Hugh Nguyen, Clerk-Recorder

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Notice of Determination

Appendix D

To:

☒ Office of Planning and Research

U.S. Mail: P.O. Box 3044, Sacramento, CA 95812-3044

Street Address: 1400 Tenth St., Rm 113, Sacramento, CA 95814

☒ County Clerk
County of: Orange
Address: 24031 El Toro Road
Laguna Hills, CA 92653

Public Agency: Irvine Ranch Water District
Address: 15600 Sand Canyon Blvd
Irvine, CA 92618
Contact: Jo Ann Corey
Phone: (949) 453-5300

Lead Agency (if different from above):

Address:

Contact:
Phone:

FILED MAR 27 2018 ORANGE COUNTY CLERK-RECORDER DEPARTMENT BY: DEPUTY

SUBJECT: Filing of Notice of Determination in compliance with Section 21108 or 21152 of the Public Resources Code.

State Clearinghouse Number (if submitted to State Clearinghouse): 2005051174, 2011031091

Project Title: Michelson Water Recycling Plant (MWRP) Phase 2 and 3 Capacity Expansion Project

Project Applicant: Irvine Ranch Water District (IRWD)

Project Location (include county): 3512 Michelson Drive, Irvine, CA; Orange County

Project Description:
IRWD has prepared Addendum No. 4 to the Final Environmental Impact Report (EIR) for the MWRP Phase 2 and 3 Capacity Expansion Project. IRWD proposes to modify the Project to allow the discharge of tertiary-treated recycled water to San Diego Creek for critical operational flexibility (i.e. emergency situations) under certain defined conditions during winter months, when all other diversion alternatives have been implemented or are unavailable.

FILED MAR 27 2018 HUGH NGUYEN, CLERK-RECORDER BY: DEPUTY

30-2018-0291

This is to advise that the Irvine Ranch Water District has approved the above (☒ Lead Agency or ☐ Responsible Agency) described project on March 26, 2018 (date) and has made the following determinations regarding the above described project.

1. The project [☐ will ☒ will not] have a significant effect on the environment.
2. ☒ An Environmental Impact Report was prepared for this project pursuant to the provisions of CEQA.
   ☐ A Negative Declaration was prepared for this project pursuant to the provisions of CEQA.
3. Mitigation measures [☒ were ☐ were not] made a condition of the approval of the project.
4. A mitigation reporting or monitoring plan [☒ was ☐ was not] adopted for this project.
5. A statement of Overriding Considerations [☐ was ☒ was not] adopted for this project.
6. Findings [☒ were ☐ were not] made pursuant to the provisions of CEQA.

This is to certify that the final EIR with comments and responses and record of project approval, or the negative Declaration, is available to the General Public at:
www.irwd.com

Signature (Public Agency): [signature] Title: Environmental Compliance Specialist

Date: March 27, 2018 Date Received for filing at OPR:

Authority cited: Sections 21083, Public Resources Code.
Reference Section 21000-21174, Public Resources Code.

Revised 2011

Addendum No. 4 to the

MICHELSON WATER RECLAMATION PLANT PHASE 2 AND 3 CAPACITY EXPANSION PROJECT

Final Environmental Impact Report (State Clearinghouse No. 2005051174, 2011031091)

Prepared for:
Irvine Ranch Water District
15600 Sand Canyon Avenue
Irvine, CA 92618

March 2018

ESA

Addendum No. 4 to the

MICHELSON WATER RECLAMATION PLANT PHASE 2 AND 3 CAPACITY EXPANSION PROJECT

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Prepared for:
Irvine Ranch Water District
15600 Sand Canyon Avenue
Irvine, CA 92618

March 2018

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Suite 1100
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213.599.4300
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Acronyms

CAS	Conventional activated sludge
IRWD	Irvine Ranch Water District
mgd	Million gallons per day
LAWRP	Los Alisos Water Recycling Plant
MBR	Membrane bioreactor
MMRP	Mitigation Monitoring and Reporting Plan
MS4	Municipal Separate Storm Sewer System
MWD	Metropolitan Water District
MWRP	Michelson Water Reclamation Plant
NCCP/HCP	Natural Community Conservation Plan/Habitat Conservation Plan
NOP/IS	Notice of Preparation/Initial Study
NPDES	National Pollutant Discharge Elimination System
OCSD	Orange County Sanitation District
OCWD	Orange County Water District
PLC	Programmable Logic Controller
PM_{10}	particulate matter less than 10 microns in diameter
$PM_{2.5}$	particulate matter less than 2.5 microns in diameter
PSM	Process Safety Management
RMP	Risk Management Plan
RWQCB	Regional Water Quality Control Board
SBS	sodium bisulfite
SCADA	Supervisor Controlled and Data Acquisition
SCAQMD	South Coast Air Quality Management District
SOCWA	South Orange County Wastewater Authority
SPF	Standard Project Flood
SWPPP	Stormwater Pollution Prevention Plan
UCI	University of California, Irvine
UCNRS	University of California Natural Reserve System

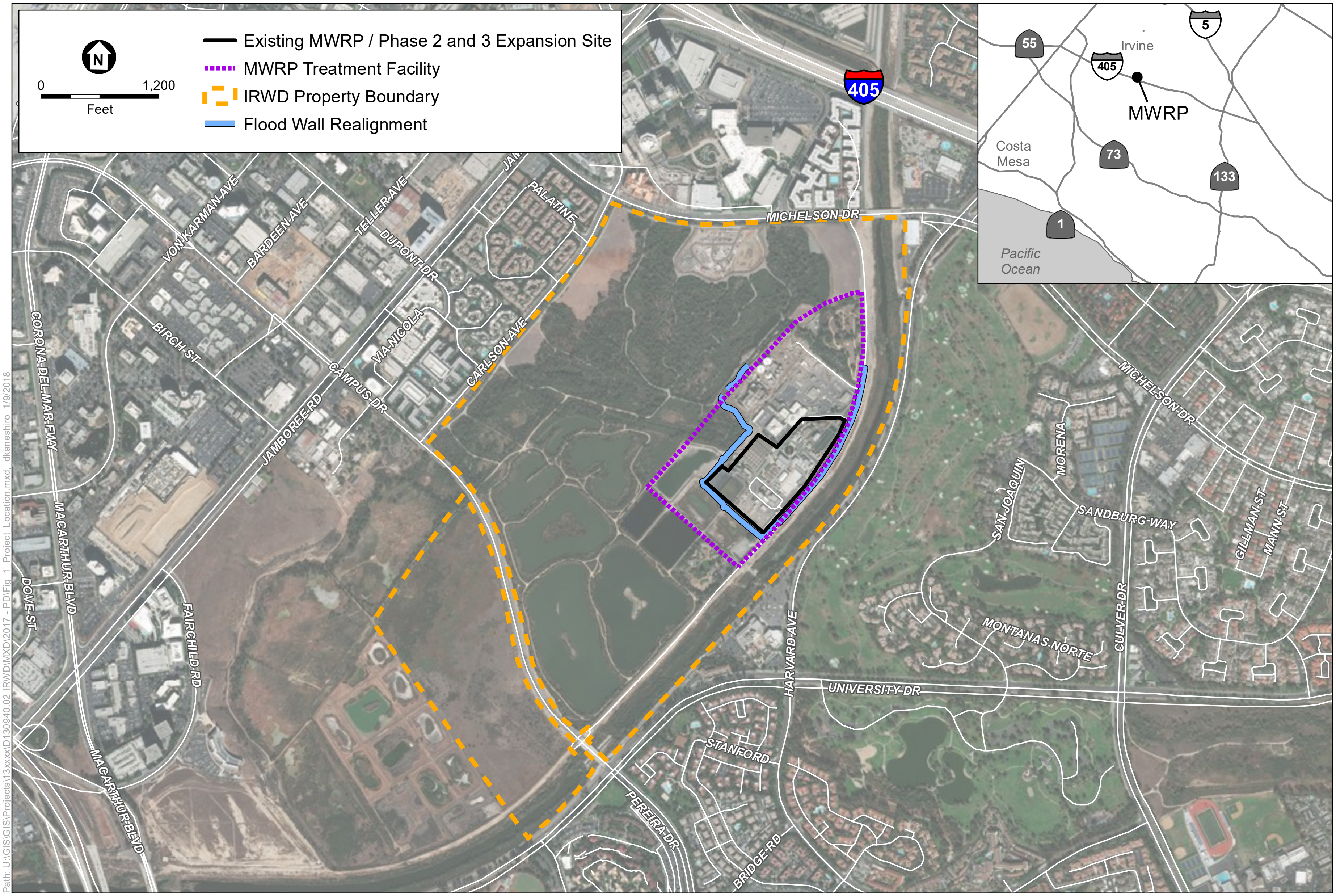
ADDENDUM NO. 4

Emergency Recycled Water Discharge to San Diego Creek

1.0 Introduction

Irvine Ranch Water District (IRWD) proposes to modify the Michelson Water Recycling Plant (MWRP) Phases 2 and 3 Capacity Expansion Project (Project) to allow the discharge of tertiary-treated recycled water to San Diego Creek for critical operational flexibility under certain defined conditions. **Figure 1** shows the location of the MWRP within IRWD's service area. Currently, the National Pollutant Discharge Elimination System (NPDES) permit for the MWRP prohibits the direct discharge of tertiary-treated recycled water to surface waters, such as San Diego Creek, except from IRWD's Sand Canyon Reservoir during specified rain events or when the California Division of Safety of Dams requires the release through emergency valves for dam safety or other reasons.

