY | Ports | MZ-dis | Isoplth | P-depth | Ttl-flo | Eff-sal | Temp | Polutnt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in) | (deg) | (deg) | (m) | (m) | () | (m) | (concent) | (ft) | (MGD) | (psu) | (C) | (ppb) |
| 2.0000 | 0.0 | 0.0 | 0.0 | 0.0 | 200.00 | 2000.0 | 0.0 | 140.00 | 23.250 | 1.3400 | 22.500 | 1200.0 |

Simulation:
Froude No: 40.23; Strat No: 2.27E-6; Spcg No: 14.05; k: 4.12E+5; eff den (sigmaT) -1.267032;
eff vel 4.119(m/s);
Current is very small, flow regime may be transient.

| Step | Depth (ft) | Amb-cur (m/s) | P-dia (in) | Eff-sal (psu) | Density (sigmaT) | Dilutn () | x-posn (m) | y-posn (m) | Iso dia (m) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 140.0 | 1.000E-5 | 1.562 | 1.340 | -1.26703 | 1.000 | 0.0 | 0.0 | 0.03968; | |
| 1 | 140.0 | 0.0 | 1.656 | 5.080 | 1.78347 | 1.125 | 0.0359 | 0.0 | 0.04207; | bottom hit; |
| 15 | 140.0 | 0.0 | 2.292 | 12.16 | 7.54668 | 1.475 | 0.150 | 0.0 | 0.05821; | |
| 30 | 140.0 | 0.0 | 3.077 | 17.85 | 12.1815 | 1.976 | 0.312 | 0.0 | 0.07817; | |
| 45 | 140.0 | 0.0 | 4.135 | 22.08 | 15.6296 | 2.651 | 0.531 | 0.0 | 0.1050; | |
| 60 | 140.0 | 0.0 | 5.558 | 25.22 | 18.1962 | 3.559 | 0.826 | 0.0 | 0.1412; | |
| 75 | 140.0 | 0.0 | 7.473 | 27.56 | 20.1067 | 4.781 | 1.224 | 0.0 | 0.1898; | |
| 90 | 140.0 | 0.0 | 10.05 | 29.29 | 21.5286 | 6.425 | 1.760 | 0.0 | 0.2552; | |
| 105 | 139.9 | 0.0 | 13.51 | 30.58 | 22.5865 | 8.639 | 2.480 | 0.0 | 0.3431; | |
| 120 | 139.9 | 0.0 | 18.14 | 31.54 | 23.3733 | 11.62 | 3.447 | 0.0 | 0.4608; | |
| 131 | 139.8 | 0.0 | 22.26 | 32.06 | 23.7981 | 14.28 | 4.304 | 0.0 | 0.5655; | merging; |
| 135 | 139.7 | 0.0 | 23.58 | 32.18 | 23.8994 | 15.10 | 4.593 | 0.0 | 0.5990; | |
| 150 | 139.5 | 0.0 | 27.68 | 32.49 | 24.1530 | 17.65 | 5.587 | 0.0 | 0.7032; | |
| 165 | 139.2 | 0.0 | 31.13 | 32.69 | 24.3163 | 19.81 | 6.491 | 0.0 | 0.7907; | |
| 180 | 138.9 | 0.0 | 34.22 | 32.83 | 24.4378 | 21.79 | 7.348 | 0.0 | 0.8691; | |
| 195 | 138.5 | 0.0 | 37.08 | 32.95 | 24.5360 | 23.70 | 8.183 | 0.0 | 0.9418; | |
| 210 | 138.0 | 0.0 | 39.80 | 33.06 | 24.6202 | 25.63 | 9.014 | 0.0 | 1.0109; | |
| 225 | 137.5 | 0.0 | 42.45 | 33.15 | 24.6954 | 27.65 | 9.856 | 0.0 | 1.0783; | |
| 240 | 136.8 | 0.0 | 45.10 | 33.23 | 24.7653 | 29.82 | 10.73 | 0.0 | 1.1457; | |
| 255 | 135.9 | 0.0 | 47.84 | 33.31 | 24.8319 | 32.24 | 11.64 | 0.0 | 1.2152; | |
| 270 | 134.9 | 0.0 | 50.77 | 33.39 | 24.8972 | 35.03 | 12.61 | 0.0 | 1.2896; | |
| 285 | 133.6 | 0.0 | 54.05 | 33.47 | 24.9625 | 38.34 | 13.66 | 0.0 | 1.3728; | |
| 300 | 131.9 | 0.0 | 57.90 | 33.55 | 25.0289 | 42.42 | 14.82 | 0.0 | 1.4707; | |
| 315 | 129.7 | 0.0 | 62.70 | 33.64 | 25.0976 | 47.66 | 16.13 | 0.0 | 1.5926; | |
| 330 | 126.7 | 0.0 | 69.10 | 33.72 | 25.1691 | 54.73 | 17.64 | 0.0 | 1.7552; | |
| 345 | 122.3 | 0.0 | 78.35 | 33.81 | 25.2437 | 64.87 | 19.43 | 0.0 | 1.9901; | |
| 360 | 115.4 | 0.0 | 92.95 | 33.91 | 25.3212 | 80.55 | 21.65 | 0.0 | 2.3609; | |
| 375 | 104.0 | 0.0 | 117.6 | 34.01 | 25.3992 | 106.5 | 24.45 | 0.0 | 2.9870; | |
| 390 | 87.79 | 0.0 | 154.0 | 34.11 | 25.4607 | 143.4 | 27.36 | 0.0 | 3.9105; | |
| 405 | 65.86 | 0.0 | 206.7 | 34.20 | 25.5031 | 193.0 | 30.30 | 0.0 | 5.2508; | |
| 420 | 35.74 | 0.0 | 279.0 | 34.29 | 25.5337 | 259.7 | 33.36 | 0.0 | 7.0866; | |
| 431 | 7.488 | 0.0 | 342.8 | 34.35 | 25.5521 | 322.9 | 35.55 | 0.0 | 8.7075; | |
| 434 | -1.466 | 0.0 | 371.8 | 34.36 | 25.5542 | 342.6 | 36.18 | 0.0 | 9.4445; | surface; |

Horiz plane projections in effluent direction: radius(m): 0.0; CL(m): 11.027
Lmz(m): 11.027
forced entrain 1 0.0 43.12 9.444 0.0697
Rate sec-1 0.0 dy-1 0.0 kt: 0.0 Amb Sal 34.5995
;
11:52:11 AM. amb fills: 4


Plumes 20 (UM3) Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
January 2014, maximum discharge (23.25 mgd) with maximum brine additions
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
Initial Dilution, Dm
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
minimum initial dilution, Dm = 237:1
Dm = 341.6
(plume broaches
sea surface)

## B.3 CORMIX v-12 Prediction File of Maximum SEOO Discharge with Maximum Brine Additions for February 2014 Density Profiles

```
CORMIX2 PREDICTION FILE:
2222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222222
                  CORMIX MIXING ZONE EXPERT SYSTEM
            Subsystem CORMIX2: Multiport Diffuser Discharges
                     CORMIX Version 12.0GTH
                  HYDRO2 Version 12.0.0.0 December 2020
------------------------------------------------------------------------------------------
------------------------------------------------------------------------------------------
CASE DESCRIPTION
 Site name/label:   San Elijo, CA
 Design case:       SEOO 23.25 MGD with Max-Brine
 FILE NAME:         C:\...y\SEOO_23.25mgd_Feb2014_Worst-Case_TS-profile.prd
 Time stamp:        08/22/2022--14:00:51

ENVIRONMENT PARAMETERS (metric units)
 Unbounded section
 HA    =    39.32  HD    =    33.53
 UA    =     0.000 F     =     0.010 USTAR =0.3540E-07
 UW    =     0.000 UWSTAR=0.0000E+00
 Uniform density environment
 STRCND=  U         RHOAM = 1024.8000

DIFFUSER DISCHARGE PARAMETERS (metric units)
 Diffuser type:     DITYPE= alternating_perpendicular
 BANK  =  LEFT      DISTB =   2255.52  YB1   =   2072.64  YB2   =   2438.40
 LD    =   365.76  NOPEN = 2000       NRISER= 2000       SPAC  =     0.18    NPPERR =    1
 D0    =     0.051 A0    =     0.002 H0    =     0.67  SUB0  =    32.86
 D0INP =     0.051 CR0   =     1.000 B0    =0.1107E-01
 Nozzle/port arrangement:   alternating_without_fanning
 GAMMA =    90.00  THETA =    -5.00  SIGMA =     0.00  BETA  =    90.00
 U0    =     0.251 Q0    =     1.019 Q0A   =0.1019E+01
 RHO0  =  998.6750  DRHO0 =0.2613E+02  GP0   =0.2500E+00
 C0    =0.1000E+03  CUNITS=  %
 IPOLL =  1         KS    =0.0000E+00  KD    =0.0000E+00

FLUX VARIABLES - PER UNIT DIFFUSER LENGTH (metric units)
 q0    =0.2785E-02        SIGNJ0=     1.0
 m0 =U0^2*B0 =0.7001E-03   j0 =U0*GP0*B0 =0.6959E-03   (based on slot width B0)
 m0 =U0*q0   =0.7004E-03   j0 =q0*GP0    =0.6962E-03   (based on volume flux q0)
 Associated 2-d length scales (meters)
 lQ=B  =     0.011 lM    =     0.09  lm    =  99999.00
 lmp   =  99999.00  lbp   =  99999.00  la    =  99999.00

FLUX VARIABLES - ENTIRE DIFFUSER (metric units)
 Q0    =0.1019E+01  M0    =0.2561E+00  J0    =0.2545E+00
 Associated 3-d length scales (meters)
 LQ    =     0.05  LM    =     0.71  Lm    =  99999.00  Lb    =  99999.00
```

```
                    Lmp   =  99999.00  Lbp   =  99999.00

NON-DIMENSIONAL PARAMETERS
 FR0  =     4.78  FRD0 =     2.23  R    =  99999.00  PL   =   27.17
 (slot)          (port/nozzle)

RECOMPUTED SOURCE CONDITIONS FOR ALTERNATING JETS OR RISER GROUPS:
 Momentum fluxes:   m0   =0.9613E-03  M0   =0.3516E+00
 lQ=B =     0.008 lM   =     0.12  lm   =  99999.00  lmp  =  99999.00
 LQ   =     2.358 LM   =     0.91  Lm   =  99999.00  Lmp  =  99999.00
 Properties of riser group with  1 ports/nozzles each:
 U0   =     0.345 D0   =     0.043 A0   =     0.001 THETA =    90.00
 FR0  =     7.69  FRD0 =     3.32  R    =  99999.00
 (slot)          (riser group)

FLOW CLASSIFICATION
 22222222222222222222222222222222222222222222222
 2  Flow class (CORMIX2)     =    MU1V        2
 2  Applicable layer depth HS =    33.53       2
 22222222222222222222222222222222222222222222222

MIXING ZONE / TOXIC DILUTION / REGION OF INTEREST PARAMETERS
 C0   =0.1000E+03  CUNITS=  %
 NTOX  =  0
 NSTD  =  0
 REGMZ =  0
 XINT  =   5000.00  XMAX  =   5000.00

X-Y-Z COORDINATE SYSTEM:
   ORIGIN is located at the bottom and the diffuser mid-point:
    2255.52 m  from the LEFT  bank/shore.
   X-axis points downstream, Y-axis points to left, Z-axis points upward.
NSTEP = 100 display intervals per module
-------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
BEGIN MOD101: DISCHARGE MODULE (SINGLE PORT AT DIFFUSER CENTER)

     X      Y      Z      S      C      BV      BH      Uc       TT
    0.00    0.00   0.67    1.0 0.100E+03  0.02    0.02    0.251   .00000E+00

END OF MOD101: DISCHARGE MODULE (SINGLE PORT AT DIFFUSER CENTER)
-------------------------------------------------------------------------------------------
-------------------------------------------------------------------------------------------
BEGIN CORJET (MOD110): JET/PLUME NEAR-FIELD MIXING REGION

 Jet/plume transition motion in weak crossflow.

 Zone of flow establishment:          THETAE=    90.00  SIGMAE=     0.00
  LE   =     0.21  XE   =     0.00  YE   =     0.00  ZE   =     0.88

 Profile definitions:
```

BV = Gaussian 1/e (37%) width, in vertical plane normal to trajectory
BH = before merging: Gaussian 1/e (37%) half-width in horizontal plane normal to trajectory
after merging: top-hat half-width in horizontal plane parallel to diffuser line
S = hydrodynamic centerline dilution
C = centerline concentration (includes reaction effects, if any)
Uc = Local centerline excess velocity (above ambient)
TT = Cumulative travel time