Due to recent wet weather events, IRWD is proposing to amend its NPDES permit for the MWRP to add defined conditions under which direct discharge of dechlorinated tertiary recycled water to San Diego Creek would be allowed. IRWD has prepared this Addendum No. 4 pursuant to the California Environmental Quality Act (CEQA) Guidelines Section 15164 to describe the modifications to the Project and to evaluate whether the modifications present any new significant impacts not identified in the previously certified MWRP Phase 2 and 3 Capacity Expansion Project Final Environmental Impact Report, as amended, that would require preparation of a subsequent or supplemental EIR. As documented in the analysis presented below, the proposed modifications would not result in substantial changes that warrant preparation of a subsequent EIR or another supplemental EIR pursuant to Sections 15162 and 15163 of the CEQA Guidelines.



SOURCE: ESA, 2012.

Emergency Recycled Water Discharge to San Diego Creek Project

Figure 1
Project Location

ESA

2.0 Project Background

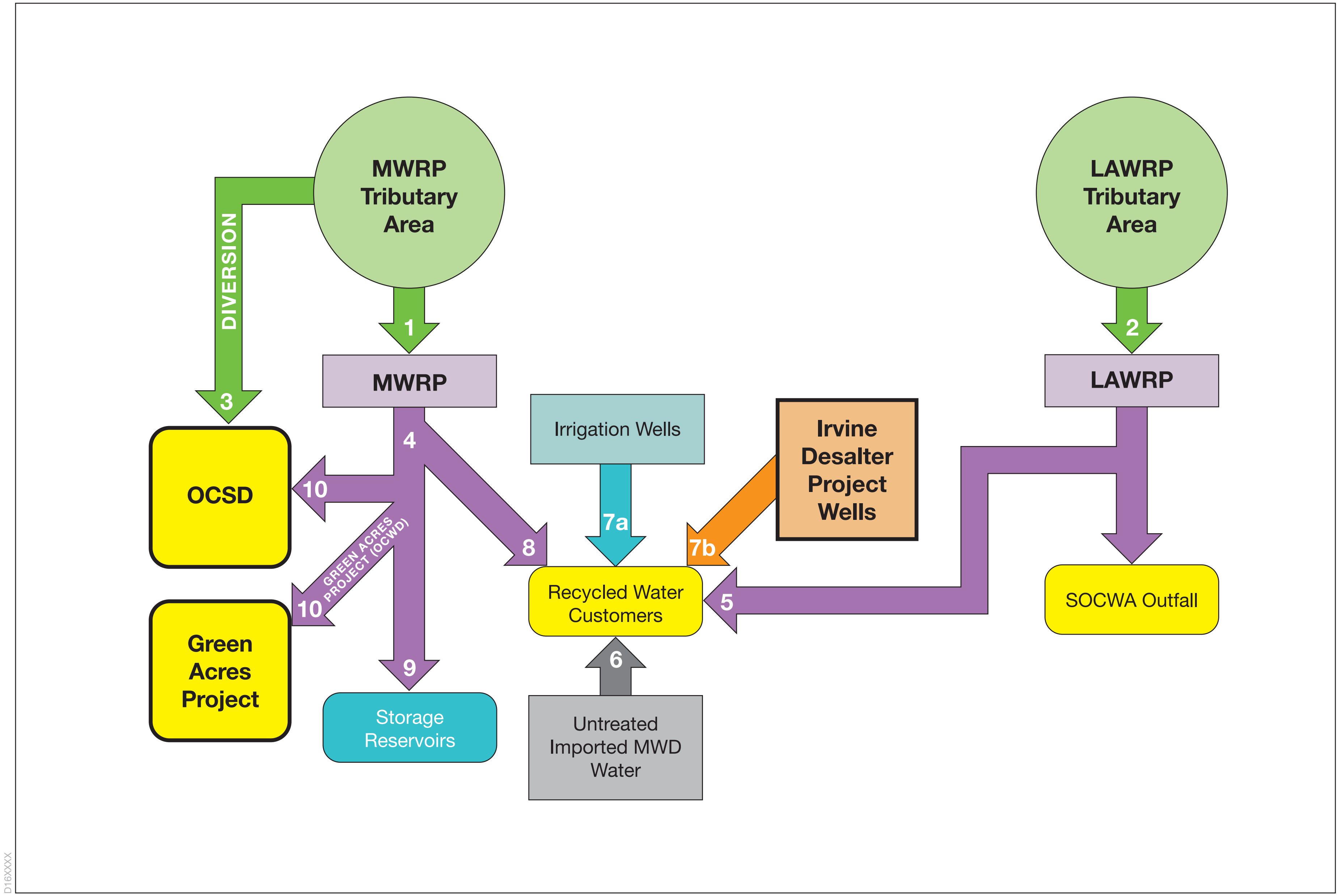
2.1 CEQA Documents

The potential environmental effects of the proposed modifications to the Project are addressed in this Addendum No. 4 to the MWRP Phase 2 and 3 Capacity Expansion Project Final Environmental Impact Report (EIR), as amended. The Final EIR for the Phase 2 and 3 Capacity Expansion Project was certified by IRWD's Board of Directors in February 2006 (State Clearinghouse No. 2005051174). The Phase 2 Capacity Expansion, which is complete, increased the recycled water treatment capacity at the MWRP from 18 to 28 million gallons per day (mgd). The MWRP currently operates below its 28 mgd capacity. Between June 2015 and May 2017, the MWRP produced 17.3 to 21.5 mgd (27 to 33 cfs), resulting in an average production capacity of 18.9 mgd (29 cfs). This excludes the three below-average months during which diversion to OCSD was required in the winter of 2016-2017. The Phase 3 Capacity Expansion will increase the recycled water treatment capacity at the MWRP to 33 mgd, but currently there is no schedule for implementation of Phase 3.

Subsequent Addenda Nos. 1, 2, and 3 to the Final EIR were adopted in 2008, 2009, and 2010, respectively. The addenda covered potential flooding risks and planned flood protection facilities; improvements to the access road between Campus Drive and the IRWD San Joaquin Marsh Campus; and modifications to the flood channel access road. In addition, in 2012, IRWD certified Final Supplemental EIR No. 1 (State Clearinghouse No. 2011031091), which addressed the construction of onsite residuals management facilities at the MWRP that would produce Class A and Class B biosolids. The residuals management facilities are currently under construction at the MWRP. Collectively these CEQA documents are referred to as the "MWRP Final EIR."

2.2 Project Need

Currently, IRWD has several outlets for the recycled water produced at MWRP. Under the existing Santa Ana Regional Water Quality Control Board (RWQCB) NPDES/Waste Discharge Requirement (WDR) Permit (Order No. R8-2015-0024/NPDES No. CA8000326), MWRP's recycled water is permitted to be directly distributed to customers for their use or stored for later use in a combination of closed storage tanks and open storage reservoirs. Additionally, IRWD has the ability to send a limited amount of recycled water to Orange County Water District's Green Acres Project (GAP), divert sewage to Orange County Sanitation District (OCSD) and send solids through MWRP's sludge line to OCSD for treatment. **Table 1** lists the components of the current IRWD sewage treatment and recycled water system. **Figure 2** illustrates the relationship between these components.



SOURCE: IRWD, 2017

Emergency Recycled Water Discharge to San Diego Creek Project

Figure 2
Inflows and Outflows of the Existing IRWD Sewage Treatment and Recycled Water System

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TABLE 1
DESCRIPTION OF THE INFLOWS AND OUTFLOWS OF THE EXISTING IRWD SEWAGE TREATMENT AND RECYCLED WATER SYSTEM

Number*	Item	Description
Sewage Treatment		
1	Michelson Water Recycling Plant (MWRP)	MWRP can treat up to 28 mgd of sewage.
2	Los Alisos Water Recycling Plant (LAWRP)	LARWP can treat up to 7.5 mgd of sewage.
3	Orange County Sanitation District (OCSD)	OCSD provides IRWD with 32 mgd disposal/treatment capacity rights. Sewage is continuously sent from IRWD's Irvine Business Complex and Newport Coast service area to OCSD since both of these entities lack a physical connection for sewage distribution to MWRP or LAWRP.
Recycled Water Sources		
4	MWRP	MWRP can produce a maximum of 28 mgd of tertiary-treated recycled water.
5	LAWRP	LAWRP can produce a maximum of 5.5 mgd of tertiary-treated recycled water. Tertiary treated water production can be stopped during times of high recycled water demand; up to 7.5 mgd secondary treated effluent is then produced and disposed of at the South Orange County Wastewater Authority Aliso Creek Ocean Outfall.
6	Untreated imported Metropolitan Water District (MWD) water	Untreated imported MWD water can be purchased to supplement the recycled water system. Some irrigation customers lack a physical connection to the IRWD recycled water distribution system and are solely provided imported water.
7a	Irrigation wells	Several non-potable wells can be used to supplement recycled water during times of high recycled water demand.
7b	Irvine Desalter Project wells	The groundwater treatment system is used to supplement the recycled water system; wells can only be shut down for up to two months a year as ordered by the U.S. Department of Justice and the U.S. Department of the Navy.
Recycled Water Outlet Options		
8	Customers	Recycled water is used principally for outdoor irrigation as well as industrial and commercial uses.
9	Recycled water storage reservoirs	Storage of recycled water during low demand times can occur in San Joaquin, Rattlesnake, Sand Canyon and Syphon Reservoirs, that together have a total available storage capacity of 4,298 acre-feet.
10	Orange County Water District (OCWD)	Up to 8 mgd of recycled water produced at MWRP can be sent to OCWD through the Green Acres Project. If OCWD cannot take or doesn't need the recycled water, up to 3 mgd can be sent to OCSD for disposal through their ocean outfall.
11	South Orange County Wastewater Authority (SOCWA) Aliso Creek Ocean Outfall	IRWD can send the following to SOCWA's Aliso Creek Ocean Outfall: up to 7.5 mgd of secondary treated effluent from LAWRP, 1 mgd of brine from the Irvine Desalter Project Potable Treatment Plant and up to 0.85 mgd of treated water from the shallow groundwater unit.

*Note: Numbers for items listed in this table correspond with their numbers in Figure 2 of this addendum.

The existing Permit prohibits the direct discharge of tertiary-treated recycled water to surface water, except from Sand Canyon Reservoir during specified rain events or when the California Division of Safety of Dams requires the release through emergency valves for dam safety or other reasons. IRWD now seeks the ability to send compliant disinfected tertiary recycled water from MWRP to Reach 1 of the San Diego Creek under conditions that prevent the use of outlet options described above.

Recycled water is a valuable resource that is beneficially reused, and it is IRWD's goal to utilize all recycled water produced at its facilities. At times, particularly in the summer months, IRWD's recycled water demand is greater than its recycled water production and requires the addition of supplemental water from non-potable groundwater wells and the purchase of expensive untreated imported water. During the winter months, irrigation demands drop and recycled water demands are significantly lower. IRWD drafts a Recycled Water System Reservoir Management Plan annually to manage and adapt recycled water supply to meet system demands. The Plan sets reservoir storage volume capacities along with target dates for these capacities and takes into consideration assumptions on projected recycled water demands, supplemental water needs and rainfall amounts. Throughout the year, IRWD staff continuously monitors and tracks reservoir capacity, rainfall, weather forecasts, recycled water productions and demands to determine when an operational trigger has been met to begin lowering production and filling storage. Although the sequence may vary, **Table 2** lists steps IRWD may take to curtail recycled water production when a period of low recycled water demand is approaching.

TABLE 2
IRWD RECYCLED WATER MANAGEMENT OPERATIONAL DECISIONS OPTIONS

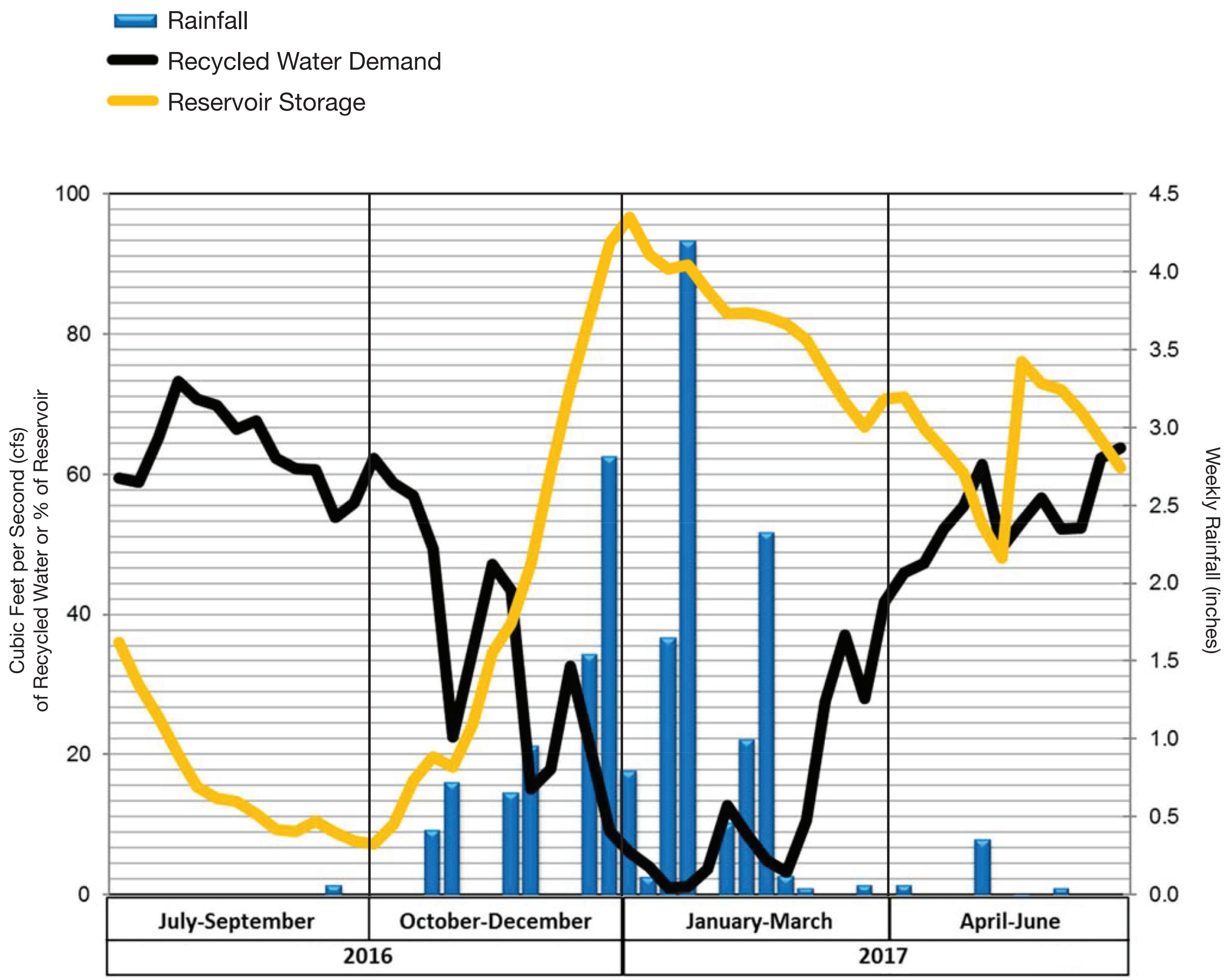
Step 1	Stop importing untreated MWD water
Step 2	Shut off irrigation wells
Step 3	Discontinue recycled water production at LAWRP
Step 4	Route recycled water to the Green Acres Project
Step 5	Shutoff Irvine Desalter Project wells
Step 6	Route recycled water to OCSD outfall
Step 7	Route recycled water to SOCWA outfall

Table 3 provides a detailed timeline of the actions taken by IRWD during the most-recent wet season of 2016-2017. Despite employing all available best management practices and options, the 2016-2017 wet-weather events resulted in an emergency situation that exhausted all of IRWD's available outlets for its recycled water; storage was at capacity, and MWRP was not able to discharge to GAP. IRWD's best efforts in planning could not predict the pattern of rainfall events and near zero recycled water demands. Further, IRWD received a notification from OCSD that it could not accept diverted sewage, yet sewage was continuing to arrive at MWRP. This put IRWD at risk for sewer backups and overflows from upstream recycled water reservoirs, thereby creating the potential to cause downstream flooding and damage to public and private infrastructure and property and harm to the environment, including the Back Bay in upper Newport Bay. **Figure 3** illustrates the rainfall, recycled water demand, and reservoir storage use from July 2016 to June 2017.