| X | Y | Z | S | C | BV | BH | Uc | TT |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 0.88 | 1.0 | 0.100E+03 | 0.02 | 0.02 | 0.251 | .00000E+00 |
| 0.00 | 0.00 | 0.88 | 1.0 | 0.100E+03 | 0.02 | 0.02 | 0.251 | .25233E-02 |
| 0.00 | 0.00 | 1.17 | 3.3 | 0.301E+02 | 0.06 | 0.06 | 0.251 | .80486E+00 |
| 0.00 | 0.00 | 1.45 | 7.2 | 0.140E+02 | 0.09 | 0.09 | 0.245 | .18765E+01 |
| 0.00 | 0.00 | 1.47 | 10.0 | 0.100E+02 | 0.11 | 182.99 | 0.172 | .19489E+01 |
| 0.00 | 0.00 | 2.02 | 16.9 | 0.592E+01 | 0.18 | 183.06 | 0.185 | .50071E+01 |
| 0.00 | 0.00 | 2.31 | 20.6 | 0.485E+01 | 0.22 | 183.10 | 0.186 | .65491E+01 |
| 0.00 | 0.00 | 2.59 | 24.4 | 0.410E+01 | 0.26 | 183.14 | 0.186 | .80876E+01 |
| 0.00 | 0.00 | 2.88 | 28.2 | 0.355E+01 | 0.30 | 183.18 | 0.186 | .96247E+01 |
| 0.00 | 0.00 | 3.17 | 32.0 | 0.313E+01 | 0.34 | 183.22 | 0.186 | .11161E+02 |
| 0.00 | 0.00 | 3.45 | 35.8 | 0.280E+01 | 0.38 | 183.26 | 0.186 | .12697E+02 |
| 0.00 | 0.00 | 3.74 | 39.6 | 0.253E+01 | 0.42 | 183.30 | 0.186 | .14233E+02 |
| 0.00 | 0.00 | 4.02 | 43.3 | 0.231E+01 | 0.46 | 183.34 | 0.186 | .15769E+02 |
| 0.00 | 0.00 | 4.31 | 47.1 | 0.212E+01 | 0.50 | 183.38 | 0.186 | .17305E+02 |
| 0.00 | 0.00 | 4.60 | 50.9 | 0.196E+01 | 0.54 | 183.42 | 0.186 | .18841E+02 |
| 0.00 | 0.00 | 4.88 | 54.7 | 0.183E+01 | 0.58 | 183.46 | 0.186 | .20377E+02 |
| 0.00 | 0.00 | 5.17 | 58.5 | 0.171E+01 | 0.62 | 183.50 | 0.186 | .21913E+02 |
| 0.00 | 0.00 | 5.45 | 62.3 | 0.161E+01 | 0.66 | 183.54 | 0.186 | .23449E+02 |
| 0.00 | 0.00 | 5.74 | 66.1 | 0.151E+01 | 0.70 | 183.58 | 0.186 | .24984E+02 |
| 0.00 | 0.00 | 6.03 | 69.9 | 0.143E+01 | 0.74 | 183.62 | 0.186 | .26520E+02 |
| 0.00 | 0.00 | 6.31 | 73.7 | 0.136E+01 | 0.78 | 183.66 | 0.186 | .28056E+02 |
| 0.00 | 0.00 | 6.60 | 77.5 | 0.129E+01 | 0.82 | 183.70 | 0.186 | .29592E+02 |
| 0.00 | 0.00 | 6.88 | 81.3 | 0.123E+01 | 0.86 | 183.74 | 0.186 | .31128E+02 |
| 0.00 | 0.00 | 7.17 | 85.0 | 0.118E+01 | 0.91 | 183.79 | 0.186 | .32664E+02 |
| 0.00 | 0.00 | 7.46 | 88.8 | 0.113E+01 | 0.95 | 183.83 | 0.186 | .34200E+02 |
| 0.00 | 0.00 | 7.74 | 92.6 | 0.108E+01 | 0.99 | 183.87 | 0.186 | .35736E+02 |
| 0.00 | 0.00 | 8.03 | 96.4 | 0.104E+01 | 1.03 | 183.91 | 0.186 | .37278E+02 |
| 0.00 | 0.00 | 8.31 | 100.2 | 0.998E+00 | 1.07 | 183.95 | 0.186 | .38814E+02 |
| 0.00 | 0.00 | 8.60 | 104.0 | 0.961E+00 | 1.11 | 183.99 | 0.186 | .40350E+02 |
| 0.00 | 0.00 | 8.89 | 107.8 | 0.928E+00 | 1.15 | 184.03 | 0.186 | .41886E+02 |
| 0.00 | 0.00 | 9.17 | 111.6 | 0.896E+00 | 1.19 | 184.07 | 0.186 | .43422E+02 |
| 0.00 | 0.00 | 9.46 | 115.4 | 0.867E+00 | 1.23 | 184.11 | 0.186 | .44958E+02 |
| 0.00 | 0.00 | 9.74 | 119.2 | 0.839E+00 | 1.27 | 184.15 | 0.186 | .46493E+02 |
| 0.00 | 0.00 | 10.03 | 123.0 | 0.813E+00 | 1.31 | 184.19 | 0.186 | .48029E+02 |
| 0.00 | 0.00 | 10.32 | 126.8 | 0.789E+00 | 1.35 | 184.23 | 0.186 | .49565E+02 |
| 0.00 | 0.00 | 10.60 | 130.6 | 0.766E+00 | 1.39 | 184.27 | 0.186 | .51101E+02 |
| 0.00 | 0.00 | 10.89 | 134.3 | 0.744E+00 | 1.43 | 184.31 | 0.186 | .52637E+02 |
| 0.00 | 0.00 | 11.17 | 138.1 | 0.724E+00 | 1.47 | 184.35 | 0.186 | .54173E+02 |
| 0.00 | 0.00 | 11.46 | 141.9 | 0.705E+00 | 1.51 | 184.39 | 0.186 | .55702E+02 |
| 0.00 | 0.00 | 11.74 | 145.7 | 0.686E+00 | 1.55 | 184.43 | 0.186 | .57238E+02 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 12.03 | 149.5 | 0.669E+00 | 1.59 | 184.47 | 0.186 | .58774E+02 |
| 0.00 | 0.00 | 12.32 | 153.3 | 0.652E+00 | 1.63 | 184.51 | 0.186 | .60310E+02 |
| 0.00 | 0.00 | 12.60 | 157.1 | 0.637E+00 | 1.67 | 184.55 | 0.186 | .61846E+02 |
| X | Y | Z | S | C | BV | BH | Uc | TT |
| 0.00 | 0.00 | 12.89 | 160.9 | 0.622E+00 | 1.71 | 184.59 | 0.186 | .63382E+02 |
| 0.00 | 0.00 | 13.17 | 164.7 | 0.607E+00 | 1.75 | 184.63 | 0.186 | .64918E+02 |
| 0.00 | 0.00 | 13.46 | 168.5 | 0.594E+00 | 1.79 | 184.67 | 0.186 | .66453E+02 |
| 0.00 | 0.00 | 13.75 | 172.2 | 0.581E+00 | 1.83 | 184.71 | 0.186 | .67989E+02 |
| 0.00 | 0.00 | 14.03 | 176.0 | 0.568E+00 | 1.87 | 184.75 | 0.186 | .69525E+02 |
| 0.00 | 0.00 | 14.32 | 179.8 | 0.556E+00 | 1.91 | 184.79 | 0.186 | .71061E+02 |
| 0.00 | 0.00 | 14.60 | 183.6 | 0.545E+00 | 1.95 | 184.83 | 0.186 | .72597E+02 |
| 0.00 | 0.00 | 14.89 | 187.4 | 0.534E+00 | 1.99 | 184.87 | 0.186 | .74133E+02 |
| 0.00 | 0.00 | 15.18 | 191.2 | 0.523E+00 | 2.03 | 184.91 | 0.186 | .75669E+02 |
| 0.00 | 0.00 | 15.46 | 195.0 | 0.513E+00 | 2.08 | 184.96 | 0.186 | .77205E+02 |
| 0.00 | 0.00 | 15.75 | 198.8 | 0.503E+00 | 2.12 | 185.00 | 0.186 | .78741E+02 |
| 0.00 | 0.00 | 16.03 | 202.6 | 0.494E+00 | 2.16 | 185.04 | 0.186 | .80276E+02 |
| 0.00 | 0.00 | 16.32 | 206.4 | 0.485E+00 | 2.20 | 185.08 | 0.186 | .81812E+02 |
| 0.00 | 0.00 | 16.60 | 210.2 | 0.476E+00 | 2.24 | 185.12 | 0.186 | .83348E+02 |
| 0.00 | 0.00 | 16.89 | 213.9 | 0.467E+00 | 2.28 | 185.16 | 0.186 | .84884E+02 |
| 0.00 | 0.00 | 17.18 | 217.7 | 0.459E+00 | 2.32 | 185.20 | 0.186 | .86420E+02 |
| 0.00 | 0.00 | 17.46 | 221.5 | 0.451E+00 | 2.36 | 185.24 | 0.186 | .87956E+02 |
| 0.00 | 0.00 | 17.75 | 225.3 | 0.444E+00 | 2.40 | 185.28 | 0.186 | .89498E+02 |
| 0.00 | 0.00 | 18.04 | 229.1 | 0.436E+00 | 2.44 | 185.32 | 0.186 | .91034E+02 |
| 0.00 | 0.00 | 18.32 | 232.9 | 0.429E+00 | 2.48 | 185.36 | 0.186 | .92570E+02 |
| 0.00 | 0.00 | 18.61 | 236.7 | 0.422E+00 | 2.52 | 185.40 | 0.186 | .94106E+02 |
| 0.00 | 0.00 | 18.89 | 240.5 | 0.416E+00 | 2.56 | 185.44 | 0.186 | .95642E+02 |
| 0.00 | 0.00 | 19.18 | 244.3 | 0.409E+00 | 2.60 | 185.48 | 0.186 | .97178E+02 |
| 0.00 | 0.00 | 19.47 | 248.1 | 0.403E+00 | 2.64 | 185.52 | 0.186 | .98720E+02 |
| 0.00 | 0.00 | 19.75 | 251.9 | 0.397E+00 | 2.68 | 185.56 | 0.186 | .10026E+03 |
| 0.00 | 0.00 | 20.04 | 255.7 | 0.391E+00 | 2.72 | 185.60 | 0.186 | .10179E+03 |
| 0.00 | 0.00 | 20.32 | 259.5 | 0.385E+00 | 2.76 | 185.64 | 0.186 | .10333E+03 |
| 0.00 | 0.00 | 20.61 | 263.3 | 0.380E+00 | 2.80 | 185.68 | 0.186 | .10486E+03 |
| 0.00 | 0.00 | 20.90 | 267.1 | 0.374E+00 | 2.84 | 185.72 | 0.186 | .10640E+03 |
| 0.00 | 0.00 | 21.18 | 270.9 | 0.369E+00 | 2.88 | 185.76 | 0.186 | .10794E+03 |
| 0.00 | 0.00 | 21.47 | 274.7 | 0.364E+00 | 2.92 | 185.80 | 0.186 | .10948E+03 |
| 0.00 | 0.00 | 21.76 | 278.4 | 0.359E+00 | 2.96 | 185.84 | 0.186 | .11101E+03 |
| 0.00 | 0.00 | 22.04 | 282.2 | 0.354E+00 | 3.00 | 185.88 | 0.186 | .11255E+03 |
| 0.00 | 0.00 | 22.33 | 286.0 | 0.350E+00 | 3.04 | 185.92 | 0.186 | .11409E+03 |
| 0.00 | 0.00 | 22.61 | 289.8 | 0.345E+00 | 3.08 | 185.96 | 0.186 | .11562E+03 |
| 0.00 | 0.00 | 22.90 | 293.6 | 0.341E+00 | 3.12 | 186.00 | 0.186 | .11716E+03 |
| 0.00 | 0.00 | 23.19 | 297.4 | 0.336E+00 | 3.17 | 186.05 | 0.186 | .11870E+03 |
| 0.00 | 0.00 | 23.47 | 301.2 | 0.332E+00 | 3.21 | 186.09 | 0.186 | .12024E+03 |
| 0.00 | 0.00 | 23.76 | 305.0 | 0.328E+00 | 3.25 | 186.13 | 0.186 | .12177E+03 |
| 0.00 | 0.00 | 24.04 | 308.8 | 0.324E+00 | 3.29 | 186.17 | 0.186 | .12331E+03 |
| 0.00 | 0.00 | 24.33 | 312.6 | 0.320E+00 | 3.33 | 186.21 | 0.186 | .12484E+03 |
| 0.00 | 0.00 | 24.62 | 316.4 | 0.316E+00 | 3.37 | 186.25 | 0.186 | .12638E+03 |
| 0.00 | 0.00 | 24.90 | 320.2 | 0.312E+00 | 3.41 | 186.29 | 0.186 | .12792E+03 |
| 0.00 | 0.00 | 25.19 | 324.0 | 0.309E+00 | 3.45 | 186.33 | 0.186 | .12946E+03 |
| 0.00 | 0.00 | 25.47 | 327.8 | 0.305E+00 | 3.49 | 186.37 | 0.186 | .13099E+03 |
| 0.00 | 0.00 | 25.76 | 331.6 | 0.302E+00 | 3.53 | 186.41 | 0.186 | .13253E+03 |
| 0.00 | 0.00 | 26.05 | 335.3 | 0.298E+00 | 3.57 | 186.45 | 0.186 | .13407E+03 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 0.00 | 0.00 | 26.33 | 339.1 | 0.295E+00 | 3.61 | 186.49 | 0.186 | .13560E+03 |
| 0.00 | 0.00 | 26.62 | 342.9 | 0.292E+00 | 3.65 | 186.53 | 0.186 | .13714E+03 |
| 0.00 | 0.00 | 26.91 | 346.7 | 0.288E+00 | 3.69 | 186.57 | 0.186 | .13868E+03 |
| 0.00 | 0.00 | 27.19 | 350.5 | 0.285E+00 | 3.73 | 186.61 | 0.186 | .14022E+03 |
| X | Y | Z | S | C | BV | BH | Uc | TT |
| 0.00 | 0.00 | 27.48 | 354.3 | 0.282E+00 | 3.77 | 186.65 | 0.186 | .14175E+03 |
| 0.00 | 0.00 | 27.76 | 358.1 | 0.279E+00 | 3.81 | 186.69 | 0.186 | .14329E+03 |
| 0.00 | 0.00 | 28.05 | 361.9 | 0.276E+00 | 3.85 | 186.73 | 0.186 | .14482E+03 |
| 0.00 | 0.00 | 28.34 | 365.7 | 0.273E+00 | 3.89 | 186.77 | 0.186 | .14636E+03 |
| 0.00 | 0.00 | 28.62 | 369.5 | 0.271E+00 | 3.93 | 186.81 | 0.186 | .14790E+03 |
| 0.00 | 0.00 | 28.91 | 373.3 | 0.268E+00 | 3.97 | 186.85 | 0.186 | .14944E+03 |
| 0.00 | 0.00 | 29.19 | 377.1 | 0.265E+00 | 4.01 | 186.89 | 0.186 | .15097E+03 |
| 0.00 | 0.00 | 29.48 | 380.9 | 0.263E+00 | 4.05 | 186.93 | 0.186 | .15251E+03 |

Cumulative travel time = 152.5065 sec ( 0.04 hrs)

END OF CORJET (MOD110): JET/PLUME NEAR-FIELD MIXING REGION

---

---

BEGIN MOD232: LAYER BOUNDARY IMPINGEMENT/UPSTREAM SPREADING

Vertical angle of layer/boundary impingement = 90.00 deg
Horizontal angle of layer/boundary impingement = 0.00 deg

Discharge into STAGNANT AMBIENT environment:
STEADY-STATE MIXING CONDITION IS NOT POSSIBLE in this zone,
even though some ADDITIONAL DILUTION MAY OCCUR!
Also, all far-field processes will be UNSTEADY.
SIMULATION STOPS because of stagnant ambient conditions.

END OF MOD232: LAYER BOUNDARY IMPINGEMENT/UPSTREAM SPREADING

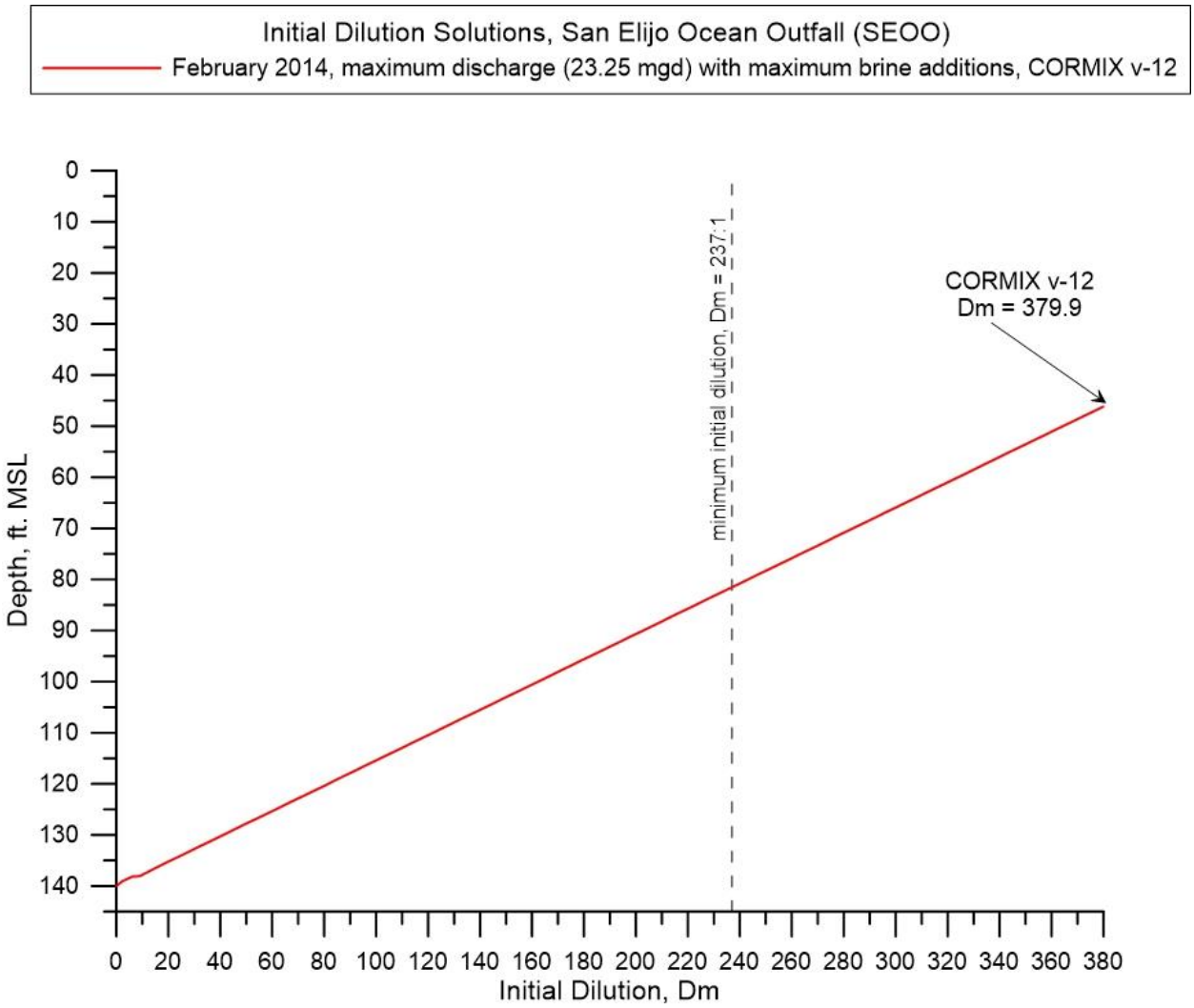
---

** End of NEAR-FIELD REGION (NFR) **

SIMULATION STOPS because of STAGNANT AMBIENT conditions.
All far-field processes will be UNSTEADY.

---

CORMIX2: Multiport Diffuser Discharges End of Prediction File


Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
February 2014, maximum discharge (23.25 mgd) with maximum brine additions, CORMIX v-12
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
minimum initial dilution, Dm = 237:1
CORMIX v-12
Dm = 379.9
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360 380
Initial Dilution, Dm

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# APPENDIX C:
# Plumes 20 Initial Dilution Results for Discharge Scenario #2: Maximum Discharge Rate (23.25 mgd) with Maximum Brine Additions based on Spring Density Profiles from March 2014 Through May 2014

## C.1 Maximum SEOO Discharge with Maximum Brine Additions for March 2014 Density Profiles

Project "C:\Plumes20\Max-SEOO_Mar2014_Max-Brine"
memo

Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Medium
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 0.61
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 15
Maximum dilution reported 10000
Text output format : Standard
Max vertical reversals : to max rise or fall

/ UM3. 8/21/2022 11:45:38 AM
Case 1; ambient file C:\Plumes20\Max-SEOO_Mar2014_Max-Brine.001.db; Diffuser table record 1

Ambient Table:

| Depth | Amb-cur | Amb-dir | Amb-sal | Amb-tem | Amb-pol | Decay | Far-spd | Far-dir | Disprsn | Density |
|---|---|---|---|---|---|---|---|---|---|---|
| m | m/s | deg | psu | C | kg/kg | s-1 | m/s | deg | m0.67/s2 | sigma-T |
| 0.0 | 0.0 | 0.0 | 35.71 | 16.50 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.19803 |
| 3.048 | 0.0 | 0.0 | 35.70 | 16.49 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.19364 |
| 6.096 | 0.0 | 0.0 | 35.61 | 16.38 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.14659 |
| 9.143 | 0.0 | 0.0 | 35.63 | 16.11 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.22430 |
| 12.19 | 0.0 | 0.0 | 35.66 | 15.71 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.34095 |
| 15.24 | 0.0 | 0.0 | 35.49 | 15.27 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.31399 |
| 18.29 | 0.0 | 0.0 | 35.38 | 14.76 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.33594 |
| 21.33 | 0.0 | 0.0 | 35.26 | 14.39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.32377 |
| 24.38 | 0.0 | 0.0 | 35.20 | 14.03 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.35746 |
| 27.43 | 0.0 | 0.0 | 35.17 | 13.92 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.36071 |
| 30.48 | 0.0 | 0.0 | 34.91 | 12.17 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.51278 |
| 33.53 | 0.0 | 0.0 | 34.89 | 11.85 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.55198 |
| 36.57 | 0.0 | 0.0 | 34.89 | 11.85 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.55198 |
| 39.62 | 0.0 | 0.0 | 34.90 | 11.83 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.56509 |
| 42.67 | 0.0 | 0.0 | 34.90 | 11.83 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 26.56509 |

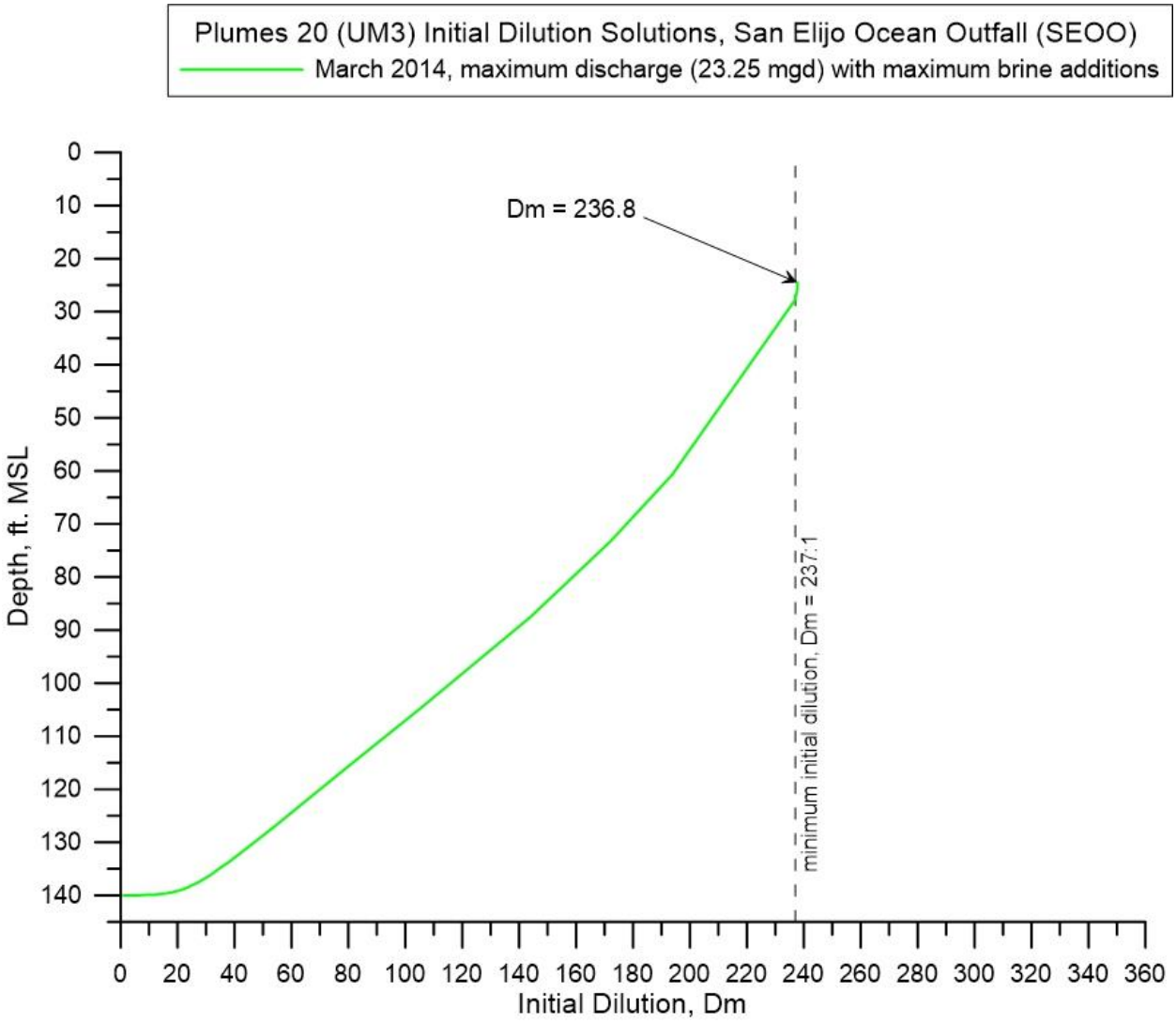
Diffuser table:

| P-dia | Ver angl | H-Angle | SourceX | SourceY | Ports | MZ-dis | Isoplth | P-depth | Ttl-flo | Eff-sal | Temp | Polutnt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in) | (deg) | (deg) | (m) | (m) | () | (m) | (concent) | (ft) | (MGD) | (psu) | (C) | (ppb) |
| 2.0000 | 0.0 | 0.0 | 0.0 | 0.0 | 200.00 | 2000.0 | 0.0 | 140.00 | 23.250 | 1.3400 | 22.500 | 1200.0 |