TABLE 3
TIMELINE OF IRWD ACTIONS TAKEN DURING 2016-2017 WET WEATHER

Date	Inflow/Outflow Item	Number*	Action
2016-2017 wet season	Untreated imported MWD water	6	No purchase of untreated imported water from MWD, excluding a few irrigation customers not connected to IRWD's recycled water system that are supplied untreated imported water for irrigation.
2016-2017 wet season	OCSD	3	Flow continued to OCSD from the Irvine Business Complex and Newport Coast portions of IRWD's service area.
10/31/2016	Irrigation wells	7a	Wells taken offline following drop off of recycled water demand for fall season.
11/30/2016	LAWRP	5	Recycled water production stopped at LAWRP following drop off of recycled water demand for fall season.
December 2016 – March 2017	Customers	8	Generated little to no recycled water demand during record rainfall events.
1/1/2017 – 3/1/2017	Irvine Desalter Project Wells	7b	Shut down of wells was delayed until the new calendar year (2017), as mandated by the U.S. Department of Justice and the U.S. Department of Navy, since the two-month shut down time had already been used in 2016 .
1/13/2017	OCWD	10	Diversion of recycled water to the Green Acres Project and OCSD Outfall began.
1/19/2017	SOCWA Aliso Creek Ocean Outfall	11	Diversion of recycled water to the SOCWA Aliso Creek Ocean Outfall via LAWRP began.
1/20/2017 – 2/17/2017; 2/19/2017 – 3/8/2017	OCSD	3	Diversion of sewage away from MWRP to OCSD. Sewage diversions stopped on February 17 per OCSD request and concern over treatment capacity due to a pending storm. Sewage diversions were reinitiated two days later.
1/24/2017	Recycled water storage reservoirs	9	Storage of recycled water in reservoirs reached operational capacity. Sand Canyon Reservoir began to overflow on January 23, 2017 and continued to overflow intermittently until April 10, 2017.
December 2016 – March 2017	MWRP	1	MWRP collection system does not experience much inflow and infiltration. Average daily flow remained at a normal 20 mgd during the entire rainy season.
December 2016 – March 2017	LAWRP	2	LAWRP collection system does not experience much inflow and infiltration. Average daily flow remained at a normal 3.4 mgd during the entire rainy season.

*Note: Numbers for items listed in this table correspond with their numbers in Figure 2 of this addendum.



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SOURCE: ESA, 2017

Emergency Recycled Water Discharge to San Diego Creek Project

Figure 3
2016 - 2017 Rainfall, Recycled Water Demand, and Reservoir Storage

In the future, sewage diversions from MWRP to OCSD will be constrained by operational requirements for the continuous treatment of sewage. IRWD is currently constructing the Biosolids and Energy Recovery Facilities Project that will allow IRWD to beneficially reuse solids and gas generated at the MWRP. This facility requires an uninterrupted and consistent volume of sewage to treat in order to maintain operational functionality. Therefore, IRWD needs to continuously treat sewage at the MWRP, even during very wet winters. While the biosolids processed at the MWRP will result in an environmentally beneficial final product, IRWD's ability to divert sewage to OCSD will be substantially limited.

These situations, among others, revealed the need for IRWD to have the flexibility under certain conditions to have a reliable, safe outlet for a controlled and permitted discharge of fully-treated dechlorinated recycled water from the MWRP to Reach 1 of the adjacent San Diego Creek.

2.3 Alternative Diversion Measures

To avoid and/or minimize the diversion of water into the San Diego Creek watershed, IRWD has explored other alternative diversion measures. To create alternative diversion measures, IRWD has committed to:

- Moving forward with the Syphon Reservoir Improvement Project;
- Pursuing the procurement of space in Santa Margarita Water District's Upper Oso Recycled Water Reservoir to increase overall seasonal storage capacity;
- Pursuing the design, permitting, and construction of improvements to increase the diversion of recycled water to the Santa Ana River watershed through the Green Acres Project;
- Working with OCWD to ensure the installation of facilities to allow IRWD's recycled water to be diverted to OCWD's Ground Water Replenishment System; and
- Diverting recycled water to San Diego Creek watershed only after IRWD has exhausted all the other available options.

Even when many of these alternative options are operational or available, the option of discharging to San Diego Creek is still necessary due to the unpredictability of an emergency event. Discharging to San Diego Creek would be viewed as a last resort.

3.0 Purpose of Addendum

Under CEQA, the lead agency or a responsible agency shall prepare an addendum to a previously-certified Final EIR if some changes or additions are necessary to the prior EIR, but none of the conditions calling for preparation of a subsequent or supplemental EIR have occurred (CEQA Guidelines §§ 15162, 15164). Once an EIR has been certified, a subsequent EIR is only required when the lead agency or responsible agency determines that one of the following conditions has been met:

1. Substantial changes are proposed in the project, or substantial changes occur with respect to the circumstances under which the project is undertaken, which require major revisions of the previous EIR due to the involvement of new significant environmental effects or a substantial

increase in the severity of previously identified significant effects (CEQA Guidelines §15162(a)(1), (2));

2. New information of substantial importance, which was not known and could not have been known with the exercise of reasonable diligence at the time the previous EIR was certified as complete, shows any of the following:
   a. The project will have one or more significant effects not discussed in the previous EIR;
   b. Significant effects previously examined will be substantially more severe than shown in the previous EIR;
   c. Mitigation measures or alternatives previously found not to be feasible would in fact be feasible and would substantially reduce one or more significant effects of the project, but the project proponents decline to adopt the mitigation measure or alternative; or
   d. Mitigation measures or alternatives which are considerably different from those analyzed in the previous EIR would substantially reduce one or more significant effects on the environment, but the project proponents decline to adopt the mitigation measure or alternative (CEQA Guidelines §15162(a)(3)).

If one or more of the conditions described above for a subsequent EIR exist, but only minor additions or changes would be necessary to make the previous EIR adequately apply to the project in the changed situation, then the lead agency may prepare a supplement to an EIR, rather than a subsequent EIR *(*CEQA Guidelines §15163(a)).

CEQA recommends that a brief explanation of the decision to prepare an addendum rather than a subsequent or supplemental EIR be included in the record (CEQA Guidelines §15164(e)). IRWD has evaluated the potential environmental impacts of the proposed modifications as set forth below in Section 6 of this Addendum No. 4. IRWD acting as the Lead Agency, has determined that none of the above CEQA conditions apply and that Addendum No. 4 to the adopted MWRP Final EIR is the appropriate environmental documentation for the proposed modifications and fully complies with CEQA, as described in the CEQA Guidelines.

An addendum does not need to be circulated for public review, but rather can be attached to the MWRP Final EIR (CEQA Guidelines §15164(c)). Prior to initiating the modified Project, the IRWD Board of Directors will consider this Addendum No. 4 together with the adopted MWRP Final EIR and make a decision regarding the modified Project (CEQA Guidelines §15164(d)).

4.0 Proposed Modifications

4.1 MWRP Recycled Water Discharge to San Diego Creek

IRWD is proposing to use primarily existing facilities to discharge tertiary-treated dechlorinated recycled water from the MWRP to San Diego Creek. The conditions under which discharge would occur would be defined by, but not limited to, the following list of factors:

- Availability of outlets for recycled water (i.e. recycled water storage capacity, pipeline or pump station operability, level of recycled water demand, GAP availability, diversion of sewage to OCSD, etc.);
- Required addition of non-potable supply from wells to recycled water system;

- Forecasted major storm events; and
- Compliance and plant process stability (i.e. impact of diversion of sewage from MWRP).

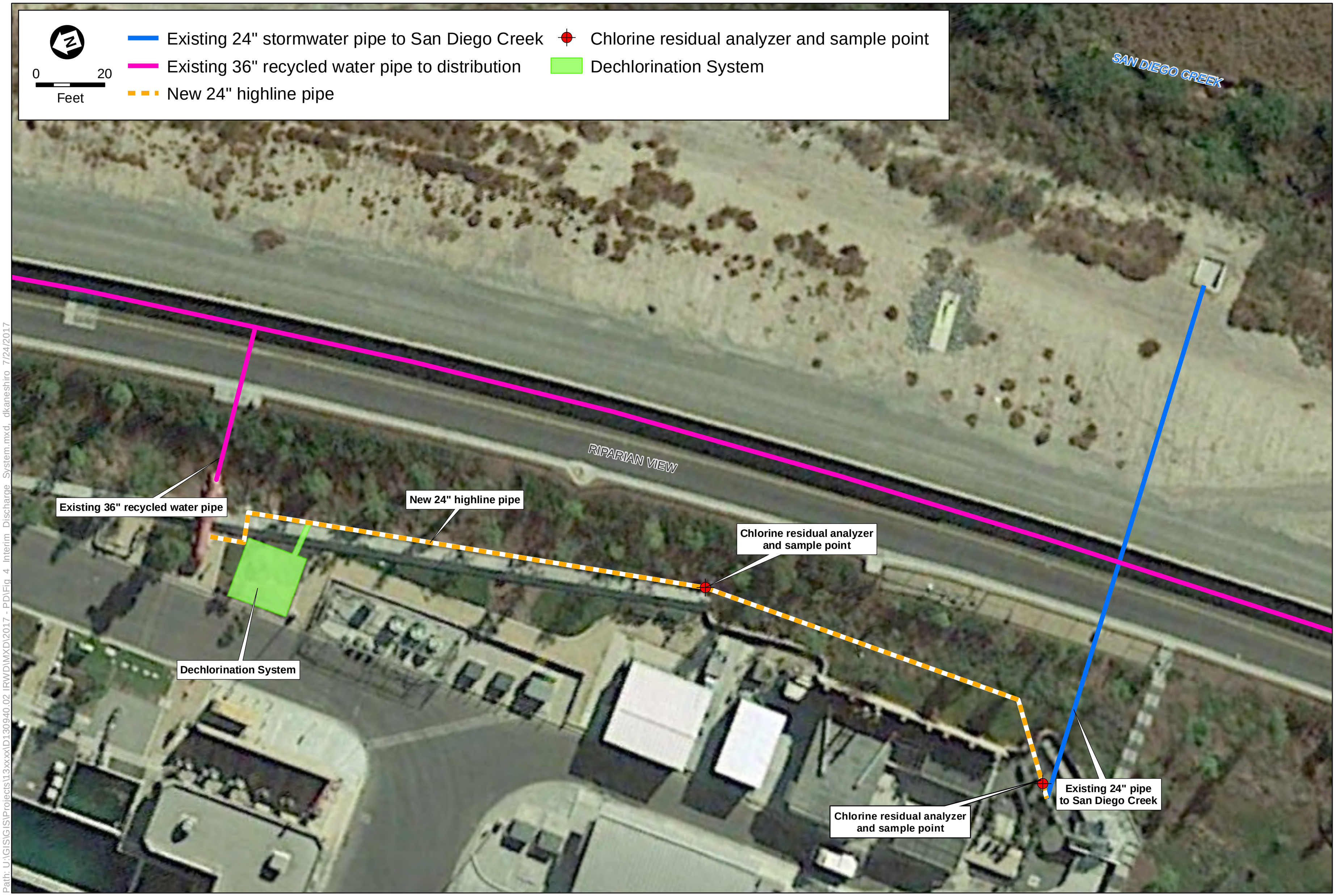
Best management practices would be employed at MWRP to manage storage and flows to return recycled water to its normal outlets as soon as practicable.

IRWD is proposing to install an interim discharge system to accommodate discharge of approximately 22.5 mgd (35 cubic feet per second [cfs]) to San Diego Creek and a permanent discharge system to accommodate discharge up to 33 mgd (51 cfs) to San Diego Creek The proposed interim discharge to San Diego Creek is lower than the plant's maximum capacity of 28 mgd because it is estimated that a minimum of 5.5 mgd of recycled water could be reliably diverted to other outlets including the SOCWA Aliso Creek Ocean Outfall and OCSD diversion (discussed in Table 1). When the MWRP Phase 3 Expansion Project is built, the MWRP maximum capacity will increase to 33 mgd. Although the same aforementioned recycled water outlets will likely be available following Phase 3 completion, the estimated maximum proposed discharge to San Diego Creek during this time is the entire plant capacity (33 mgd) for a more conservative approach to the analysis. Under both the interim and permanent discharge systems, co-mingled disinfected tertiary-treated water from both of MWRP's treatment trains (MBR/UV and Conventional) would be discharged to San Diego Creek using the existing onsite Michelson Recycled Water Pump Station.

As shown in **Figure 4**, the interim discharge system will convey a maximum of approximately 22.5 mgd and consist of an approximate 24-inch diameter pipeline connecting the existing 36-inch recycled water pipeline to the existing 24-inch stormwater discharge pipeline downstream of Stormwater Pump Station No. 1. Stormwater Pump Station No. 1 has a maximum capacity of about 26 mgd and discharges via the existing 24-inch pipeline into San Diego Creek at the existing outfall (DP Storm-007) (see Figure 4). In the event of discharge of tertiary-treated recycled water to San Diego Creek, only recycled water would be discharged through the stormwater pipeline, and not a combination of storm water and recycled water. Rather, stormwater collected at Stormwater Pump Station No. 1 would be redirected back into the headworks of the MWRP for treatment.

The proposed interim pipeline would be a combination of welded steel pipe and HDPE piping, which will be installed at grade (i.e. highline), located inside the MWRP property and associated floodwall. The interim system would consist of a 24-inch butterfly valve for flow isolation, a pressure reducing valve, flow meter, dechlorination system, phosphorus removal system, and associated sampling and chlorine residual monitoring.

The dechlorination system would dechlorinate the water, and would consist of a skid-mounted sodium bisulfite (SBS) storage tank and automated multi-pump chemical metering system. The chemical metering system would be controlled via a Supervisory Control and Data Acquisition (SCADA) system. SBS dosing would be calculated in the Programmable Logic Controller (PLC) based on chlorine residual of the treated water and the flow rate measured by the proposed flow meter.



SOURCE: IRWD, 2017.

Emergency Recycled Water Discharge to San Diego Creek Project

Figure 4
Interim Discharge to San Diego Creek

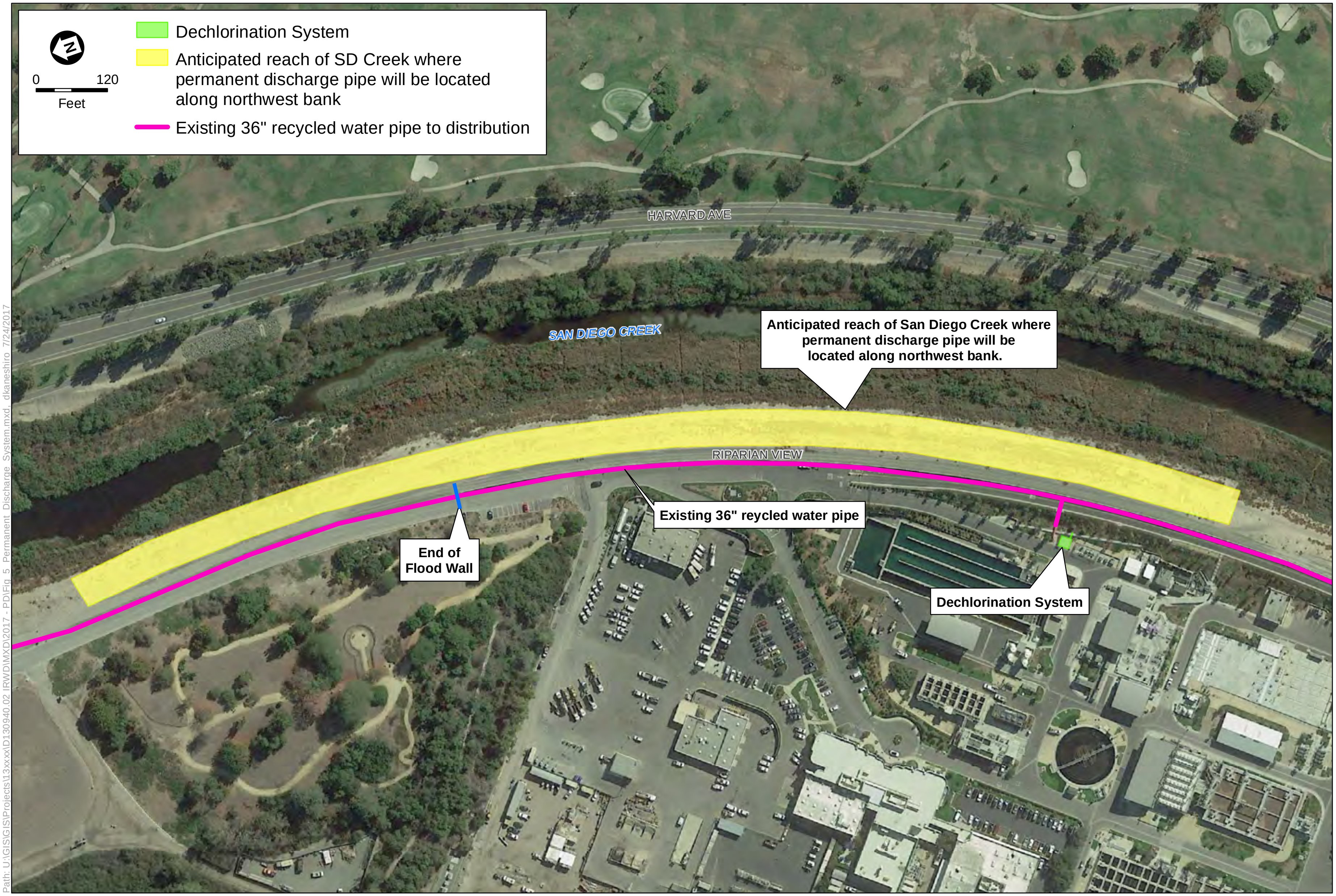
ESA

The phosphorus removal system would use iron salts to reduce total phosphorus levels in the effluent to <0.5 mg/L. Two types of phosphorus removal methods and two types of iron salts are being tested for phosphorus removal effectiveness at MWRP. The membrane bioreactor (MBR) process is being tested by installing a small membrane filtration pilot system. The conventional activated sludge (CAS) treatment process is being tested by dosing chemicals into one of the system's aeration tanks and secondary clarifier. Two types of iron salts (both alum and ferric chloride) are added to the effluent at various dose rates and phosphorus is continually monitored to provide feedback of iron salt dose effectiveness. Results will be analyzed to determine the dosages required to achieve <0.5 mg/L of total phosphorus in the filtrate under both the MBR and CAS processes. Pilot testing was initiated in mid-December 2017 and will continue for about 8 weeks until mid-February 2018. The memo describing the current pilot testing methods can be found in **Appendix A**. Following completion of pilot testing, a second memo will be prepared summarizing testing results and providing a recommendation for the phosphorus removal method that would be best for full-scale implementation at MWRP. Regardless of the method used, the phosphorus removal equipment would be installed within the existing MWRP footprint near the CAS pre-secondary clarifiers and near the MBR mixed liquor wet well.