Simulation:
Froude No: 39.56; Strat No: 1.22E-5; Spcg No: 14.05; k: 4.12E+5; eff den (sigmaT) -1.267032;
eff vel 4.119(m/s);
Current is very small, flow regime may be transient.

| Step | Depth (ft) | Amb-cur (m/s) | P-dia (in) | Eff-sal (psu) | Density (sigmaT) | Dilutn () | x-posn (m) | y-posn (m) | Iso dia (m) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 140.0 | 1.000E-5 | 1.562 | 1.340 | -1.26703 | 1.000 | 0.0 | 0.0 | 0.03968; | |
| 1 | 140.0 | 0.0 | 1.656 | 5.150 | 1.89597 | 1.125 | 0.0359 | 0.0 | 0.04207; | bottom hit; |
| 15 | 140.0 | 0.0 | 2.292 | 12.35 | 7.86058 | 1.475 | 0.150 | 0.0 | 0.05821; | |
| 30 | 140.0 | 0.0 | 3.077 | 18.15 | 12.6525 | 1.976 | 0.312 | 0.0 | 0.07816; | |
| 45 | 140.0 | 0.0 | 4.134 | 22.45 | 16.2153 | 2.650 | 0.531 | 0.0 | 0.1050; | |
| 60 | 140.0 | 0.0 | 5.556 | 25.65 | 18.8662 | 3.557 | 0.826 | 0.0 | 0.1411; | |
| 75 | 140.0 | 0.0 | 7.471 | 28.03 | 20.8391 | 4.778 | 1.223 | 0.0 | 0.1898; | |
| 90 | 140.0 | 0.0 | 10.05 | 29.79 | 22.3072 | 6.421 | 1.759 | 0.0 | 0.2552; | |
| 105 | 139.9 | 0.0 | 13.50 | 31.11 | 23.3994 | 8.633 | 2.479 | 0.0 | 0.3430; | |
| 120 | 139.9 | 0.0 | 18.13 | 32.08 | 24.2118 | 11.61 | 3.445 | 0.0 | 0.4606; | |
| 131 | 139.7 | 0.0 | 22.19 | 32.60 | 24.6448 | 14.22 | 4.288 | 0.0 | 0.5636; | merging; |
| 135 | 139.7 | 0.0 | 23.48 | 32.72 | 24.7480 | 15.03 | 4.570 | 0.0 | 0.5963; | |
| 150 | 139.5 | 0.0 | 27.48 | 33.04 | 25.0076 | 17.54 | 5.540 | 0.0 | 0.6981; | |
| 165 | 139.2 | 0.0 | 30.86 | 33.24 | 25.1758 | 19.66 | 6.424 | 0.0 | 0.7838; | |
| 180 | 138.9 | 0.0 | 33.88 | 33.39 | 25.3014 | 21.61 | 7.263 | 0.0 | 0.8605; | |
| 195 | 138.5 | 0.0 | 36.68 | 33.51 | 25.4032 | 23.51 | 8.081 | 0.0 | 0.9317; | |
| 210 | 138.0 | 0.0 | 39.35 | 33.61 | 25.4907 | 25.42 | 8.896 | 0.0 | 0.9994; | |
| 225 | 137.5 | 0.0 | 41.95 | 33.71 | 25.5690 | 27.42 | 9.723 | 0.0 | 1.0654; | |
| 240 | 136.8 | 0.0 | 44.55 | 33.80 | 25.6418 | 29.58 | 10.58 | 0.0 | 1.1316; | |
| 255 | 136.0 | 0.0 | 47.24 | 33.88 | 25.7113 | 31.99 | 11.47 | 0.0 | 1.1999; | |
| 270 | 134.9 | 0.0 | 50.12 | 33.96 | 25.7795 | 34.76 | 12.43 | 0.0 | 1.2732; | |
| 285 | 133.7 | 0.0 | 53.36 | 34.04 | 25.8478 | 38.07 | 13.47 | 0.0 | 1.3552; | |
| 300 | 132.0 | 0.0 | 57.17 | 34.12 | 25.9173 | 42.15 | 14.61 | 0.0 | 1.4520; | |
| 315 | 129.8 | 0.0 | 61.92 | 34.21 | 25.9892 | 47.41 | 15.90 | 0.0 | 1.5729; | |
| 330 | 126.8 | 0.0 | 68.29 | 34.30 | 26.0640 | 54.52 | 17.39 | 0.0 | 1.7345; | |
| 345 | 122.3 | 0.0 | 77.53 | 34.39 | 26.1422 | 64.75 | 19.17 | 0.0 | 1.9692; | |
| 360 | 115.4 | 0.0 | 92.19 | 34.49 | 26.2231 | 80.65 | 21.37 | 0.0 | 2.3417; | |
| 375 | 104.0 | 0.0 | 117.1 | 34.59 | 26.3031 | 107.0 | 24.13 | 0.0 | 2.9750; | |
| 390 | 87.51 | 0.0 | 163.6 | 34.70 | 26.3461 | 144.0 | 27.15 | 0.0 | 4.1561; | |
| 399 | 73.33 | 0.0 | 224.8 | 34.78 | 26.3503 | 172.0 | 29.56 | 0.0 | 5.7094; | trap level; |
| 405 | 60.68 | 0.0 | 290.4 | 34.83 | 26.3501 | 193.8 | 31.75 | 0.0 | 7.3749; | |
| 420 | 27.80 | 0.0 | 647.5 | 34.95 | 26.3504 | 236.9 | 38.41 | 0.0 | 16.448; | begin overlap; |
| 435 | 25.83 | 0.0 | 862.3 | 34.96 | 26.3501 | 237.7 | 39.01 | 0.0 | 21.903; | |
| 450 | 24.94 | 0.0 | 1056.5 | 34.96 | 26.3500 | 237.8 | 39.36 | 0.0 | 26.835; | |
| 465 | 24.46 | 0.0 | 1242.4 | 34.96 | 26.3500 | 237.8 | 39.60 | 0.0 | 31.558; | |
| 466 | 24.43 | 0.0 | 1254.5 | 34.96 | 26.3500 | 237.8 | 39.61 | 0.0 | 31.865; | surface; |

Horiz plane projections in effluent direction: radius(m): 0.0; CL(m): 12.073
Lmz(m): 12.073
forced entrain 1 0.0 35.23 31.87 0.472
Rate sec-1 0.0 dy-1 0.0 kt: 0.0 Amb Sal 35.6155
;
11:45:38 AM. amb fills: 4


Plumes 20 (UM3) Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
March 2014, maximum discharge (23.25 mgd) with maximum brine additions
Dm = 236.8
minimum initial dilution, Dm = 237.1
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
Initial Dilution, Dm

## C.2 Maximum SEOO Discharge with Maximum Brine Additions for April 2014 Density Profiles

Project "C:\Plumes20\Max-SEOO_Apr2014_Max-Brine"
memo

Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Medium
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 0.61
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 15
Maximum dilution reported 10000
Text output format : Standard
Max vertical reversals : to max rise or fall

/ UM3. 8/21/2022 12:16:26 PM
Case 1; ambient file C:\Plumes20\Max-SEOO_Apr2014_Max-Brine.001.db; Diffuser table record 1

Ambient Table:

| Depth | Amb-cur | Amb-dir | Amb-sal | Amb-tem | Amb-pol | Decay | Far-spd | Far-dir | Disprsn | Density |
|---|---|---|---|---|---|---|---|---|---|---|
| m | m/s | deg | psu | C | kg/kg | s-1 | m/s | deg | m0.67/s2 | sigma-T |
| 0.0 | 0.0 | 0.0 | 34.00 | 14.61 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.30798 |
| 3.048 | 0.0 | 0.0 | 33.95 | 14.62 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.26842 |
| 6.096 | 0.0 | 0.0 | 33.95 | 13.84 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.43362 |
| 9.143 | 0.0 | 0.0 | 33.64 | 12.78 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.40372 |
| 12.19 | 0.0 | 0.0 | 33.69 | 12.64 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.47018 |
| 15.24 | 0.0 | 0.0 | 33.60 | 12.01 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.52377 |
| 18.29 | 0.0 | 0.0 | 33.49 | 11.63 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.51043 |
| 21.33 | 0.0 | 0.0 | 33.50 | 11.44 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.55376 |
| 24.38 | 0.0 | 0.0 | 33.48 | 11.32 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.55665 |
| 27.43 | 0.0 | 0.0 | 33.48 | 11.27 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.56855 |
| 30.48 | 0.0 | 0.0 | 33.45 | 11.23 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.54772 |
| 33.53 | 0.0 | 0.0 | 33.43 | 11.21 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.54147 |
| 36.57 | 0.0 | 0.0 | 33.43 | 11.21 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.54147 |
| 39.62 | 0.0 | 0.0 | 33.43 | 11.19 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.54490 |
| 42.67 | 0.0 | 0.0 | 33.43 | 11.19 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 25.54490 |

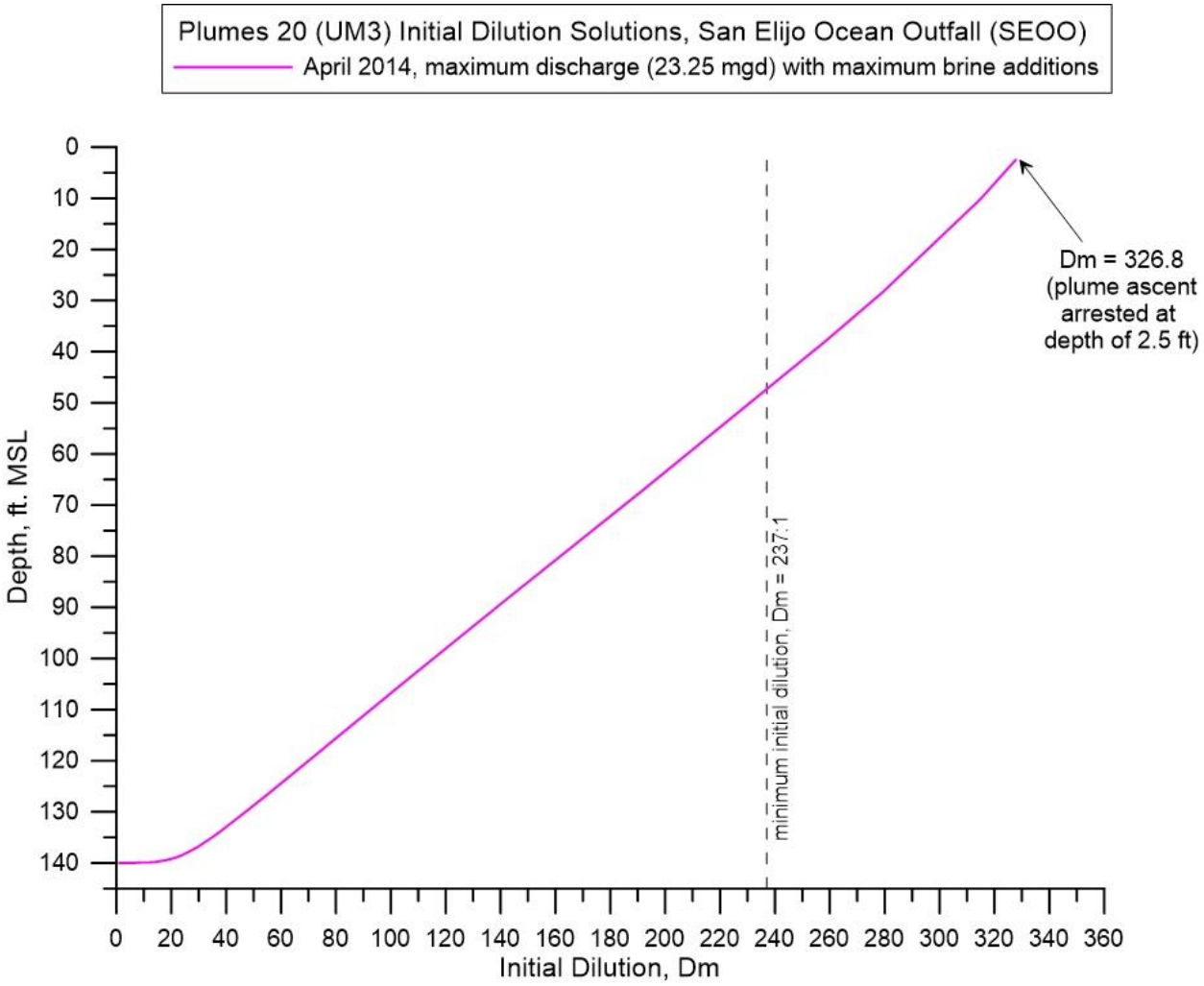
Diffuser table:

| P-dia | Ver angl | H-Angle | SourceX | SourceY | Ports | MZ-dis | Isoplth | P-depth | Ttl-flo | Eff-sal | Temp | Polutnt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in) | (deg) | (deg) | (m) | (m) | () | (m)(concent) | | (ft) | (MGD) | (psu) | (C) | (ppb) |
| 2.0000 | 0.0 | 0.0 | 0.0 | 0.0 | 200.00 | 2000.0 | 0.0 | 140.00 | 23.250 | 1.3400 | 22.500 | 1200.0 |

Simulation:
Froude No: 40.31; Strat No: 8.22E-6; Spcg No: 14.05; k: 4.12E+5; eff den (sigmaT) -1.267032;
eff vel 4.119(m/s);
Current is very small, flow regime may be transient.

| Step | Depth (ft) | Amb-cur (m/s) | P-dia (in) | Eff-sal (psu) | Density (sigmaT) | Dilutn () | x-posn (ft) | y-posn (ft) | Iso dia (m) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 140.0 | 1.000E-5 | 1.562 | 1.340 | -1.26703 | 1.000 | 0.0 | 0.0 | 0.03968; | |
| 1 | 140.0 | 0.0 | 1.656 | 4.980 | 1.78380 | 1.125 | 0.0359 | 0.0 | 0.04207; | bottom hit; |
| 15 | 140.0 | 0.0 | 2.292 | 11.87 | 7.53890 | 1.475 | 0.150 | 0.0 | 0.05821; | |
| 30 | 140.0 | 0.0 | 3.077 | 17.41 | 12.1584 | 1.976 | 0.312 | 0.0 | 0.07817; | |
| 45 | 140.0 | 0.0 | 4.135 | 21.53 | 15.5902 | 2.651 | 0.531 | 0.0 | 0.1050; | |
| 60 | 140.0 | 0.0 | 5.558 | 24.59 | 18.1422 | 3.559 | 0.826 | 0.0 | 0.1412; | |
| 75 | 140.0 | 0.0 | 7.473 | 26.86 | 20.0404 | 4.781 | 1.224 | 0.0 | 0.1898; | |
| 90 | 140.0 | 0.0 | 10.05 | 28.55 | 21.4524 | 6.426 | 1.760 | 0.0 | 0.2552; | |
| 105 | 139.9 | 0.0 | 13.51 | 29.80 | 22.5026 | 8.639 | 2.480 | 0.0 | 0.3432; | |
| 120 | 139.9 | 0.0 | 18.14 | 30.74 | 23.2835 | 11.62 | 3.447 | 0.0 | 0.4609; | |
| 131 | 139.8 | 0.0 | 22.28 | 31.24 | 23.7063 | 14.29 | 4.307 | 0.0 | 0.5659; | merging; |
| 135 | 139.7 | 0.0 | 23.61 | 31.36 | 23.8072 | 15.12 | 4.599 | 0.0 | 0.5996; | |
| 150 | 139.5 | 0.0 | 27.73 | 31.66 | 24.0594 | 17.68 | 5.599 | 0.0 | 0.7044; | |
| 165 | 139.2 | 0.0 | 31.20 | 31.86 | 24.2215 | 19.85 | 6.509 | 0.0 | 0.7925; | |
| 180 | 138.9 | 0.0 | 34.30 | 32.00 | 24.3420 | 21.83 | 7.371 | 0.0 | 0.8713; | |
| 195 | 138.5 | 0.0 | 37.18 | 32.12 | 24.4393 | 23.75 | 8.210 | 0.0 | 0.9444; | |
| 210 | 138.0 | 0.0 | 39.92 | 32.22 | 24.5227 | 25.69 | 9.044 | 0.0 | 1.0139; | |
| 225 | 137.4 | 0.0 | 42.58 | 32.30 | 24.5972 | 27.71 | 9.891 | 0.0 | 1.0816; | |
| 240 | 136.8 | 0.0 | 45.25 | 32.39 | 24.6663 | 29.89 | 10.76 | 0.0 | 1.1494; | |
| 255 | 135.9 | 0.0 | 48.00 | 32.46 | 24.7322 | 32.31 | 11.68 | 0.0 | 1.2192; | |
| 270 | 134.9 | 0.0 | 50.94 | 32.54 | 24.7968 | 35.10 | 12.65 | 0.0 | 1.2940; | |
| 285 | 133.6 | 0.0 | 54.23 | 32.62 | 24.8613 | 38.41 | 13.71 | 0.0 | 1.3775; | |
| 300 | 131.9 | 0.0 | 58.10 | 32.70 | 24.9270 | 42.49 | 14.88 | 0.0 | 1.4757; | |
| 315 | 129.7 | 0.0 | 62.91 | 32.78 | 24.9948 | 47.73 | 16.19 | 0.0 | 1.5979; | |
| 330 | 126.7 | 0.0 | 69.30 | 32.86 | 25.0655 | 54.78 | 17.70 | 0.0 | 1.7601; | |
| 345 | 122.3 | 0.0 | 78.42 | 32.95 | 25.1396 | 64.82 | 19.49 | 0.0 | 1.9919; | |
| 360 | 115.5 | 0.0 | 92.63 | 33.04 | 25.2169 | 80.25 | 21.68 | 0.0 | 2.3528; | |
| 375 | 104.2 | 0.0 | 116.8 | 33.14 | 25.2957 | 105.9 | 24.45 | 0.0 | 2.9655; | |
| 390 | 88.24 | 0.0 | 151.1 | 33.22 | 25.3620 | 142.6 | 27.32 | 0.0 | 3.8374; | |
| 405 | 67.08 | 0.0 | 197.8 | 33.29 | 25.4126 | 191.9 | 30.08 | 0.0 | 5.0232; | |
| 420 | 38.04 | 0.0 | 277.0 | 33.36 | 25.4400 | 258.2 | 32.97 | 0.0 | 7.0370; | |
| 424 | 28.26 | 0.0 | 313.8 | 33.38 | 25.4412 | 279.5 | 33.84 | 0.0 | 7.9702; | trap level; |
| 430 | 10.19 | 0.0 | 410.6 | 33.43 | 25.4400 | 314.8 | 35.52 | 0.0 | 10.428; | matched energy |
| 434 | 2.460 | 0.0 | 553.7 | 33.45 | 25.4360 | 327.8 | 36.38 | 0.0 | 14.065; | surface; |