Online chlorine residual monitoring would provide loop feedback to ensure complete quenching of the chlorine residual prior to discharge. The chemical storage tank and metering pump system would be located outside, within secondary containment within the MWRP property (Figure 4). Construction of the system would be achieved with a crane for pipe placement, and minor excavation by hand or small excavator at the stormwater pipe tie-in location; a contractor would likely be hired by IRWD to perform this construction work.

The permanent discharge system is at a concept design level, however is anticipated to convey up to 33 mgd and consist of an approximate 36-inch buried pipeline with a new discharge outlet and associated headwall to the San Diego Creek (see **Figure 5**). The discharge point would be located along a reach of the San Diego Creek, adjacent to the MWRP as depicted in Figure 3. IRWD's property boundary encompasses San Diego Creek in this area, and the proposed discharge outlet would likely be located within IRWD's property (see Figure 1). The permanent system would include the same isolation valve, pressure reducing valve, flow meter, automated dechlorination system, and phosphorus removal system as described above for the interim system

Construction of the permanent discharge piping concepts may include excavation and open-cut trenches with associated shoring, or may consider subsurface directional drilling depending on the chosen route and associated geology. Thus, the construction equipment required may include excavator, grader, paver and drilling equipment.



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SOURCE: IRWD, 2017.

Emergency Recycled Water Discharge to San Diego Creek Project

Figure 5
Permanent Discharge to San Diego Creek

ESA

4.2 Project Phasing and Schedule

The proposed interim discharge system at the MWRP would be constructed in May, 2018 and would be operational in January, 2019. IRWD will likely maintain the interim system for a few years to verify operational needs and potential operational improvements. Construction of the permanent discharge system would proceed after IRWD concludes its review of any operational needs and potential operational improvements to the interim phase and securing approvals from the regulatory agencies.

4.3 Recycled Water Discharge Duration

Per a request from the RWQCB, IRWD conducted a Water Quality Evaluation (WQE) that examined the impact of the proposed MWRP recycled water diversions on Newport Bay with respect to nutrient (nitrogen and phosphorus) content in the water. Given the unpredictable nature of the necessity of an emergency diversion to San Diego Creek and what other diversion options would be available to IRWD at the time, the WQE was conducted to consider a range of potential diversion durations (1-day, 7-day and 14-day releases of water). The WQE can be found in **Appendix B**. Information from the WQE has been incorporated into the hydrology and water quality analysis included in Section 6.4 of this Addendum.

5.0 Incorporation by Reference

Consistent with Section 15150 of the CEQA Guidelines, the following documents were used in the preparation of this Addendum and are incorporated herein by reference:

- MRWP Phases 2 and 3 Capacity Expansion Project Draft Environmental Impact Report, November 2005 (State Clearinghouse No. 2010051174)
- MRWP Phases 2 and 3 Capacity Expansion Project Final Environmental Impact Report, February 2006 (State Clearinghouse No. 2010051174)
- MRWP Phases 2 and 3 Capacity Expansion Project Final Environmental Impact Report Addendum No. 1, March 2008 (State Clearinghouse No. 2010051174)
- MRWP Phases 2 and 3 Capacity Expansion Project Final Environmental Impact Report Addendum No. 2, August 2009 (State Clearinghouse No. 2010051174)
- MRWP Phases 2 and 3 Capacity Expansion Project Final Environmental Impact Report Addendum No. 3, June 2010 (State Clearinghouse No. 2010051174)
- MRWP Phases 2 and 3 Capacity Expansion Project, Biosolids Handling Component Supplemental EIR, September 2012 (State Clearinghouse No. 2011031091)

These documents are available for review on IRWD's website (www.irwd.com) or during regular business hours at IRWD's headquarters, located at 15600 Sand Canyon Avenue, Irvine, California 92618-3102.

6.0 Analysis of Potential Environmental Impacts Associated with the Proposed Modifications

The Notice of Preparation/Initial Study (NOP/IS) prepared for the 2006 Final EIR determined that Project impacts would be less than significant in multiple environmental resource areas and thus concluded that further discussion and analyses of these resource areas were not warranted in the EIR. The environmental resource areas in which the Project was determined to have less than significant effects were aesthetics, agricultural resources, cultural resources, land use and planning, mineral resources, population and housing, public services, recreation, transportation and circulation, and utilities and service systems. For some of the above-mentioned resources, environmental commitments were included as part of the project description, such as shielding of nighttime lighting during construction activities; restricting truck hauling to routes designated by the County and City; and providing an archaeological monitor during ground disturbances within the site boundary and buffer zone for CA-ORA 196 H and CA-ORA-197 to ensure avoidance. These environmental commitments are applicable to the proposed modifications as deemed relevant.

The modifications proposed under this Addendum No. 4 would also not result in impacts to the abovementioned environmental resource areas, and as such, these environmental resource areas are not discussed in this analysis. This Addendum No. 4 evaluates the potential for construction and operation of the proposed interim and permanent discharge facilities to affect the following resources: air quality, biological resources, geology and soils, hydrology and water quality, noise, and public health and safety.

6.1 Air Quality

The MWRP Final EIR determined that the potential impacts to air quality would be less than significant without mitigation. Best available control measures were recommended to be implemented during construction due to the basin air quality and attainment status. The following discussion addresses potential impacts of the proposed modifications to the Project.

6.1.1 Setting

The Project area is located in the South Coast Air Basin. The applicable air quality plan for the Project area is the South Coast Air Basin air quality management plan (AQMP). The AQMP specifies significance thresholds (daily regional significance thresholds for construction and net regional significance thresholds for operation) for various air quality contaminants to determine significance of a project's impacts to air quality. The Southern California Air Quality Management District (SCAQMD) collects ambient air quality data at monitoring stations near the Project site in Costa Mesa and Mission Viejo. The Basin is currently in non-attainment of three criteria pollutants: ozone, PM_{10} (particulate matter less than 10 microns in diameter) and $PM_{2.5}$ (particulate matter less than 2.5 microns in diameter). All sensitive receptors in the Project vicinity are located 0.25 mile from the Project site at the closest.

6.1.2 Summary of Potential Impact

The MWRP Final EIR assessed the potential impacts of the Project on air quality. Given that construction emissions would not exceed identified air quality thresholds and would be short-term, the MWRP Final EIR concluded that construction impacts related to air quality threshold exceedances and exposing sensitive receptors to substantial pollutant concentrations would be less than significant. Mitigation measures pertaining to best available control measures (BACM) for dust control (A-1a) and equipment emissions control (A-1b) were adopted to further ensure construction emissions associated with the Project would not be significant. The MWRP Final EIR concluded that the only direct air quality impacts from Project operation would be vehicular exhaust emissions from four additional employees and one added chemical delivery truck every few weeks; therefore, direct operational air emissions would be negligible. Odors produced from construction vehicles were determined to be less than significant as they would be confined to the Project site. The MWRP Final EIR concluded that operational odor-related impacts associated with the biosolids facilities would be less than significant with implementation of an Odor Control Maintenance and Monitoring Plan. Since the AQMP is based on growth forecasts and the proposed Project would not induce population growth, the Project would comply with the plan.

Construction of the proposed modifications including the interim discharge system and permanent discharge system would require construction activities within the IRWD property boundaries at the MRWP. Construction of the interim system would occur prior to the permanent discharge system. Construction activity, equipment, and duration for the interim and permanent discharge systems would be less than that described in the MWRP Final EIR. Therefore, similar to the conclusions in the MWRP Final EIR, the short-term emissions associated with construction of both the interim and permanent systems would not result in significant impacts to air quality or expose sensitive receptors to substantial pollutant concentrations. Odors associated with this construction equipment would be contained onsite. Implementation of MWRP Final EIR mitigation measures pertaining to dust control (A-1a) and equipment emissions control (A-1b) would further reduce air quality impacts related to construction of the proposed modifications. During operation, dechlorination and phosphorus removal facilities require the use of sodium bisulfite and iron salts, respectively, that would routinely need to be replenished via truck delivery. However, these truck trips would be less than the one to two additional truck trips per month generated by the Project as described in the MWRP Final EIR. Further, the dechlorination and phosphorus removal treatment processes would not generate odors onsite. Similar to the Project, the proposed modifications would not induce population growth and would thus comply with the AQMP.