Horiz plane projections in effluent direction: radius(m): 0.0; CL(m): 11.088
Lmz(m): 11.088
forced entrain 1 0.0 41.92 14.06 0.117
Rate sec-1 0.0 dy-1 0.0 kt: 0.0 Amb Sal 33.9825
;
12:16:27 PM. amb fills: 4


Plumes 20 (UM3) Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
April 2014, maximum discharge (23.25 mgd) with maximum brine additions
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
minimum initial dilution, Dm = 237.1
Dm = 326.8
(plume ascent
arrested at
depth of 2.5 ft)
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
Initial Dilution, Dm

## C.3 Maximum SEOO Discharge with Maximum Brine Additions for May 2014 Density Profiles

Project "C:\Plumes20\Max-SEOO_May2014_Max-Brine"
memo

Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Medium
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 0.61
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 15
Maximum dilution reported 10000
Text output format : Standard
Max vertical reversals : to max rise or fall

/ UM3. 8/21/2022 12:48:43 PM
Case 1; ambient file C:\Plumes20\Max-SEOO_May2014_Max-Brine.001.db; Diffuser table record 1

Ambient Table:

| Depth | Amb-cur | Amb-dir | Amb-sal | Amb-tem | Amb-pol | Decay | Far-spd | Far-dir | Disprsn | Density |
|---|---|---|---|---|---|---|---|---|---|---|
| m | m/s | deg | psu | C | kg/kg | s-1 | m/s | deg | m0.67/s2 | sigma-T |
| 0.0 | 0.0 | 0.0 | 33.47 | 17.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.36431 |
| 3.048 | 0.0 | 0.0 | 33.46 | 16.99 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.35984 |
| 6.096 | 0.0 | 0.0 | 33.48 | 16.95 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.37988 |
| 9.143 | 0.0 | 0.0 | 33.48 | 16.81 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.41370 |
| 12.19 | 0.0 | 0.0 | 33.40 | 16.39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.45040 |
| 15.24 | 0.0 | 0.0 | 33.16 | 14.81 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.61622 |
| 18.29 | 0.0 | 0.0 | 32.80 | 13.21 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.67571 |
| 21.33 | 0.0 | 0.0 | 32.68 | 12.41 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.73594 |
| 24.38 | 0.0 | 0.0 | 32.57 | 12.05 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.71709 |
| 27.43 | 0.0 | 0.0 | 32.55 | 11.88 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.73096 |
| 30.48 | 0.0 | 0.0 | 32.49 | 11.88 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.68818 |
| 33.53 | 0.0 | 0.0 | 32.48 | 11.79 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.69958 |
| 36.57 | 0.0 | 0.0 | 32.48 | 11.79 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.69958 |
| 39.62 | 0.0 | 0.0 | 32.50 | 11.78 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.71514 |
| 42.67 | 0.0 | 0.0 | 32.50 | 11.78 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.71514 |

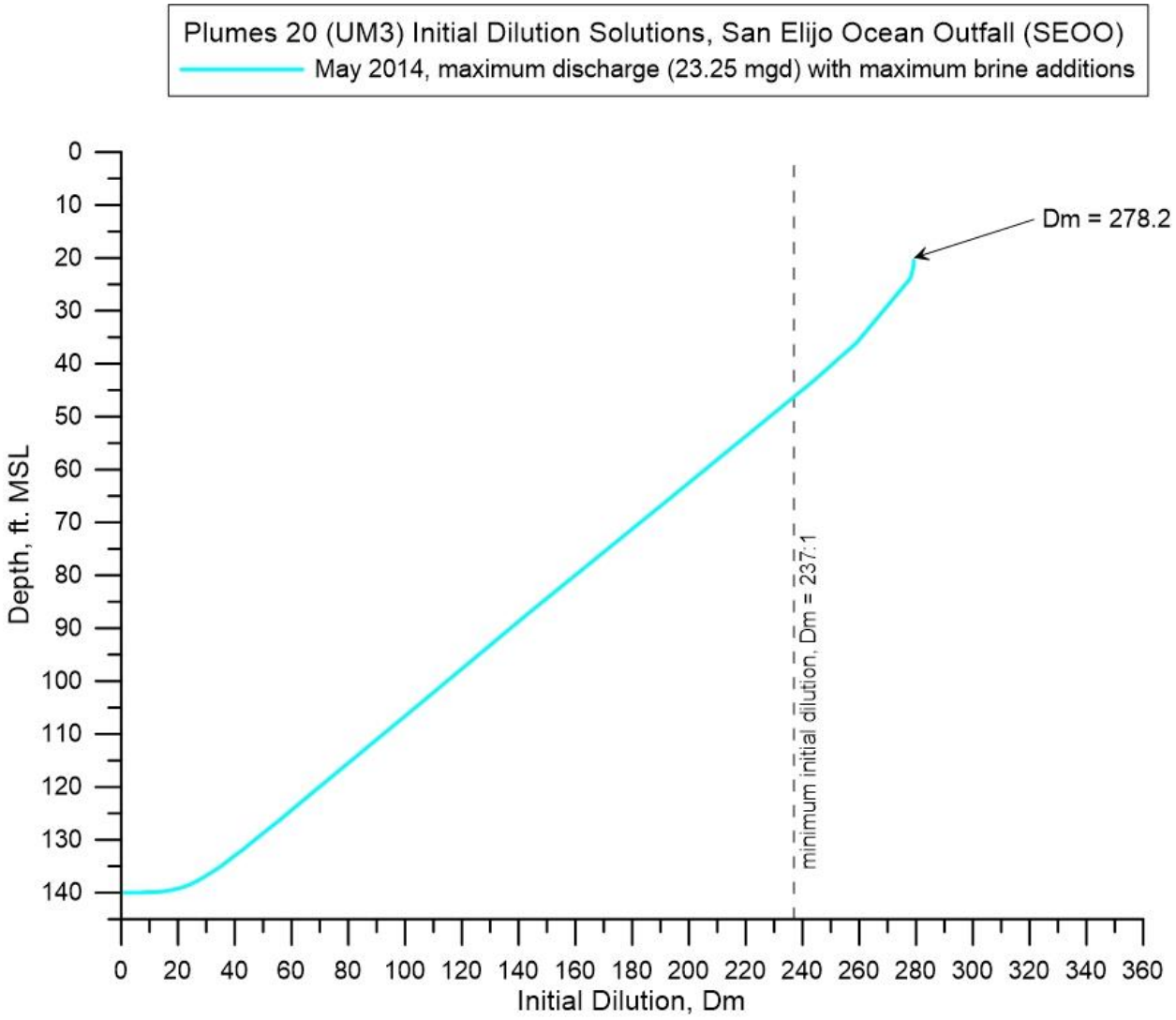
Diffuser table:

| P-dia | Ver angl | H-Angle | SourceX | SourceY | Ports | MZ-dis | Isoplth | P-depth | Ttl-flo | Eff-sal | Temp | Polutnt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in) | (deg) | (deg) | (m) | (m) | () | (m) | (concent) | (ft) | (MGD) | (psu) | (C) | (ppb) |
| 2.0000 | 0.0 | 0.0 | 0.0 | 0.0 | 200.00 | 2000.0 | 0.0 | 140.00 | 23.250 | 1.3400 | 22.500 | 1200.0 |

Simulation:
Froude No: 40.94; Strat No: 1.25E-5; Spcg No: 14.05; k: 4.12E+5; eff den (sigmaT) -1.267032;
eff vel 4.119(m/s);
Current is very small, flow regime may be transient.

| Step | Depth (ft) | Amb-cur (m/s) | P-dia (in) | Eff-sal (psu) | Density (sigmaT) | Dilutn () | x-posn (m) | y-posn (m) | Iso dia (m) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 140.0 | 1.000E-5 | 1.562 | 1.340 | -1.26703 | 1.000 | 0.0 | 0.0 | 0.03968; | |
| 1 | 140.0 | 0.0 | 1.656 | 4.872 | 1.68653 | 1.125 | 0.036 | 0.0 | 0.04207; | bottom hit; |
| 15 | 140.0 | 0.0 | 2.292 | 11.56 | 7.26396 | 1.476 | 0.150 | 0.0 | 0.05821; | |
| 30 | 140.0 | 0.0 | 3.078 | 16.94 | 11.7416 | 1.977 | 0.312 | 0.0 | 0.07818; | |
| 45 | 140.0 | 0.0 | 4.135 | 20.94 | 15.0681 | 2.652 | 0.531 | 0.0 | 0.1050; | |
| 60 | 140.0 | 0.0 | 5.559 | 23.91 | 17.5415 | 3.561 | 0.827 | 0.0 | 0.1412; | |
| 75 | 140.0 | 0.0 | 7.475 | 26.12 | 19.3813 | 4.784 | 1.225 | 0.0 | 0.1899; | |
| 90 | 140.0 | 0.0 | 10.05 | 27.76 | 20.7497 | 6.430 | 1.760 | 0.0 | 0.2553; | |
| 105 | 139.9 | 0.0 | 13.51 | 28.98 | 21.7674 | 8.645 | 2.481 | 0.0 | 0.3433; | |
| 120 | 139.9 | 0.0 | 18.15 | 29.88 | 22.5241 | 11.63 | 3.449 | 0.0 | 0.4611; | |
| 130 | 139.8 | 0.0 | 21.97 | 30.34 | 22.9078 | 14.09 | 4.244 | 0.0 | 0.5581; | merging; |
| 135 | 139.7 | 0.0 | 23.70 | 30.50 | 23.0370 | 15.18 | 4.621 | 0.0 | 0.6020; | |
| 150 | 139.5 | 0.0 | 27.92 | 30.79 | 23.2839 | 17.79 | 5.646 | 0.0 | 0.7093; | |
| 165 | 139.2 | 0.0 | 31.47 | 30.98 | 23.4415 | 19.99 | 6.577 | 0.0 | 0.7993; | |
| 180 | 138.9 | 0.0 | 34.64 | 31.12 | 23.5581 | 22.01 | 7.457 | 0.0 | 0.8799; | |
| 195 | 138.5 | 0.0 | 37.58 | 31.23 | 23.6520 | 23.95 | 8.313 | 0.0 | 0.9545; | |
| 210 | 138.0 | 0.0 | 40.37 | 31.33 | 23.7323 | 25.90 | 9.164 | 0.0 | 1.0255; | |
| 225 | 137.4 | 0.0 | 43.09 | 31.41 | 23.8039 | 27.94 | 10.03 | 0.0 | 1.0946; | |
| 240 | 136.7 | 0.0 | 45.81 | 31.49 | 23.8702 | 30.13 | 10.91 | 0.0 | 1.1636; | |
| 255 | 135.9 | 0.0 | 48.61 | 31.57 | 23.9335 | 32.57 | 11.85 | 0.0 | 1.2347; | |
| 270 | 134.9 | 0.0 | 51.60 | 31.64 | 23.9953 | 35.36 | 12.84 | 0.0 | 1.3107; | |
| 285 | 133.5 | 0.0 | 54.94 | 31.71 | 24.0570 | 38.68 | 13.91 | 0.0 | 1.3954; | |
| 300 | 131.9 | 0.0 | 58.85 | 31.79 | 24.1199 | 42.76 | 15.09 | 0.0 | 1.4947; | |
| 315 | 129.6 | 0.0 | 63.70 | 31.87 | 24.1847 | 47.99 | 16.42 | 0.0 | 1.6180; | |
| 330 | 126.6 | 0.0 | 70.16 | 31.95 | 24.2522 | 55.02 | 17.95 | 0.0 | 1.7822; | |
| 345 | 122.1 | 0.0 | 79.51 | 32.03 | 24.3225 | 65.08 | 19.78 | 0.0 | 2.0196; | |
| 360 | 115.2 | 0.0 | 94.25 | 32.12 | 24.3953 | 80.59 | 22.04 | 0.0 | 2.3940; | |
| 375 | 103.8 | 0.0 | 119.1 | 32.21 | 24.4685 | 106.3 | 24.90 | 0.0 | 3.0258; | |
| 390 | 87.37 | 0.0 | 155.1 | 32.28 | 24.5292 | 143.0 | 27.92 | 0.0 | 3.9401; | |
| 405 | 65.77 | 0.0 | 200.2 | 32.37 | 24.5798 | 192.5 | 30.78 | 0.0 | 5.0845; | |
| 417 | 43.13 | 0.0 | 268.0 | 32.48 | 24.6002 | 244.1 | 33.13 | 0.0 | 6.8081; | trap level; |
| 420 | 36.05 | 0.0 | 309.0 | 32.53 | 24.5983 | 259.0 | 33.87 | 0.0 | 7.8475; | |
| 435 | 23.90 | 0.0 | 659.6 | 32.60 | 24.5921 | 277.9 | 35.58 | 0.0 | 16.754; | |
| 436 | 23.65 | 0.0 | 680.2 | 32.60 | 24.5920 | 278.1 | 35.64 | 0.0 | 17.277; | begin overlap; |
| 450 | 21.57 | 0.0 | 951.1 | 32.60 | 24.5916 | 279.1 | 36.12 | 0.0 | 24.159; | |
| 465 | 20.66 | 0.0 | 1225.4 | 32.60 | 24.5916 | 279.2 | 36.41 | 0.0 | 31.125; | |
| 471 | 20.45 | 0.0 | 1332.2 | 32.60 | 24.5915 | 279.2 | 36.49 | 0.0 | 33.838; | surface; |

Horiz plane projections in effluent direction: radius(m): 0.0; CL(m): 11.124
Lmz(m): 11.124
forced entrain 1 0.0 36.44 33.84 0.366
Rate sec-1 0.0 dy-1 0.0 kt: 0.0 Amb Sal 33.4751
;
12:48:43 PM. amb fills: 4


Plumes 20 (UM3) Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
May 2014, maximum discharge (23.25 mgd) with maximum brine additions
Dm = 278.2
minimum initial dilution, Dm = 237:1
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0 20 40 60 80 100 120 140 160 180 200 220 240 260 280 300 320 340 360
Initial Dilution, Dm

# APPENDIX D:
# Plumes 20 Initial Dilution Results for Discharge Scenario #3: Minimum Discharge Rate (7.2 mgd) with Maximum Brine Additions based on Summer Density Profiles from June 2014 Through August 2014

## D.1 Minimum SEOO Discharge with Maximum Brine Additions for June 2014 Density Profiles

Project "C:\Plumes20\Min-SEOO_June2014_Max-Brine"
memo

Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Medium
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 0.61
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 15
Maximum dilution reported 10000
Text output format : Standard
Max vertical reversals : to max rise or fall

/ UM3. 8/21/2022 1:27:30 PM
Case 1; ambient file C:\Plumes20\Max-SEOO_June2014_Max-Brine.001.db; Diffuser table record 1:

Ambient Table:

| Depth | Amb-cur | Amb-dir | Amb-sal | Amb-tem | Amb-pol | Decay | Far-spd | Far-dir | Disprsn | Density |
|---|---|---|---|---|---|---|---|---|---|---|
| m | m/s | deg | psu | C | kg/kg | s-1 | m/s | deg | m0.67/s2 | sigma-T |
| 0.0 | 0.0 | 0.0 | 33.42 | 19.73 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.65286 |
| 3.048 | 0.0 | 0.0 | 33.41 | 19.73 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.64577 |
| 6.096 | 0.0 | 0.0 | 33.45 | 18.72 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.93411 |
| 9.143 | 0.0 | 0.0 | 33.15 | 17.43 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.01715 |
| 12.19 | 0.0 | 0.0 | 32.98 | 16.61 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.07776 |
| 15.24 | 0.0 | 0.0 | 32.85 | 15.39 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.25736 |
| 18.29 | 0.0 | 0.0 | 32.51 | 14.30 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.22215 |
| 21.33 | 0.0 | 0.0 | 32.36 | 13.73 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.22474 |
| 24.38 | 0.0 | 0.0 | 32.16 | 12.84 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.25389 |
| 27.43 | 0.0 | 0.0 | 32.01 | 12.40 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.21632 |
| 30.48 | 0.0 | 0.0 | 31.91 | 11.91 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.23399 |
| 33.53 | 0.0 | 0.0 | 31.85 | 11.46 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.26940 |
| 36.57 | 0.0 | 0.0 | 31.85 | 11.46 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.26940 |
| 39.62 | 0.0 | 0.0 | 31.80 | 11.44 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.23334 |
| 42.67 | 0.0 | 0.0 | 31.80 | 11.44 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.23334 |

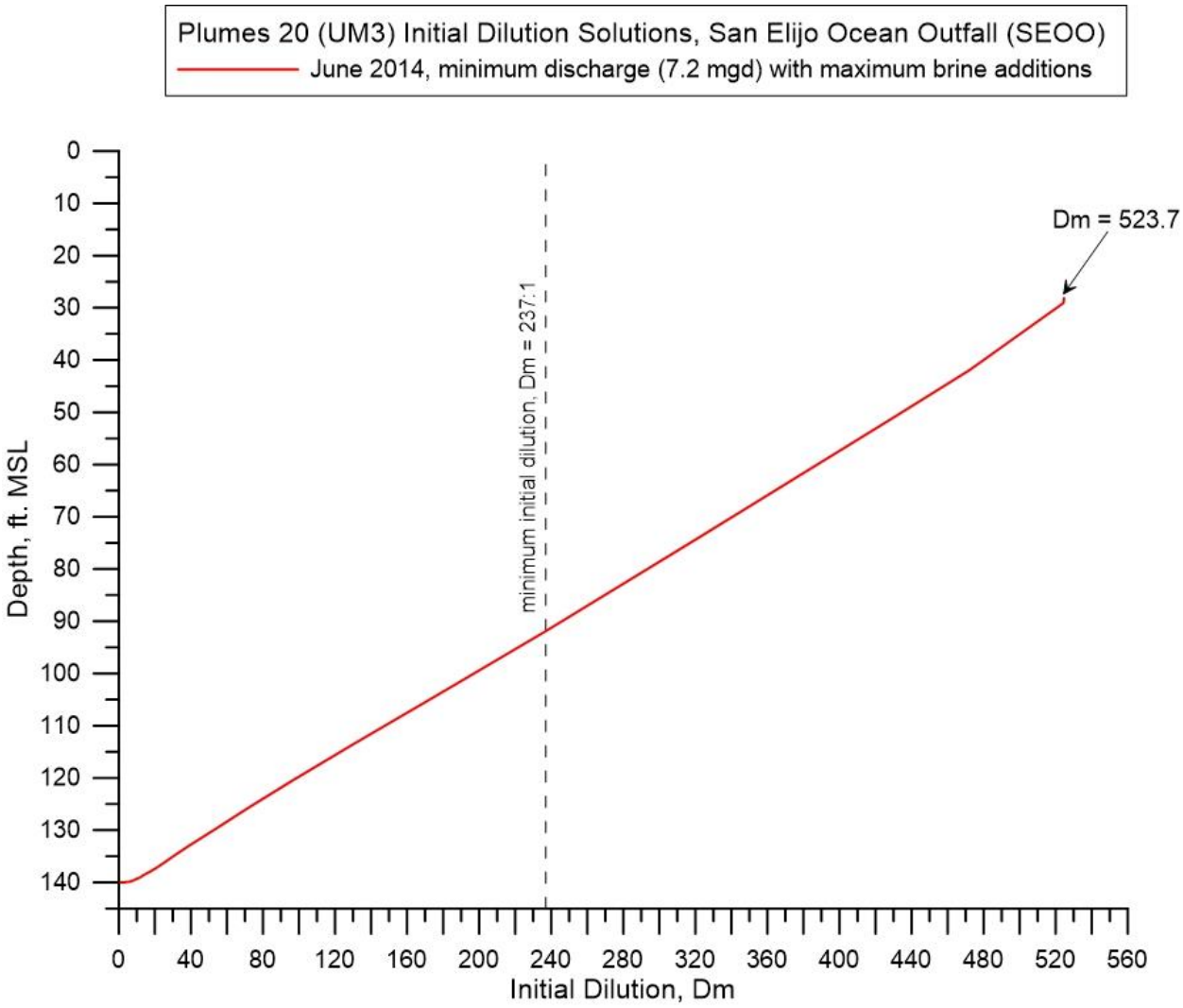
Diffuser table:

| P-dia | Ver angl | H-Angle | SourceX | SourceY | Ports | MZ-dis | Isoplth | P-depth | Ttl-flo | Eff-sal | Temp | Polutnt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in) | (deg) | (deg) | (m) | (m) | () | (m) | (concent) | (ft) | (MGD) | (psu) | (C) | (ppb) |
| 2.0000 | 0.0 | 0.0 | 0.0 | 0.0 | 200.00 | 2000.0 | 0.0 | 140.00 | 7.2000 | 1.8800 | 22.500 | 1200.0 |

Simulation:
Froude No: 12.91; Strat No: 2.15E-5; Spcg No: 14.05; k: 1.27E+5; eff den (sigmaT) -0.858500;
eff vel 1.276(m/s);
Current is very small, flow regime may be transient.

| Step | Depth (ft) | Amb-cur (m/s) | P-dia (in) | Eff-sal (psu) | Density (sigmaT) | Dilutn () | x-posn (m) | y-posn (m) | Iso dia (m) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 140.0 | 1.000E-5 | 1.562 | 1.880 | -0.85850 | 1.000 | 0.0 | 0.0 | 0.03968; | |
| 1 | 140.0 | 0.0 | 1.592 | 3.018 | 0.10105 | 1.039 | 0.0121 | 0.0 | 0.04043; | bottom hit; |
| 15 | 140.0 | 0.0 | 2.114 | 9.987 | 5.95736 | 1.362 | 0.117 | 0.0 | 0.0537; | |
| 30 | 140.0 | 0.0 | 2.839 | 15.59 | 10.6528 | 1.825 | 0.267 | 0.0 | 0.0721; | |
| 45 | 140.0 | 0.0 | 3.813 | 19.76 | 14.1379 | 2.448 | 0.468 | 0.0 | 0.09685; | |
| 60 | 140.0 | 0.0 | 5.121 | 22.85 | 16.7278 | 3.286 | 0.740 | 0.0 | 0.1301; | |
| 75 | 139.9 | 0.0 | 6.845 | 25.13 | 18.6336 | 4.399 | 1.099 | 0.0 | 0.1739; | |
| 90 | 139.9 | 0.0 | 8.465 | 26.43 | 19.7217 | 5.456 | 1.436 | 0.0 | 0.2150; | |
| 105 | 139.8 | 0.0 | 9.832 | 27.21 | 20.3800 | 6.385 | 1.726 | 0.0 | 0.2497; | |
| 120 | 139.7 | 0.0 | 11.05 | 27.76 | 20.8433 | 7.256 | 1.990 | 0.0 | 0.2806; | |
| 135 | 139.6 | 0.0 | 12.16 | 28.19 | 21.2003 | 8.108 | 2.237 | 0.0 | 0.3089; | |
| 150 | 139.5 | 0.0 | 13.21 | 28.54 | 21.4933 | 8.974 | 2.475 | 0.0 | 0.3356; | |
| 165 | 139.3 | 0.0 | 14.23 | 28.84 | 21.7451 | 9.881 | 2.709 | 0.0 | 0.3614; | |
| 180 | 139.2 | 0.0 | 15.23 | 29.11 | 21.9698 | 10.86 | 2.945 | 0.0 | 0.3868; | |
| 195 | 139.0 | 0.0 | 16.25 | 29.35 | 22.1763 | 11.95 | 3.185 | 0.0 | 0.4127; | |
| 210 | 138.7 | 0.0 | 17.31 | 29.58 | 22.3712 | 13.20 | 3.433 | 0.0 | 0.4398; | |
| 225 | 138.4 | 0.0 | 18.47 | 29.81 | 22.5589 | 14.68 | 3.695 | 0.0 | 0.4691; | |
| 240 | 138.1 | 0.0 | 19.77 | 30.03 | 22.7431 | 16.49 | 3.975 | 0.0 | 0.5020; | |
| 255 | 137.6 | 0.0 | 21.29 | 30.25 | 22.9265 | 18.80 | 4.279 | 0.0 | 0.5409; | |
| 261 | 137.4 | 0.0 | 22.00 | 30.33 | 23.0000 | 19.92 | 4.410 | 0.0 | 0.5587; | merging; |
| 270 | 137.0 | 0.0 | 23.07 | 30.46 | 23.1039 | 21.75 | 4.618 | 0.0 | 0.5860; | |
| 285 | 136.1 | 0.0 | 25.10 | 30.66 | 23.2717 | 25.54 | 5.006 | 0.0 | 0.6376; | |
| 300 | 134.8 | 0.0 | 27.82 | 30.86 | 23.4413 | 31.01 | 5.468 | 0.0 | 0.7065; | |
| 315 | 132.8 | 0.0 | 31.92 | 31.07 | 23.6157 | 39.76 | 6.042 | 0.0 | 0.8107; | |
| 330 | 129.8 | 0.0 | 38.07 | 31.25 | 23.7741 | 53.47 | 6.702 | 0.0 | 0.9669; | |
| 345 | 125.7 | 0.0 | 46.04 | 31.40 | 23.8938 | 71.96 | 7.341 | 0.0 | 1.1694; | |
| 360 | 120.4 | 0.0 | 56.33 | 31.51 | 23.9870 | 96.84 | 7.959 | 0.0 | 1.4308; | |
| 375 | 113.5 | 0.0 | 69.96 | 31.60 | 24.0595 | 130.3 | 8.553 | 0.0 | 1.7769; | |
| 390 | 104.4 | 0.0 | 89.16 | 31.66 | 24.1124 | 175.4 | 9.134 | 0.0 | 2.2646; | |
| 405 | 92.09 | 0.0 | 119.8 | 31.73 | 24.1443 | 236.0 | 9.736 | 0.0 | 3.0440; | |
| 420 | 74.86 | 0.0 | 160.9 | 31.82 | 24.1686 | 317.7 | 10.39 | 0.0 | 4.0876; | |
| 435 | 51.52 | 0.0 | 221.7 | 31.98 | 24.1892 | 427.5 | 11.06 | 0.0 | 5.6308; | |
| 440 | 41.95 | 0.0 | 242.3 | 32.06 | 24.1973 | 472.0 | 11.29 | 0.0 | 6.1554; | trap level; |
| 449 | 29.08 | 0.0 | 713.6 | 32.15 | 24.1934 | 524.3 | 11.74 | 0.0 | 18.125; | begin overlap; |
| 450 | 28.91 | 0.0 | 802.9 | 32.15 | 24.1934 | 524.4 | 11.75 | 0.0 | 20.393; | |
| 465 | 28.23 | 0.0 | 1916.5 | 32.15 | 24.1934 | 524.6 | 11.82 | 0.0 | 48.679; | |
| 480 | 28.12 | 0.0 | 2932.8 | 32.15 | 24.1934 | 524.6 | 11.84 | 0.0 | 74.493; | surface; |

Horiz plane projections in effluent direction: radius(m): 0.0; CL(m): 3.6102
Lmz(m): 3.6102
forced entrain 1 0.0 34.10 74.49 0.231
Rate sec-1 0.0 dy-1 0.0 kt: 0.0 Amb Sal 33.2068
;
1:27:30 PM. amb fills: 4


Plumes 20 (UM3) Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
June 2014, minimum discharge (7.2 mgd) with maximum brine additions
Dm = 523.7
minimum initial dilution, Dm = 237:1
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
40
80
120
160
200
240
280
320
360
400
440
480
520
560
Initial Dilution, Dm

## D.2 Minimum SEOO Discharge with Maximum Brine Additions for July 2014 Density Profiles

Project "C:\Plumes20\Min-SEOO_July2014_Max-Brine"
memo

Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Medium
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 0.61
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 15
Maximum dilution reported 10000
Text output format : Standard
Max vertical reversals : to max rise or fall

/ UM3. 8/21/2022 2:10:43 PM
Case 1; ambient file C:\Plumes20\Max-SEOO_July2014_Max-Brine.001.db; Diffuser table record 1:

Ambient Table:

| Depth | Amb-cur | Amb-dir | Amb-sal | Amb-tem | Amb-pol | Decay | Far-spd | Far-dir | Disprsn | Density |
|---|---|---|---|---|---|---|---|---|---|---|
| m | m/s | deg | psu | C | kg/kg | s-1 | m/s | deg | m0.67/s2 | sigma-T |
| 0.0 | 0.0 | 0.0 | 33.95 | 21.92 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.46816 |
| 3.048 | 0.0 | 0.0 | 33.94 | 21.90 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.46917 |
| 6.096 | 0.0 | 0.0 | 34.01 | 21.84 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.53555 |
| 9.143 | 0.0 | 0.0 | 34.02 | 19.27 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.22836 |
| 12.19 | 0.0 | 0.0 | 32.77 | 15.12 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.25294 |
| 15.24 | 0.0 | 0.0 | 32.45 | 14.32 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.17258 |
| 18.29 | 0.0 | 0.0 | 32.38 | 13.85 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.22064 |
| 21.33 | 0.0 | 0.0 | 32.23 | 13.14 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.24290 |
| 24.38 | 0.0 | 0.0 | 32.20 | 13.00 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.25090 |
| 27.43 | 0.0 | 0.0 | 32.16 | 12.83 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.25563 |
| 30.48 | 0.0 | 0.0 | 32.14 | 12.63 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.27779 |
| 33.53 | 0.0 | 0.0 | 32.15 | 12.50 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.30805 |
| 36.57 | 0.0 | 0.0 | 32.15 | 12.50 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.30805 |
| 39.62 | 0.0 | 0.0 | 32.15 | 12.48 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.31244 |
| 42.67 | 0.0 | 0.0 | 32.15 | 12.48 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.31244 |

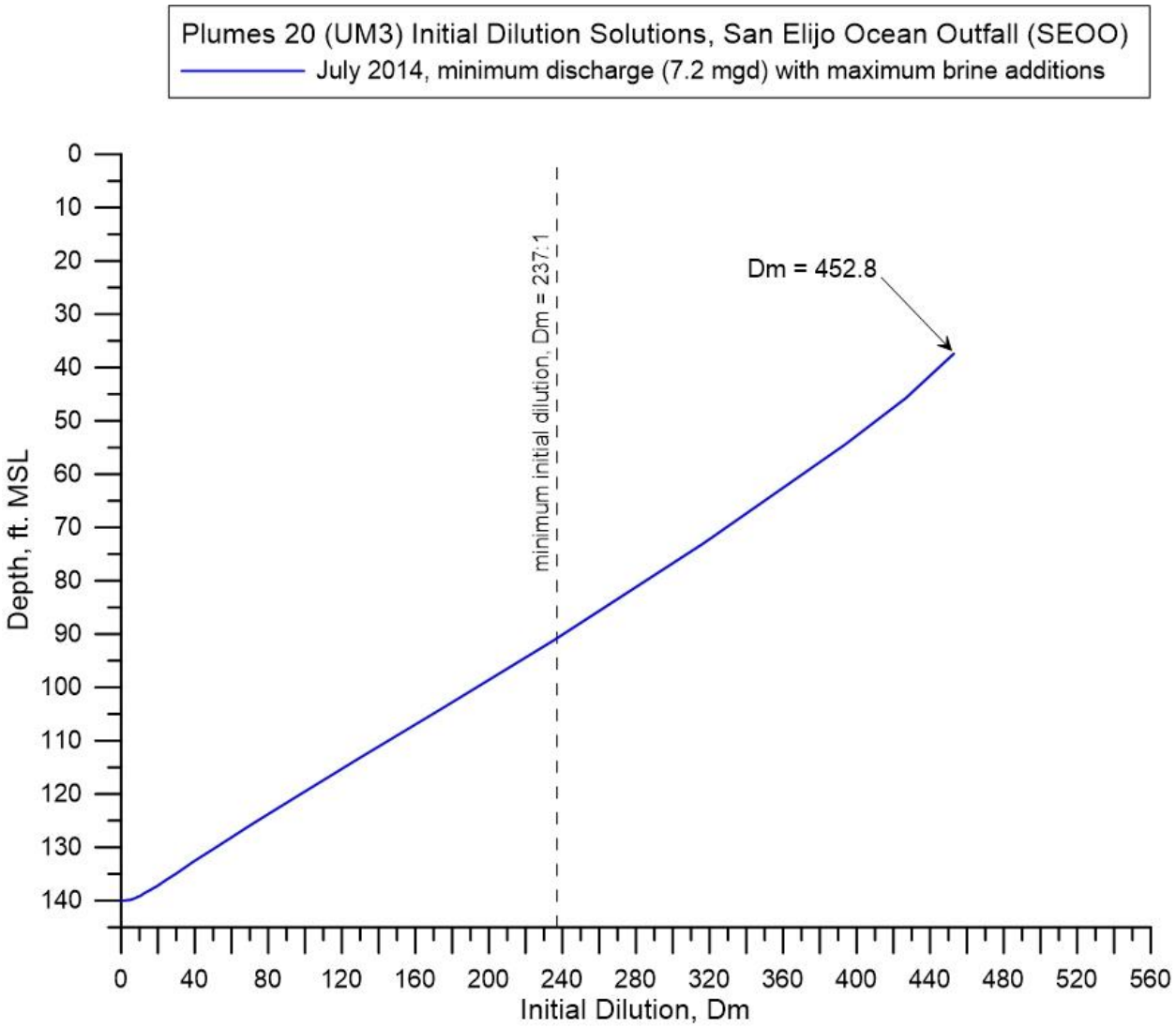
Diffuser table:

| P-dia | Ver angl | H-Angle | SourceX | SourceY | Ports | MZ-dis | Isopth | P-depth | Ttl-flo | Eff-sal | Temp | Polutnt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in) | (deg) | (deg) | (m) | (m) | () | (m) | (concent) | (ft) | (MGD) | (psu) | (C) | (ppb) |
| 2.0000 | 0.0 | 0.0 | 0.0 | 0.0 | 200.00 | 2000.0 | 0.0 | 140.00 | 7.2000 | 1.8800 | 22.500 | 1200.0 |

Simulation:
Froude No: 12.88; Strat No: 3.12E-5; Spcg No: 14.05; k: 1.27E+5; eff den (sigmaT) -0.858500;
eff vel 1.276(m/s);
Current is very small, flow regime may be transient.