6.1.3 Applicable Mitigation Measures

Mitigation Measure A-1a: Best available control measures shall be used during grading. The menu of enhanced dust control measures includes the following:

- Water all active construction areas at least twice daily.
- Cover all haul trucks or maintain at least 2 feet of freeboard.
- Pave or apply water four times daily to all unpaved parking or staging areas.

- Sweep or wash any site access points within 30 minutes of any visible dirt deposition on any public roadway.
- Cover or water twice daily any on-site stockpiles of debris, dirt or other dusty material.
- Suspend all operations on any unpaved surface if winds exceed 25 mph.
- Hydroseed or otherwise stabilize any cleared area which is to remain inactive for more than 96 hours after clearing is completed.

Mitigation Measure A-1b: Equipment Emissions shall be reduced by implementing the following:

- Require 90-day low-NOx tune-ups for off-road equipment.
- Limit allowable idling to 5 minutes for trucks and heavy equipment before shutting the equipment down.
- Encourage carpooling for construction workers.
- Limit lane closures to off-peak travel periods.
- Park construction vehicles off traveled roadways.
- Encourage receipt of materials during non-peak traffic hours.

6.1.4 Conclusion

The proposed modifications would not result in a new significant impact nor substantially increase the severity of an impact identified in the MWRP Final EIR or subsequent CEQA analyses. No mitigation is required beyond the existing commitments contained within the mitigation monitoring and reporting plan (MMRP). Impacts to air quality would be less than significant.

6.2 Biological Resources

The MWRP Final EIR assessed potential impacts to biological resources and concluded that construction of the Project would have a less than significant impact with the incorporation of mitigation. The following discussion addresses potential impacts of the proposed modifications.

6.2.1 Setting

The MWRP site is located in a highly developed area characterized by mixed recreational, preservation, commercial and residential use. The site is bounded to the west and south by the IRWD San Joaquin Marsh and Wildlife Sanctuary, which includes an area of mature riparian vegetation, a wetlands mitigation site and ponds. The San Joaquin Marsh and Wildlife Sanctuary is located on property owned by IRWD and consists of 300 acres of freshwater wetlands. Reach 1 of San Diego Creek is located to the east of the Project site. No sensitive plant species were identified at the Project site, but multiple sensitive wildlife species were either observed or determined to have the potential to occur in riparian and marsh habitats surrounding the MWRP site. Coyotes have the potential to occur onsite, and Cooper’s hawk, white-tailed kite and osprey may nest in eucalyptus trees at the MWRP site. The MWRP site has no habitat and no value as a wildlife movement corridor or habitat linkage. The surrounding open space areas are mapped as Non-Reserve Open Space in the Central and Coastal Natural Community Conservation Plan/Habitat Conservation Plan (NCCP/HCP) and are considered part of regional habitat linkage. used by bobcats (*Lynx rufus*) and other bird and mammal species.

6.2.2 Summary of Potential Impact

The MWRP Final EIR assessed the potential impacts of the Project to biological resources in and around the MWRP site. Since the proposed expansion would be developed entirely within the existing footprint of the MWRP, the MWRP Final EIR concluded that no direct or permanent impacts to sensitive plant species, sensitive plant communities, or jurisdictional waters would occur. For this same reason, no conflict with the NCCP/HCP was identified.

The MWRP Final EIR concluded that Project construction could result in short-term indirect impacts to vegetation communities including 1) dust, which could affect plant growth and insect use of adjacent vegetation; 2) erosion and subsequent sedimentation, which could affect plant viability in depositional areas and water quality and habitat value of San Diego Creek; 3) and run-off of pollutants including chemicals used during construction and operation, which could contaminate the soil and water in adjacent habitat and adversely impacting the health of plants and animals. The MWRP Final EIR stated that implementation of construction best management practices (BMPs) developed as part of the Storm Water Pollution Prevention Plan (SWPPP) required for the Project would help control erosion and sediment, limit toxic pollutants, and control dust. During operation, stormwater on the MWRP site would be treated prior to its release offsite. Associated short-term indirect impacts to vegetation communities would be less than significant.

To reduce potentially significant direct impacts to sensitive wildlife associated with removal of trees such as eucalyptus to less-than-significant levels, the MWRP Final EIR required implementation of Mitigation Measure BIO-1. Regarding short-term indirect impacts to sensitive wildlife, such as the least Bell's vireo and nesting southwestern willow flycatcher within the San Joaquin Marsh, the MWRP Final EIR required implementation of Mitigation Measures BIO-2a and BIO-2b to reduce impacts to less-than-significant levels. Mitigation Measure BIO-3 was required to reduce the effects of nighttime lighting for Project construction on nocturnal wildlife using habitat linkages in the San Joaquin Marsh and San Diego Creek. In summary, mitigation measures were adopted that would ensure construction and operation of the MWRP expansion components did not directly impact sensitive wildlife (BIO-1). Mitigation measures were also adopted to ensure there were no adverse indirect impacts on sensitive wildlife (BIO-2a and BIO-2b) or wildlife movement due to construction (BIO-3).

The MWRP Final EIR concluded that the increase in discharge to San Diego Creek from two new dewatering wells would not substantially alter hydrologic conditions and would thus not indirectly affect sensitive vegetation or wildlife species. Since the recycled water produced by the Project would be tertiary-treated, the MWRP Final EIR concluded that the amount of nutrients and other chemicals entering the watershed due to the increased use of recycled water produced by the Project would have a less than significant impact to the composition of the riparian/wetland vegetation in the watershed and to any sensitive species dependent on this habitat. Although flow in San Diego Creek would be increased, the Project was determined to not have a significant impact on the saltwater/freshwater interface downstream in Upper Newport Bay.

Similar to the Phase 2 and 3 Capacity Expansion Project as described in the MWRP Final EIR, the proposed modifications would be developed within the existing boundary of IRWD's MWRP facilities. Therefore, the proposed modifications also would not have direct impacts to sensitive plant species, sensitive plant communities, or jurisdictional waters, and would not conflict with the NCCP/HCP. Dust, erosion, sedimentation, and pollutant runoff caused from construction of the interim and permanent discharge systems could indirectly impact sensitive species or jurisdictional waters. The proposed modifications would be subject to a SWPPP and its BMPs to mitigate such impacts to less than significant levels.

During operation, stormwater from the MWRP site would continue to be treated prior to its release offsite. Therefore, indirect impacts to sensitive vegetation communities, jurisdictional waters, or sensitive plant species would be less than significant.

The proposed interim and permanent discharge systems would not directly or permanently impact sensitive wildlife since construction of facilities would occur in areas that are already built out. IRWD does not anticipate that vegetation or trees that support wildlife would be directly affected or removed by the proposed project. The facilities also would not be installed in the portion of the MWRP that is adjacent to the San Joaquin Marsh and thus would not affect least Bell's vireo or southwestern willow flycatcher during construction. However, the proposed discharge systems would be located next to the San Diego Creek. As such, implementation of Mitigation Measure BIO-3 would reduce potential impacts from construction nighttime lighting on nocturnal wildlife that may be using habitat linkages in the San Diego Creek to less-than-significant levels.

The recycled water discharged through the interim and permanent discharge facilities would be tertiary-treated, disinfected and dechlorinated. Total phosphorus in the effluent would be reduced to very low levels (<0.5 mg/L). As described below in Section 6.4, the discharge of recycled water would not have adverse effects to water quality or beneficial uses in San Diego Creek; as such, there would be a less than significant impact to the composition of the riparian/wetland vegetation in the watershed and creek and to any sensitive species dependent on this habitat. The proposed intermittent increase in flow to San Diego Creek from the periodic discharge of recycled water would not have a significant impact on hydrologic conditions in San Diego Creek as described below in Section 6.4. Therefore, impacts to in-channel and riparian vegetation or wildlife species downstream of the proposed discharge would not be significant.

6.2.3 Applicable Mitigation Measures

> **Mitigation Measure BIO-3**: If construction occurs during nighttime, lighting shall be directed away from San Joaquin Marsh and San Diego Creek.

6.2.4 Conclusion

The proposed modifications would not result in a new significant impact not previously identified in the MWRP Final EIR, nor would it substantially increase the severity of an impact identified in the MWRP Final EIR. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to biological resources would be less than significant with mitigation.