| Step | Depth (ft) | Amb-cur (m/s) | P-dia (in) | Eff-sal (psu) | Density (sigmaT) | Dilutn () | x-posn (m) | y-posn (m) | Iso dia (m) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 140.0 | 1.000E-5 | 1.562 | 1.880 | -0.85850 | 1.000 | 0.0 | 0.0 | 0.03968; |
| 1 | 140.0 | 0.0 | 1.592 | 3.032 | 0.10200 | 1.039 | 0.0121 | 0.0 | 0.04043; bottom hit; |
| 15 | 140.0 | 0.0 | 2.114 | 10.08 | 5.96740 | 1.362 | 0.117 | 0.0 | 0.0537; |
| 30 | 140.0 | 0.0 | 2.839 | 15.75 | 10.6748 | 1.825 | 0.267 | 0.0 | 0.0721; |
| 45 | 140.0 | 0.0 | 3.813 | 19.97 | 14.1715 | 2.448 | 0.468 | 0.0 | 0.09685; |
| 60 | 140.0 | 0.0 | 5.120 | 23.10 | 16.7714 | 3.286 | 0.740 | 0.0 | 0.1301; |
| 75 | 139.9 | 0.0 | 6.844 | 25.40 | 18.6839 | 4.397 | 1.099 | 0.0 | 0.1738; |
| 90 | 139.9 | 0.0 | 8.457 | 26.71 | 19.7740 | 5.450 | 1.434 | 0.0 | 0.2148; |
| 105 | 139.8 | 0.0 | 9.818 | 27.50 | 20.4347 | 6.377 | 1.723 | 0.0 | 0.2494; |
| 120 | 139.7 | 0.0 | 11.03 | 28.06 | 20.9001 | 7.245 | 1.986 | 0.0 | 0.2801; |
| 135 | 139.6 | 0.0 | 12.14 | 28.49 | 21.2591 | 8.095 | 2.232 | 0.0 | 0.3083; |
| 150 | 139.5 | 0.0 | 13.19 | 28.84 | 21.5537 | 8.958 | 2.470 | 0.0 | 0.3350; |
| 165 | 139.3 | 0.0 | 14.20 | 29.15 | 21.8071 | 9.863 | 2.704 | 0.0 | 0.3607; |
| 180 | 139.2 | 0.0 | 15.20 | 29.42 | 22.0332 | 10.84 | 2.938 | 0.0 | 0.3861; |
| 195 | 139.0 | 0.0 | 16.22 | 29.67 | 22.2412 | 11.93 | 3.178 | 0.0 | 0.4119; |
| 210 | 138.7 | 0.0 | 17.28 | 29.90 | 22.4373 | 13.17 | 3.426 | 0.0 | 0.4389; |
| 225 | 138.4 | 0.0 | 18.43 | 30.13 | 22.6264 | 14.65 | 3.687 | 0.0 | 0.4681; |
| 240 | 138.1 | 0.0 | 19.73 | 30.35 | 22.8120 | 16.46 | 3.966 | 0.0 | 0.5010; |
| 255 | 137.6 | 0.0 | 21.25 | 30.57 | 22.9967 | 18.77 | 4.270 | 0.0 | 0.5398; |
| 261 | 137.4 | 0.0 | 21.95 | 30.66 | 23.0708 | 19.89 | 4.400 | 0.0 | 0.5576; merging; |
| 270 | 137.0 | 0.0 | 23.03 | 30.79 | 23.1759 | 21.73 | 4.608 | 0.0 | 0.5851; |
| 285 | 136.1 | 0.0 | 25.07 | 30.99 | 23.3451 | 25.53 | 4.995 | 0.0 | 0.6367; |
| 300 | 134.9 | 0.0 | 27.78 | 31.20 | 23.5159 | 31.00 | 5.457 | 0.0 | 0.7056; |
| 315 | 132.8 | 0.0 | 31.89 | 31.41 | 23.6916 | 39.77 | 6.030 | 0.0 | 0.8099; |
| 330 | 129.8 | 0.0 | 38.03 | 31.60 | 23.8509 | 53.48 | 6.687 | 0.0 | 0.9659; |
| 345 | 125.7 | 0.0 | 46.09 | 31.74 | 23.9693 | 71.98 | 7.325 | 0.0 | 1.1707; |
| 360 | 120.4 | 0.0 | 56.87 | 31.84 | 24.0567 | 96.86 | 7.952 | 0.0 | 1.4445; |
| 375 | 113.3 | 0.0 | 71.52 | 31.92 | 24.1213 | 130.4 | 8.572 | 0.0 | 1.8166; |
| 390 | 104.0 | 0.0 | 91.85 | 31.98 | 24.1682 | 175.4 | 9.191 | 0.0 | 2.3330; |
| 405 | 91.20 | 0.0 | 124.2 | 32.02 | 24.1960 | 236.1 | 9.839 | 0.0 | 3.1547; |
| 420 | 72.95 | 0.0 | 176.4 | 32.06 | 24.2108 | 317.8 | 10.58 | 0.0 | 4.4812; |
| 431 | 54.36 | 0.0 | 238.0 | 32.11 | 24.2158 | 395.1 | 11.22 | 0.0 | 6.0445; trap level; |
| 435 | 45.75 | 0.0 | 286.6 | 32.13 | 24.2144 | 427.7 | 11.53 | 0.0 | 7.2784; |
| 438 | 37.41 | 0.0 | 349.8 | 32.16 | 24.2150 | 453.8 | 11.84 | 0.0 | 8.8844; trap level; |

Horiz plane projections in effluent direction: radius(m): 0.0; CL(m): 3.6101
Lmz(m): 3.6101
forced entrain 1 0.0 31.27 8.884 0.0386
Rate sec-1 0.0 dy-1 0.0 kt: 0.0 Amb Sal 32.7560
;
2:10:44 PM. amb fills: 4


Plumes 20 (UM3) Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
July 2014, minimum discharge (7.2 mgd) with maximum brine additions
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
minimum initial dilution, Dm = 237:1
Dm = 452.8
0
40
80
120
160
200
240
280
320
360
400
440
480
520
560
Initial Dilution, Dm

## D.3 Minimum SEOO Discharge with Maximum Brine Additions for August 2014 Density Profiles

Project "C:\Plumes20\Min-SEOO_Aug2014_Max-Brine"
memo

Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Medium
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 0.61
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 15
Maximum dilution reported 10000
Text output format : Standard
Max vertical reversals : to max rise or fall

/ UM3. 8/21/2022 2:35:01 PM
Case 1; ambient file C:\Plumes20\Max-SEOO_Aug2014_Max-Brine.001.db; Diffuser table record 1

Ambient Table:

| Depth | Amb-cur | Amb-dir | Amb-sal | Amb-tem | Amb-pol | Decay | Far-spd | Far-dir | Disprsn | Density |
|---|---|---|---|---|---|---|---|---|---|---|
| m | m/s | deg | psu | C | kg/kg | s-1 | m/s | deg | m0.67/s2 | sigma-T |
| 0.0 | 0.0 | 0.0 | 34.00 | 22.46 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.35347 |
| 3.048 | 0.0 | 0.0 | 34.00 | 22.46 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.35432 |
| 6.096 | 0.0 | 0.0 | 33.80 | 20.82 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.65416 |
| 9.143 | 0.0 | 0.0 | 33.53 | 19.86 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.70283 |
| 12.19 | 0.0 | 0.0 | 33.09 | 18.58 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.69328 |
| 15.24 | 0.0 | 0.0 | 32.91 | 16.52 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.04382 |
| 18.29 | 0.0 | 0.0 | 32.41 | 15.48 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.90214 |
| 21.33 | 0.0 | 0.0 | 32.44 | 15.40 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.93447 |
| 24.38 | 0.0 | 0.0 | 32.36 | 14.40 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.09144 |
| 27.43 | 0.0 | 0.0 | 32.19 | 13.79 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.08669 |
| 30.48 | 0.0 | 0.0 | 32.04 | 13.45 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.03956 |
| 33.53 | 0.0 | 0.0 | 31.93 | 12.88 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.06816 |
| 36.57 | 0.0 | 0.0 | 31.93 | 12.88 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.06816 |
| 39.62 | 0.0 | 0.0 | 31.93 | 12.88 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.06913 |
| 42.67 | 0.0 | 0.0 | 31.93 | 12.88 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.06913 |

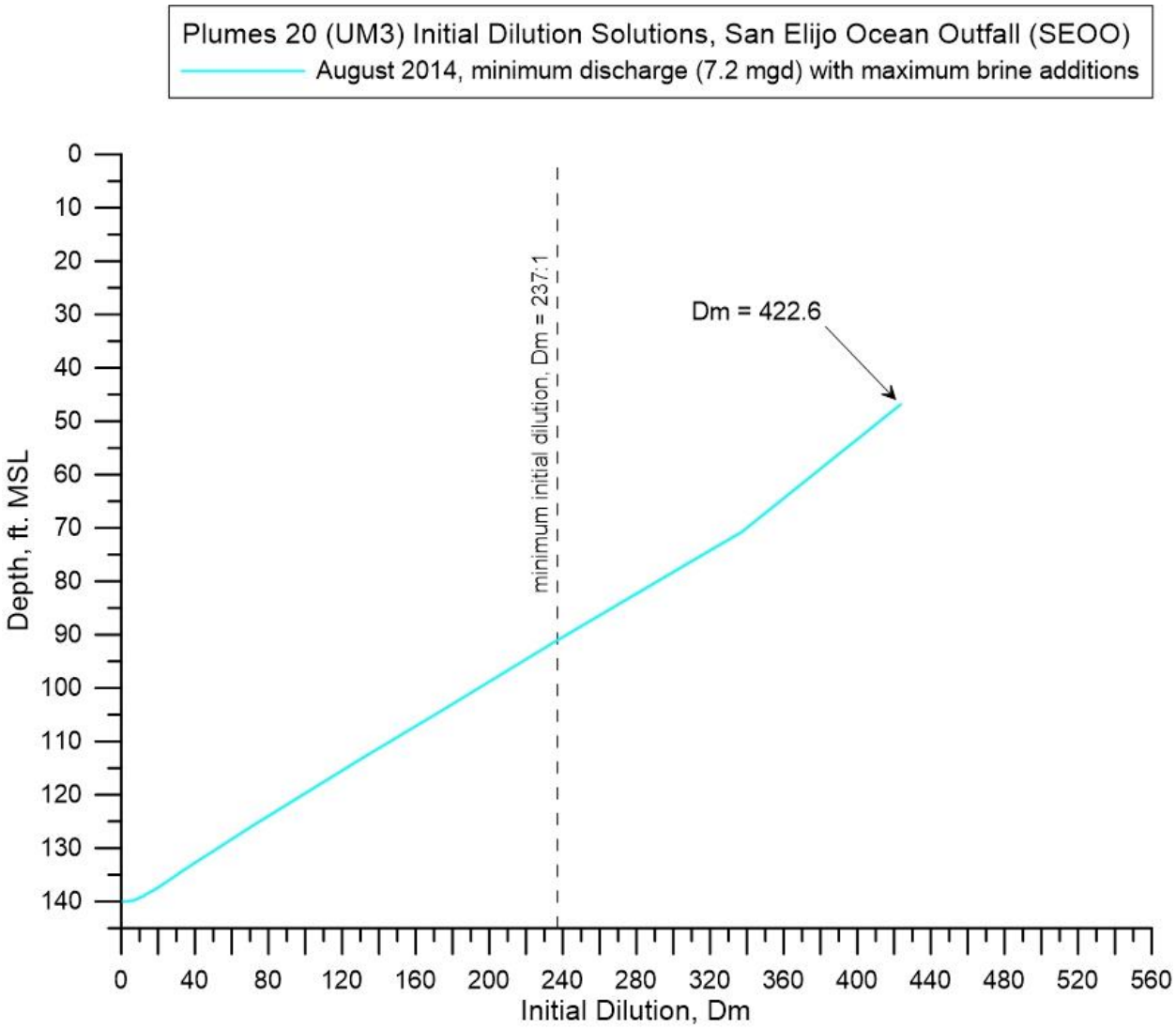
Diffuser table:

| P-dia | Ver angl | H-Angle | SourceX | SourceY | Ports | MZ-dis | Isoplth | P-depth | Ttl-flo | Eff-sal | Temp | Polutnt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in) | (deg) | (deg) | (m) | (m) | () | (m) | (concent) | (ft) | (MGD) | (psu) | (C) | (ppb) |
| 2.0000 | 0.0 | 0.0 | 0.0 | 0.0 | 200.00 | 2000.0 | 0.0 | 140.00 | 7.2000 | 1.8800 | 22.500 | 1200.0 |

Simulation:
Froude No: 12.95; Strat No: 2.67E-5; Spcg No: 14.05; k: 1.27E+5; eff den (sigmaT) -0.858500;
eff vel 1.276(m/s);
Current is very small, flow regime may be transient.

| Step | Depth (ft) | Amb-cur (m/s) | P-dia (in) | Eff-sal (psu) | Density (sigmaT) | Dilutn () | x-posn (m) | y-posn (m) | Iso dia (m) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 140.0 | 1.000E-5 | 1.562 | 1.880 | -0.85850 | 1.000 | 0.0 | 0.0 | 0.03968; | |
| 1 | 140.0 | 0.0 | 1.592 | 3.023 | 0.092036 | 1.039 | 0.0121 | 0.0 | 0.04043; | bottom hit; |
| 15 | 140.0 | 0.0 | 2.114 | 10.02 | 5.89895 | 1.362 | 0.117 | 0.0 | 0.0537; | |
| 30 | 140.0 | 0.0 | 2.839 | 15.65 | 10.5605 | 1.825 | 0.267 | 0.0 | 0.07211; | |
| 45 | 140.0 | 0.0 | 3.813 | 19.84 | 14.0237 | 2.448 | 0.468 | 0.0 | 0.09686; | |
| 60 | 140.0 | 0.0 | 5.121 | 22.95 | 16.5990 | 3.286 | 0.740 | 0.0 | 0.1301; | |
| 75 | 139.9 | 0.0 | 6.847 | 25.23 | 18.4960 | 4.400 | 1.099 | 0.0 | 0.1739; | |
| 90 | 139.9 | 0.0 | 8.473 | 26.54 | 19.5812 | 5.461 | 1.438 | 0.0 | 0.2152; | |
| 105 | 139.8 | 0.0 | 9.844 | 27.33 | 20.2369 | 6.393 | 1.729 | 0.0 | 0.2500; | |
| 120 | 139.7 | 0.0 | 11.06 | 27.88 | 20.6980 | 7.266 | 1.993 | 0.0 | 0.2810; | |
| 135 | 139.6 | 0.0 | 12.18 | 28.31 | 21.0533 | 8.120 | 2.241 | 0.0 | 0.3094; | |
| 150 | 139.5 | 0.0 | 13.23 | 28.66 | 21.3446 | 8.987 | 2.479 | 0.0 | 0.3361; | |
| 165 | 139.3 | 0.0 | 14.25 | 28.96 | 21.5950 | 9.896 | 2.714 | 0.0 | 0.3619; | |
| 180 | 139.2 | 0.0 | 15.25 | 29.23 | 21.8183 | 10.88 | 2.950 | 0.0 | 0.3875; | |
| 195 | 139.0 | 0.0 | 16.28 | 29.48 | 22.0236 | 11.97 | 3.190 | 0.0 | 0.4134; | |
| 210 | 138.7 | 0.0 | 17.34 | 29.71 | 22.2172 | 13.22 | 3.439 | 0.0 | 0.4405; | |
| 225 | 138.4 | 0.0 | 18.50 | 29.93 | 22.4038 | 14.70 | 3.701 | 0.0 | 0.4698; | |
| 240 | 138.1 | 0.0 | 19.80 | 30.15 | 22.5868 | 16.51 | 3.982 | 0.0 | 0.5028; | |
| 255 | 137.6 | 0.0 | 21.33 | 30.37 | 22.7689 | 18.82 | 4.287 | 0.0 | 0.5417; | |
| 261 | 137.4 | 0.0 | 22.03 | 30.46 | 22.8420 | 19.94 | 4.418 | 0.0 | 0.5595; | merging; |
| 270 | 137.0 | 0.0 | 23.10 | 30.58 | 22.9450 | 21.77 | 4.626 | 0.0 | 0.5867; | |
| 285 | 136.1 | 0.0 | 25.13 | 30.78 | 23.1117 | 25.55 | 5.014 | 0.0 | 0.6382; | |
| 300 | 134.8 | 0.0 | 27.84 | 30.99 | 23.2802 | 31.01 | 5.477 | 0.0 | 0.7071; | |
| 315 | 132.8 | 0.0 | 31.93 | 31.19 | 23.4535 | 39.74 | 6.052 | 0.0 | 0.8111; | |
| 330 | 129.8 | 0.0 | 38.08 | 31.38 | 23.6114 | 53.44 | 6.712 | 0.0 | 0.9673; | |
| 345 | 125.7 | 0.0 | 46.15 | 31.53 | 23.7289 | 71.91 | 7.355 | 0.0 | 1.1722; | |
| 360 | 120.4 | 0.0 | 56.91 | 31.63 | 23.8162 | 96.78 | 7.984 | 0.0 | 1.4455; | |
| 375 | 113.3 | 0.0 | 71.49 | 31.71 | 23.8809 | 130.2 | 8.606 | 0.0 | 1.8160; | |
| 390 | 104.0 | 0.0 | 91.74 | 31.77 | 23.9281 | 175.3 | 9.225 | 0.0 | 2.3303; | |
| 405 | 91.26 | 0.0 | 121.5 | 31.84 | 23.9605 | 235.9 | 9.864 | 0.0 | 3.0854; | |
| 420 | 74.69 | 0.0 | 152.5 | 31.96 | 23.9932 | 317.5 | 10.47 | 0.0 | 3.8744; | |
| 423 | 70.81 | 0.0 | 164.9 | 31.98 | 23.9948 | 336.9 | 10.59 | 0.0 | 4.1888; | trap level; |
| 435 | 46.84 | 0.0 | 403.2 | 32.08 | 23.9870 | 423.6 | 11.61 | 0.0 | 10.241; | trap level; |

Horiz plane projections in effluent direction: radius(m): 0.0; CL(m): 3.5376
Lmz(m): 3.5376
forced entrain 1 0.0 28.40 10.24 0.0528
Rate sec-1 0.0 dy-1 0.0 kt: 0.0 Amb Sal 32.8816
;
2:35:01 PM. amb fills: 4


Plumes 20 (UM3) Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
August 2014, minimum discharge (7.2 mgd) with maximum brine additions
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
minimum initial dilution, Dm = 237:1
Dm = 422.6
0
40
80
120
160
200
240
280
320
360
400
440
480
520
560
Initial Dilution, Dm

# APPENDIX E:
# Plumes 20 Initial Dilution Results for Discharge Scenario #4: Minimum Discharge Rate (7.2 mgd) with Maximum Brine Additions based on Autumn Density Profiles from September 2014 Through November 2014

## E.1 Minimum SEOO Discharge with Maximum Brine Additions for September 2014 Density Profiles

Project "C:\Plumes20\Min-SEOO_Sept2014_Max-Brine"
memo

Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Medium
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 0.61
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 15
Maximum dilution reported 10000
Text output format : Standard
Max vertical reversals : to max rise or fall

/ UM3. 8/22/2022 9:57:10 AM
Case 1; ambient file C:\Plumes20\Max-SEOO_Sept2014_Max-Brine.001.db; Diffuser table record 1:

Ambient Table:

| Depth | Amb-cur | Amb-dir | Amb-sal | Amb-tem | Amb-pol | Decay | Far-spd | Far-dir | Disprsn | Density |
|---|---|---|---|---|---|---|---|---|---|---|
| m | m/s | deg | psu | C | kg/kg | s-1 | m/s | deg | m0.67/s2 | sigma-T |
| 0.0 | 0.0 | 0.0 | 34.00 | 21.44 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.63623 |
| 3.048 | 0.0 | 0.0 | 33.97 | 21.44 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.61815 |
| 6.096 | 0.0 | 0.0 | 33.88 | 19.42 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.08204 |
| 9.143 | 0.0 | 0.0 | 33.53 | 17.25 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.35451 |
| 12.19 | 0.0 | 0.0 | 33.05 | 16.55 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.14732 |
| 15.24 | 0.0 | 0.0 | 33.06 | 16.11 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.25544 |
| 18.29 | 0.0 | 0.0 | 32.92 | 15.90 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.20016 |
| 21.33 | 0.0 | 0.0 | 32.84 | 15.76 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.16109 |
| 24.38 | 0.0 | 0.0 | 32.88 | 15.40 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.27863 |
| 27.43 | 0.0 | 0.0 | 32.68 | 14.81 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.24765 |
| 30.48 | 0.0 | 0.0 | 32.45 | 14.50 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.14262 |
| 33.53 | 0.0 | 0.0 | 32.46 | 14.22 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.20605 |
| 36.57 | 0.0 | 0.0 | 32.46 | 14.22 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.20605 |
| 39.62 | 0.0 | 0.0 | 32.50 | 14.17 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.24721 |
| 42.67 | 0.0 | 0.0 | 32.50 | 14.17 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.24721 |

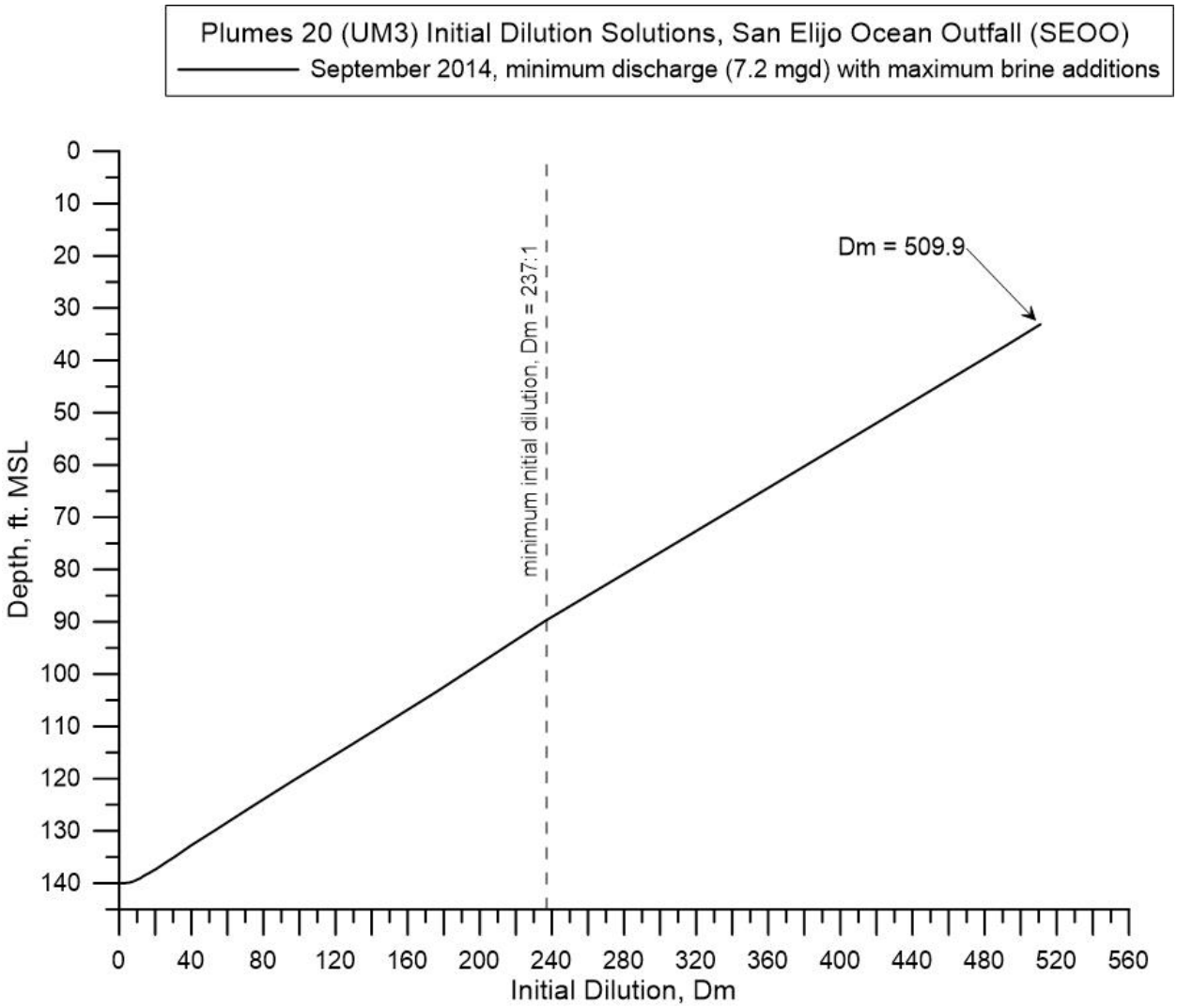
Diffuser table:

| P-dia | Ver angl | H-Angle | SourceX | SourceY | Ports | MZ-dis | Isoplth | P-depth | Ttl-flo | Eff-sal | Temp | Polutnt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in) | (deg) | (deg) | (m) | (m) | () | (m) | (concent) | (ft) | (MGD) | (psu) | (C) | (ppb) |
| 2.0000 | 0.0 | 0.0 | 0.0 | 0.0 | 200.00 | 2000.0 | 0.0 | 140.00 | 7.2000 | 1.8800 | 22.500 | 1200.0 |

Simulation:
Froude No: 12.90; Strat No: 2.26E-5; Spcg No: 14.05; k: 1.27E+5; eff den (sigmaT) -0.858500;
eff vel 1.276(m/s);
Current is very small, flow regime may be transient.

| Step | Depth (ft) | Amb-cur (m/s) | P-dia (in) | Eff-sal (psu) | Density (sigmaT) | Dilutn () | x-posn (m) | y-posn (m) | Iso dia (m) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 140.0 | 1.000E-5 | 1.562 | 1.880 | -0.85850 | 1.000 | 0.0 | 0.0 | 0.03968; | |
| 1 | 140.0 | 0.0 | 1.592 | 3.045 | 0.097028 | 1.039 | 0.0121 | 0.0 | 0.04043; | bottom hit; |
| 15 | 140.0 | 0.0 | 2.114 | 10.18 | 5.93677 | 1.362 | 0.117 | 0.0 | 0.0537; | |
| 30 | 140.0 | 0.0 | 2.839 | 15.91 | 10.6290 | 1.825 | 0.267 | 0.0 | 0.07211; | |
| 45 | 140.0 | 0.0 | 3.813 | 20.18 | 14.1174 | 2.448 | 0.468 | 0.0 | 0.09685; | |
| 60 | 140.0 | 0.0 | 5.121 | 23.34 | 16.7128 | 3.286 | 0.740 | 0.0 | 0.1301; | |
| 75 | 139.9 | 0.0 | 6.844 | 25.67 | 18.6229 | 4.398 | 1.099 | 0.0 | 0.1738; | |
| 90 | 139.9 | 0.0 | 8.458 | 27.00 | 19.7121 | 5.451 | 1.435 | 0.0 | 0.2148; | |
| 105 | 139.8 | 0.0 | 9.820 | 27.80 | 20.3722 | 6.378 | 1.724 | 0.0 | 0.2494; | |
| 120 | 139.7 | 0.0 | 11.03 | 28.36 | 20.8372 | 7.246 | 1.986 | 0.0 | 0.2802; | |
| 135 | 139.6 | 0.0 | 12.14 | 28.80 | 21.1958 | 8.096 | 2.233 | 0.0 | 0.3084; | |
| 150 | 139.5 | 0.0 | 13.19 | 29.16 | 21.4901 | 8.960 | 2.470 | 0.0 | 0.3350; | |
| 165 | 139.3 | 0.0 | 14.20 | 29.46 | 21.7433 | 9.865 | 2.704 | 0.0 | 0.3607; | |
| 180 | 139.2 | 0.0 | 15.20 | 29.74 | 21.9692 | 10.84 | 2.939 | 0.0 | 0.3861; | |
| 195 | 139.0 | 0.0 | 16.22 | 29.99 | 22.1770 | 11.93 | 3.178 | 0.0 | 0.4119; | |
| 210 | 138.7 | 0.0 | 17.28 | 30.23 | 22.3730 | 13.18 | 3.426 | 0.0 | 0.4389; | |
| 225 | 138.4 | 0.0 | 18.43 | 30.46 | 22.5619 | 14.65 | 3.687 | 0.0 | 0.4682; | |
| 240 | 138.1 | 0.0 | 19.73 | 30.68 | 22.7473 | 16.46 | 3.967 | 0.0 | 0.5011; | |
| 255 | 137.6 | 0.0 | 21.25 | 30.91 | 22.9319 | 18.77 | 4.271 | 0.0 | 0.5398; | |
| 261 | 137.4 | 0.0 | 21.95 | 31.00 | 23.0060 | 19.89 | 4.401 | 0.0 | 0.5577; | merging; |
| 270 | 137.0 | 0.0 | 23.04 | 31.12 | 23.1110 | 21.73 | 4.608 | 0.0 | 0.5851; | |
| 285 | 136.1 | 0.0 | 25.07 | 31.33 | 23.2800 | 25.52 | 4.996 | 0.0 | 0.6367; | |
| 300 | 134.9 | 0.0 | 27.78 | 31.54 | 23.4508 | 30.99 | 5.457 | 0.0 | 0.7056; | |
| 315 | 132.8 | 0.0 | 31.88 | 31.75 | 23.6263 | 39.75 | 6.030 | 0.0 | 0.8098; | |
| 330 | 129.8 | 0.0 | 38.02 | 31.94 | 23.7856 | 53.47 | 6.687 | 0.0 | 0.9658; | |
| 345 | 125.7 | 0.0 | 46.17 | 32.08 | 23.9022 | 71.95 | 7.327 | 0.0 | 1.1728; | |
| 360 | 120.3 | 0.0 | 57.44 | 32.18 | 23.9841 | 96.83 | 7.964 | 0.0 | 1.4590; | |
| 375 | 113.2 | 0.0 | 73.18 | 32.25 | 24.0412 | 130.3 | 8.614 | 0.0 | 1.8587; | |
| 390 | 103.5 | 0.0 | 95.28 | 32.31 | 24.0810 | 175.4 | 9.277 | 0.0 | 2.4202; | |
| 405 | 89.90 | 0.0 | 129.4 | 32.36 | 24.1057 | 236.0 | 10.01 | 0.0 | 3.2876; | |
| 420 | 73.11 | 0.0 | 148.8 | 32.47 | 24.1455 | 317.7 | 10.63 | 0.0 | 3.7800; | |
| 435 | 50.45 | 0.0 | 218.2 | 32.58 | 24.1596 | 427.5 | 11.26 | 0.0 | 5.5428; | |
| 442 | 37.32 | 0.0 | 241.5 | 32.64 | 24.1677 | 491.1 | 11.56 | 0.0 | 6.1351; | trap level; |
| 444 | 33.10 | 0.0 | 259.6 | 32.66 | 24.1688 | 510.9 | 11.65 | 0.0 | 6.5945; | trap level; |

Horiz plane projections in effluent direction: radius(m): 0.0; CL(m): 3.5508
Lmz(m): 3.5508
forced entrain 1 0.0 32.58 6.594 0.022
Rate sec-1 0.0 dy-1 0.0 kt: 0.0 Amb Sal 33.2790
;
9:57:10 AM. amb fills: 4


Plumes 20 (UM3) Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
September 2014, minimum discharge (7.2 mgd) with maximum brine additions
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
minimum initial dilution, Dm = 237:1
Dm = 509.9
0
40
80
120
160
200
240
280
320
360
400
440
480
520
560
Initial Dilution, Dm

## E.2 Minimum SEOO Discharge with Maximum Brine Additions for October 2014 Density Profiles

Project "C:\Plumes20\Min-SEOO_Oct2014_Max-Brine"
memo

Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Medium
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 0.61
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 15
Maximum dilution reported 10000
Text output format : Standard
Max vertical reversals : to max rise or fall

/ UM3. 8/22/2022 10:43:12 AM
Case 1; ambient file C:\Plumes20\Min-SEOO_Oct2014_Max-Brine.001.db; Diffuser table record 1

Ambient Table:

| Depth | Amb-cur | Amb-dir | Amb-sal | Amb-tem | Amb-pol | Decay | Far-spd | Far-dir | Disprsn | Density |
|---|---|---|---|---|---|---|---|---|---|---|
| m | m/s | deg | psu | C | kg/kg | s-1 | m/s | deg | m0.67/s2 | sigma-T |
| 0.0 | 0.0 | 0.0 | 33.50 | 21.28 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.30255 |
| 3.048 | 0.0 | 0.0 | 33.52 | 21.29 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.31322 |
| 6.096 | 0.0 | 0.0 | 33.50 | 21.28 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.30104 |
| 9.143 | 0.0 | 0.0 | 33.47 | 21.15 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.31202 |
| 12.19 | 0.0 | 0.0 | 33.46 | 20.89 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.37808 |
| 15.24 | 0.0 | 0.0 | 33.43 | 20.55 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.44574 |
| 18.29 | 0.0 | 0.0 | 33.27 | 19.80 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.51859 |
| 21.33 | 0.0 | 0.0 | 33.05 | 19.31 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.47883 |
| 24.38 | 0.0 | 0.0 | 32.99 | 18.56 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.62385 |
| 27.43 | 0.0 | 0.0 | 32.86 | 18.06 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.64193 |
| 30.48 | 0.0 | 0.0 | 32.81 | 17.54 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.72833 |
| 33.53 | 0.0 | 0.0 | 32.65 | 16.72 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.79972 |
| 36.57 | 0.0 | 0.0 | 32.65 | 16.72 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.79972 |
| 39.62 | 0.0 | 0.0 | 32.65 | 16.72 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.80171 |
| 42.67 | 0.0 | 0.0 | 32.65 | 16.72 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 23.80171 |

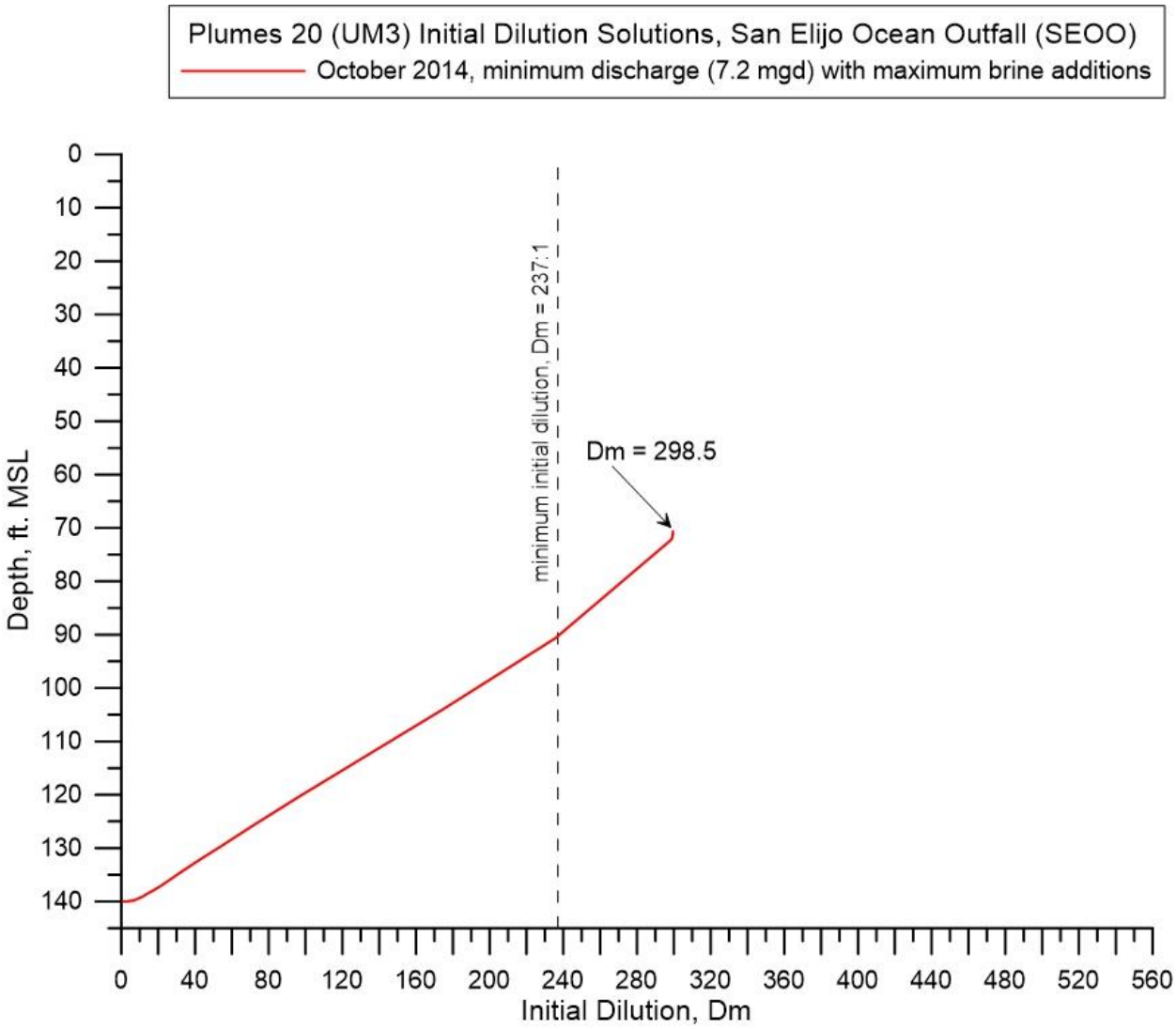
Diffuser table:

| P-dia | Ver angl | H-Angle | SourceX | SourceY | Ports | MZ-dis | Isoplth | P-depth | Ttl-flo | Eff-sal | Temp | Polutnt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in) | (deg) | (deg) | (m) | (m) | () | (m) | (concent) | (ft) | (MGD) | (psu) | (C) | (ppb) |
| 2.0000 | 0.0 | 0.0 | 0.0 | 0.0 | 200.00 | 2000.0 | 0.0 | 140.00 | 7.2000 | 1.8800 | 22.500 | 1200.0 |

Simulation:
Froude No: 13.02; Strat No: 1.88E-5; Spcg No: 14.05; k: 1.27E+5; eff den (sigmaT) -0.858500;
eff vel 1.276(m/s);
Current is very small, flow regime may be transient.

| Step | Depth (ft) | Amb-cur (m/s) | P-dia (in) | Eff-sal (psu) | Density (sigmaT) | Dilutn () | x-posn (m) | y-posn (m) | Iso dia (m) |
|---|---|---|---|---|---|---|---|---|---|
| 0 | 140.0 | 1.000E-5 | 1.562 | 1.880 | -0.85850 | 1.000 | 0.0 | 0.0 | 0.03968; |
| 1 | 140.0 | 0.0 | 1.592 | 3.050 | 0.078147 | 1.039 | 0.0121 | 0.0 | 0.04043; bottom hit; |
| 15 | 140.0 | 0.0 | 2.114 | 10.22 | 5.80798 | 1.363 | 0.117 | 0.0 | 0.05371; |
| 30 | 140.0 | 0.0 | 2.839 | 15.98 | 10.4155 | 1.825 | 0.267 | 0.0 | 0.07211; |
| 45 | 140.0 | 0.0 | 3.814 | 20.27 | 13.8428 | 2.449 | 0.469 | 0.0 | 0.09687; |
| 60 | 140.0 | 0.0 | 5.122 | 23.45 | 16.3936 | 3.287 | 0.740 | 0.0 | 0.1301; |
| 75 | 139.9 | 0.0 | 6.851 | 25.79 | 18.2758 | 4.403 | 1.100 | 0.0 | 0.1740; |
| 90 | 139.9 | 0.0 | 8.488 | 27.14 | 19.3563 | 5.470 | 1.441 | 0.0 | 0.2156; |
| 105 | 139.8 | 0.0 | 9.867 | 27.95 | 20.0074 | 6.407 | 1.733 | 0.0 | 0.2506; |
| 120 | 139.7 | 0.0 | 11.09 | 28.51 | 20.4647 | 7.284 | 1.999 | 0.0 | 0.2817; |
| 135 | 139.6 | 0.0 | 12.21 | 28.95 | 20.8167 | 8.142 | 2.248 | 0.0 | 0.3102; |
| 150 | 139.5 | 0.0 | 13.27 | 29.31 | 21.1051 | 9.012 | 2.487 | 0.0 | 0.3371; |
| 165 | 139.3 | 0.0 | 14.29 | 29.62 | 21.3530 | 9.923 | 2.723 | 0.0 | 0.3630; |
| 180 | 139.2 | 0.0 | 15.30 | 29.89 | 21.5739 | 10.91 | 2.960 | 0.0 | 0.3886; |
| 195 | 139.0 | 0.0 | 16.32 | 30.14 | 21.7770 | 12.00 | 3.201 | 0.0 | 0.4146; |
| 210 | 138.7 | 0.0 | 17.39 | 30.38 | 21.9684 | 13.25 | 3.451 | 0.0 | 0.4418; |
| 225 | 138.4 | 0.0 | 18.55 | 30.61 | 22.1529 | 14.73 | 3.714 | 0.0 | 0.4712; |
| 240 | 138.1 | 0.0 | 19.85 | 30.83 | 22.3338 | 16.55 | 3.995 | 0.0 | 0.5043; |
| 255 | 137.6 | 0.0 | 21.38 | 31.06 | 22.5139 | 18.86 | 4.301 | 0.0 | 0.5432; |
| 260 | 137.4 | 0.0 | 21.97 | 31.13 | 22.5740 | 19.78 | 4.409 | 0.0 | 0.5580; merging; |
| 270 | 137.0 | 0.0 | 23.15 | 31.27 | 22.6874 | 21.80 | 4.640 | 0.0 | 0.5880; |
| 285 | 136.1 | 0.0 | 25.17 | 31.47 | 22.8520 | 25.57 | 5.030 | 0.0 | 0.6394; |
| 300 | 134.8 | 0.0 | 27.88 | 31.68 | 23.0186 | 31.01 | 5.494 | 0.0 | 0.7082; |
| 315 | 132.8 | 0.0 | 31.97 | 31.89 | 23.1901 | 39.71 | 6.069 | 0.0 | 0.8119; |
| 330 | 129.8 | 0.0 | 38.12 | 32.09 | 23.3468 | 53.38 | 6.733 | 0.0 | 0.9682; |
| 345 | 125.7 | 0.0 | 46.20 | 32.23 | 23.4636 | 71.84 | 7.379 | 0.0 | 1.1735; |
| 360 | 120.3 | 0.0 | 56.99 | 32.34 | 23.5502 | 96.68 | 8.012 | 0.0 | 1.4474; |
| 375 | 113.3 | 0.0 | 71.62 | 32.42 | 23.6143 | 130.1 | 8.637 | 0.0 | 1.8191; |
| 390 | 103.9 | 0.0 | 92.37 | 32.48 | 23.6595 | 175.1 | 9.262 | 0.0 | 2.3463; |
| 405 | 90.64 | 0.0 | 135.4 | 32.56 | 23.6747 | 235.7 | 9.975 | 0.0 | 3.4389; trap level; |
| 420 | 72.26 | 0.0 | 374.7 | 32.64 | 23.6661 | 298.4 | 11.14 | 0.0 | 9.5163; |
| 422 | 71.92 | 0.0 | 431.4 | 32.64 | 23.6658 | 299.0 | 11.18 | 0.0 | 10.959; begin overlap; |
| 435 | 71.08 | 0.0 | 735.9 | 32.64 | 23.6656 | 299.5 | 11.30 | 0.0 | 18.691; |
| 450 | 70.83 | 0.0 | 1062.7 | 32.64 | 23.6656 | 299.5 | 11.36 | 0.0 | 26.993; |
| 465 | 70.73 | 0.0 | 1377.9 | 32.64 | 23.6656 | 299.5 | 11.39 | 0.0 | 34.998; |
| 480 | 70.68 | 0.0 | 1682.2 | 32.64 | 23.6656 | 299.5 | 11.40 | 0.0 | 42.727; |
| 495 | 70.66 | 0.0 | 1974.9 | 32.64 | 23.6656 | 299.5 | 11.42 | 0.0 | 50.163; |
| 510 | 70.64 | 0.0 | 2255.1 | 32.64 | 23.6656 | 299.5 | 11.43 | 0.0 | 57.279; |
| 525 | 70.63 | 0.0 | 2521.3 | 32.64 | 23.6656 | 299.5 | 11.44 | 0.0 | 64.042; |
| 534 | 70.62 | 0.0 | 2673.9 | 32.64 | 23.6656 | 299.5 | 11.44 | 0.0 | 67.917; surface; |

Horiz plane projections in effluent direction: radius(m): 0.0; CL(m): 3.4869
Lmz(m): 3.4869
forced entrain 1 0.0 21.15 67.92 0.635
Rate sec-1 0.0 dy-1 0.0 kt: 0.0 Amb Sal 33.0475
;
10:43:12 AM. amb fills: 4


Plumes 20 (UM3) Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
October 2014, minimum discharge (7.2 mgd) with maximum brine additions
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
minimum initial dilution, Dm = 237:1
Dm = 298.5
0
40
80
120
160
200
240
280
320
360
400
440
480
520
560
Initial Dilution, Dm

## E.3 Minimum SEOO Discharge with Maximum Brine Additions for November 2013 Density Profiles

Project "C:\Plumes20\Min-SEOO_Nov2013_Max-Brine"
memo

Model configuration items checked:
Channel width (m) 100
Start case for graphs 1
Max detailed graphs 10 (limits plots that can overflow memory)
Elevation Projection Plane (deg) 0
Shore vector (m,deg) not checked
Bacteria model : Mancini (1978) coliform model
PDS sfc. model heat transfer : Medium
Equation of State : S, T
Similarity Profile : Default profile (k=2.0, ...)
Diffuser port contraction coefficient 0.61
Light absorption coefficient 0.16
Farfield increment (m) 200
UM3 aspiration coefficient 0.1
Output file: text output tab
Output each ?? steps 15
Maximum dilution reported 10000
Text output format : Standard
Max vertical reversals : to max rise or fall

/ UM3. 8/22/2022 11:15:11 AM
Case 1; ambient file C:\Plumes20\Min-SEOO_Nov2013_Max-Brine.001.db; Diffuser table record 1

Ambient Table:

| Depth | Amb-cur | Amb-dir | Amb-sal | Amb-tem | Amb-pol | Decay | Far-spd | Far-dir | Disprsn | Density |
|---|---|---|---|---|---|---|---|---|---|---|
| m | m/s | deg | psu | C | kg/kg | s-1 | m/s | deg | m0.67/s2 | sigma-T |
| 0.0 | 0.0 | 0.0 | 33.52 | 16.11 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.60806 |
| 3.048 | 0.0 | 0.0 | 33.52 | 16.09 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.61428 |
| 6.096 | 0.0 | 0.0 | 33.59 | 16.01 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.68104 |
| 9.143 | 0.0 | 0.0 | 33.60 | 15.98 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.69766 |
| 12.19 | 0.0 | 0.0 | 33.56 | 15.97 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.67054 |
| 15.24 | 0.0 | 0.0 | 33.62 | 15.97 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.71824 |
| 18.29 | 0.0 | 0.0 | 33.59 | 15.93 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.70539 |
| 21.33 | 0.0 | 0.0 | 33.53 | 15.75 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.69856 |
| 24.38 | 0.0 | 0.0 | 33.53 | 15.43 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.77075 |
| 27.43 | 0.0 | 0.0 | 33.38 | 15.04 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.73492 |
| 30.48 | 0.0 | 0.0 | 33.35 | 14.87 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.75546 |
| 33.53 | 0.0 | 0.0 | 33.37 | 14.84 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.77081 |
| 36.57 | 0.0 | 0.0 | 33.37 | 14.84 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.77081 |
| 39.62 | 0.0 | 0.0 | 33.40 | 14.83 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.79868 |
| 42.67 | 0.0 | 0.0 | 33.40 | 14.83 | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 | 24.79868 |

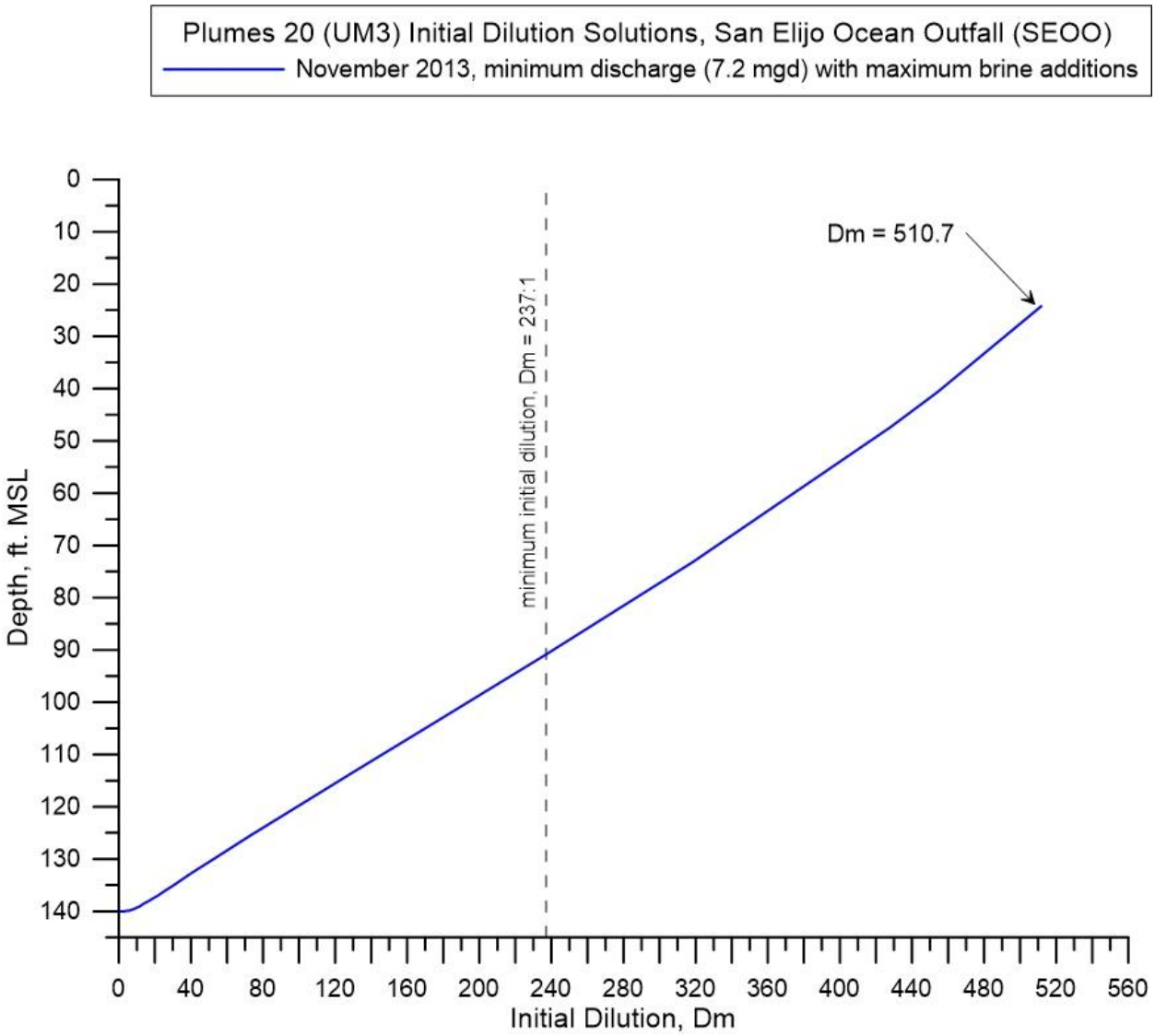
Diffuser table:

| P-dia | Ver angl | H-Angle | SourceX | SourceY | Ports | MZ-dis | Isoplth | P-depth | Ttl-flo | Eff-sal | Temp | Polutnt |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| (in) | (deg) | (deg) | (m) | (m) | () | (m) | (concent) | (ft) | (MGD) | (psu) | (C) | (ppb) |
| 2.0000 | 0.0 | 0.0 | 0.0 | 0.0 | 200.00 | 2000.0 | 0.0 | 140.00 | 7.2000 | 1.8800 | 22.500 | 1200.0 |

Simulation:
Froude No: 12.76; Strat No: 6.91E-6; Spcg No: 14.05; k: 1.27E+5; eff den (sigmaT) -0.858500;
eff vel 1.276(m/s);
Current is very small, flow regime may be transient.

| Step | Depth (ft) | Amb-cur (m/s) | P-dia (in) | Eff-sal (psu) | Density (sigmaT) | Dilutn () | x-posn (m) | y-posn (m) | Iso dia (m) | |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 140.0 | 1.000E-5 | 1.562 | 1.880 | -0.85850 | 1.000 | 0.0 | 0.0 | 0.03968; | |
| 1 | 140.0 | 0.0 | 1.592 | 3.080 | 0.11749 | 1.039 | 0.0121 | 0.0 | 0.04043; | bottom hit; |
| 15 | 140.0 | 0.0 | 2.114 | 10.42 | 6.08045 | 1.362 | 0.117 | 0.0 | 0.0537; | |
| 30 | 140.0 | 0.0 | 2.839 | 16.33 | 10.8738 | 1.825 | 0.266 | 0.0 | 0.0721; | |
| 45 | 140.0 | 0.0 | 3.813 | 20.71 | 14.4388 | 2.447 | 0.468 | 0.0 | 0.09684; | |
| 60 | 140.0 | 0.0 | 5.119 | 23.97 | 17.0919 | 3.285 | 0.740 | 0.0 | 0.1300; | |
| 75 | 139.9 | 0.0 | 6.834 | 26.36 | 19.0374 | 4.390 | 1.096 | 0.0 | 0.1736; | |
| 90 | 139.9 | 0.0 | 8.417 | 27.71 | 20.1384 | 5.425 | 1.426 | 0.0 | 0.2138; | |
| 105 | 139.8 | 0.0 | 9.757 | 28.53 | 20.8107 | 6.338 | 1.711 | 0.0 | 0.2478; | |
| 120 | 139.7 | 0.0 | 10.95 | 29.11 | 21.2863 | 7.194 | 1.969 | 0.0 | 0.2781; | |
| 135 | 139.6 | 0.0 | 12.05 | 29.56 | 21.6541 | 8.035 | 2.213 | 0.0 | 0.3059; | |
| 150 | 139.5 | 0.0 | 13.08 | 29.93 | 21.9565 | 8.889 | 2.447 | 0.0 | 0.3322; | |
| 165 | 139.3 | 0.0 | 14.08 | 30.25 | 22.2171 | 9.785 | 2.679 | 0.0 | 0.3576; | |
| 180 | 139.2 | 0.0 | 15.07 | 30.54 | 22.4499 | 10.75 | 2.911 | 0.0 | 0.3827; | |
| 195 | 139.0 | 0.0 | 16.07 | 30.80 | 22.6642 | 11.83 | 3.147 | 0.0 | 0.4083; | |
| 210 | 138.7 | 0.0 | 17.13 | 31.04 | 22.8666 | 13.07 | 3.393 | 0.0 | 0.4350; | |
| 225 | 138.4 | 0.0 | 18.27 | 31.28 | 23.0618 | 14.54 | 3.652 | 0.0 | 0.4640; | |
| 240 | 138.1 | 0.0 | 19.55 | 31.52 | 23.2535 | 16.34 | 3.929 | 0.0 | 0.4967; | |
| 255 | 137.6 | 0.0 | 21.07 | 31.75 | 23.4445 | 18.65 | 4.230 | 0.0 | 0.5352; | |
| 263 | 137.3 | 0.0 | 22.02 | 31.87 | 23.5467 | 20.17 | 4.404 | 0.0 | 0.5593; | merging; |
| 270 | 137.0 | 0.0 | 22.87 | 31.98 | 23.6313 | 21.63 | 4.565 | 0.0 | 0.5810; | |
| 285 | 136.1 | 0.0 | 24.91 | 32.19 | 23.8066 | 25.45 | 4.949 | 0.0 | 0.6328; | |
| 300 | 134.9 | 0.0 | 27.64 | 32.41 | 23.9831 | 30.96 | 5.407 | 0.0 | 0.7020; | |
| 315 | 132.8 | 0.0 | 31.76 | 32.63 | 24.1645 | 39.81 | 5.977 | 0.0 | 0.8067; | |
| 330 | 129.8 | 0.0 | 37.88 | 32.83 | 24.3273 | 53.55 | 6.624 | 0.0 | 0.9621; | |
| 345 | 125.7 | 0.0 | 45.95 | 32.97 | 24.4471 | 72.07 | 7.254 | 0.0 | 1.1672; | |
| 360 | 120.4 | 0.0 | 56.97 | 33.08 | 24.5329 | 96.99 | 7.877 | 0.0 | 1.4470; | |
| 375 | 113.3 | 0.0 | 72.18 | 33.15 | 24.5941 | 130.5 | 8.506 | 0.0 | 1.8335; | |
| 390 | 103.8 | 0.0 | 92.98 | 33.21 | 24.6389 | 175.7 | 9.140 | 0.0 | 2.3618; | |
| 405 | 90.98 | 0.0 | 124.1 | 33.25 | 24.6681 | 236.4 | 9.794 | 0.0 | 3.1517; | |
| 420 | 73.22 | 0.0 | 165.3 | 33.30 | 24.6896 | 318.2 | 10.49 | 0.0 | 4.1995; | |
| 435 | 47.34 | 0.0 | 259.4 | 33.37 | 24.6952 | 428.2 | 11.32 | 0.0 | 6.5885; | |
| 438 | 40.60 | 0.0 | 280.9 | 33.38 | 24.6960 | 454.4 | 11.53 | 0.0 | 7.1357; | trap level; |
| 444 | 24.25 | 0.0 | 375.1 | 33.41 | 24.6949 | 511.7 | 12.04 | 0.0 | 9.5275; | trap level; |

Horiz plane projections in effluent direction: radius(m): 0.0; CL(m): 3.6707
Lmz(m): 3.6707
forced entrain 1 0.0 35.28 9.528 0.0323
Rate sec-1 0.0 dy-1 0.0 kt: 0.0 Amb Sal 33.5954
;
11:15:12 AM. amb fills: 4


Plumes 20 (UM3) Initial Dilution Solutions, San Elijo Ocean Outfall (SEOO)
November 2013, minimum discharge (7.2 mgd) with maximum brine additions
Dm = 510.7
minimum initial dilution, Dm = 237:1
Depth, ft. MSL
0
10
20
30
40
50
60
70
80
90
100
110
120
130
140
0
40
80
120
160
200
240
280
320
360
400
440
480
520
560
Initial Dilution, Dm