6.3 Geology and Soils

The MWRP Final EIR assessed potential impacts associated with geology and soils and concluded that construction and operation of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the proposed modifications.

6.3.1 Setting

The MWRP site is located within a seismically active region. There are no known active faults in the immediate vicinity of the site, but there are several active faults in the region that could produce significant ground shaking. The Newport-Inglewood fault, located approximately 6.3 miles away, is the controlling fault at the Project site. The MWRP site is not considered susceptible to landslides, and the liquefaction potential of the site soils is estimated to be low because of the presence of dense to very dense sands and clayey sands at the site.

6.3.2 Summary of Potential Impact

The MWRP Final EIR assessed the potential impacts of Project implementation associated with geologic hazards and seismic events, including seismic ground shaking, liquefaction, subsidence, expansive soils, and erosion. The Project was determined to have no impact associated with liquefaction or fault rupture; and impacts associated with seismic induced ground-shaking were determined to be less than significant. Implementation of Mitigation Measure G-4a required adequate building design to resist impacts related to corrosive soils. Mitigation Measure G-5a required design-level geotechnical investigations to evaluate the potential for high groundwater levels and subsidence to affect the Project; based on these findings, engineering design and construction measures were required to reduce potential related impacts. Mitigation Measure G-6a requires balance of exported groundwater in the event of dewatering-related subsidence.

The proposed modifications are located on the same site as the Project and would not introduce new impacts associated with liquefaction, fault rupture or seismically-induced ground-shaking. The proposed interim discharge system would add infrastructure for effluent dechlorination and phosphorus removal to the MWRP site in areas that do not currently contain structures. These structures would be skid-mounted and would thus not include a foundation installed belowground. Therefore, impacts related to soil corrosion or high groundwater levels would be less than significant and would not require mitigation. The proposed permanent discharge system would result in ground disturbance to install new pipelines and potentially a new discharge outlet to San Diego Creek. Mitigation Measure G-4a would apply to ensure corrosive soils do not affect buried pipelines and structures. Mitigation Measure G-5a would apply to determine what, if any, engineering design and construction measures need to be incorporated into permanent discharge system design and implemented to mitigate for high groundwater levels and subsidence.

Once constructed, disturbed areas would be restored to pre-construction conditions; operation of the proposed modifications would not disturb soils. Therefore, construction- and operation-related impacts to erosion and sedimentation associated with the proposed modifications would be similar to those already evaluated for the Project. Since the proposed modifications would not involve dewatering or substantial soil disturbance that would alter the geologic stability of the Project site, impacts associated with liquefaction, landslides, and subsidence would be similar to those already evaluated in the MWRP Final EIR.

6.3.3 Applicable Mitigation Measures

Mitigation Measure G-4a: According to the 2001 California Building Code, concrete in contact with onsite soil shall be batched using Type V cement (CBSC, 2001). Adequate concrete cover over reinforcing steel shall be provided in accordance with good construction practices and design standards. Protective coatings shall be provided for buried ferrous metal structures and pipelines. In addition to coatings, the pipes shall be supplemented with cathodic protection if a high degree of assurance against soil corrosion is desired.

Mitigation Measure G-5a: IRWD shall perform design-level geotechnical investigations to evaluate the potential for high groundwater levels and subsidence to affect the Project and other nearby structures. Appropriate engineering design and construction measures shall be incorporated into the Project designs. Appropriate measures for Project facilities will include identifying methods of dewatering that will minimize draw-down-induced settlement at structure locations in the vicinity of the Project site, as well as foundation recommendations to provide “safe” designs intended to provide stability of structures and pipelines built at the site.

To minimize dewatering, water retention systems, such as slurry wall or sheet pile walls, combined with limited excavation, may be considered as an alternative to continuously maintained dewatering operations. All structures and facilities within 50 feet of dewatering wells should be monitored for settlement prior to dewatering, during dewatering operations, and after dewatering operations are completed. Settlement of the adjacent facilities should be restricted to less than 0.5 inch during excavation and dewatering operations. In addition, adjacent facilities should be observed to document existing conditions prior to the beginning of excavation and dewatering.

6.3.4 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of an impact identified in the MWRP Final EIR. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to geology and soils would be less than significant with mitigation.

6.4 Hydrology and Water Quality

The MWRP Final EIR assessed potential impacts to hydrology and water quality and concluded that construction and operation of the Project would have a less than significant impact. The following discussion addresses potential impacts from the proposed modifications.

6.4.1 Setting

The MWRP site and is located in the San Diego Creek Watershed. The MWRP site is adjacent to Reach 1 of San Diego Creek, which has perennial flow and drains to Upper Newport Bay. Both San Diego Creek and Upper Newport Bay are listed on the Clean Water Act Section 303(d) list as water-quality impaired. San Diego Creek is impaired with coliform, nutrients, sedimentation/siltation, selenium, toxaphene, and pesticides. Upper Newport Bay is impaired with chlordane, copper, DDT, indicator bacteria, metals, nutrients, polychlorinated biphenyls, pesticides, sediment toxicity, and sedimentation (SWRCB 2017). The San Diego Creek watershed is designated as a high priority for total maximum daily load (TMDL) development.

San Diego Creek is an unlined, earthen trapezoidal channel approximately 20 feet deep with 3:1 side slopes and a width of approximately 250 feet at the bottom and 350 feet across the top. The channel has various degrees of vegetative growth along its embankments and bottom, which subsequently affects the flood conveyance capacity of the channel. The accumulation of vegetation within the San Diego Creek Channel for the reach located between Jamboree Road and Interstate 405 has caused concerns over the creek's ability to protect the IRWD Facilities during a 100-year storm event (VA Consulting 2006). As a result, IRWD has built flood protection facilities around the MWRP as part of the MWRP Phase 2 Capacity Expansion, which protect the facilities from a 200-year storm event (see Figure 1).

6.4.2 Summary of Potential Impact

In the MWRP Final EIR, implementation of BMPs required by the Construction General Permit was determined to reduce potential impacts related to construction materials that could pollute surface waters or groundwater. The MWRP Final EIR concluded that constituents in the recycled water produced by the Project and the groundwater discharged to San Diego Creek would be within the permitted limits of the NPDES permit, Basin Plan and TMDLs as they pertain to surface water quality and groundwater quality. The MWRP Final EIR concluded that estimated changes in salinity of water due to the Project would be smaller than if there were no Project. The two proposed dewatering wells were concluded to result in negligible drawdown of San Joaquin Marsh pond water levels. Since drainage patterns at the MWRP would not be substantially altered by the Project facilities and the majority of onsite stormwater runoff is treated at the MWRP as part of the reclamation process, the MWRP Final EIR concluded there would not be a substantial increase in storm runoff from the MWRP. Since irrigation return flows would have occurred regardless of the MWRP expansion (with potable water instead of recycled water), the MWRP Final EIR concluded that Project-related production of recycled water would have less than significant impacts related to flooding in San Diego Creek.

The proposed modifications would not disturb over an acre of ground surface and are thus not expected to be covered by the Construction General Permit. However, implementation of minimum construction BMPs would be required as detailed in the Orange County Drainage Area Management Plan (DAMP) developed for compliance with the State Regional Water Board's Municipal Separate Storm Sewer System (MS4) Permit (OCFCD 2006), thereby preventing impacts to water quality from occurring during construction of the modifications. The proposed modifications would not require any dewatering and would thus not result in impacts to groundwater levels. The interim and permanent discharge systems would not occupy large areas of the MWRP site and thus are not expected to alter drainage patterns on the Project site or substantially increase stormwater runoff.

The proposed interim and permanent discharge systems could affect flooding and water quality due to discharge of recycled water directly to Reach 1 of San Diego Creek and eventual discharge of flows downstream into the Upper Newport Bay. These impacts are assessed below.

Flooding

The San Diego Creek at Culver Drive has a Standard Project Flood (SPF) peak discharge value of 21,000 cfs. The channel is designed for the Standard Project Flood as required by the Army Corps of Engineers. Estimated 100-year storm flows in San Diego Creek vary from 33,400 cfs at Michelson Drive to approximately 35,000 cfs at Campus Drive (Tettemer 2003). A floodplain study completed by Tetra Tech (2006) used hydraulic modeling to estimate the extent of flooding that would occur on San Diego Creek during the 100-year event and under varying assumptions. From Interstate 405 to approximately the MWRP, existing high ground and levees would contain the 100-year flow within San Diego Creek (or immediately adjacent to the channel) (Tetra Tech 2006).

From the MWRP to the approximate downstream (or western) extent of the University of California Natural Reserve System (UCNRS) Freshwater Marsh Reserve owed by University of California, Irvine (UCI), limited flooding would occur along the right bank, the predicted extent of which depended largely on the assumed amount vegetation within the channel (e.g., whether or not the 40-foot vegetation buffer was being maintained); flow along the left bank within this reach is contained by levees. With the vegetation buffer maintained to a 40-foot width, the total right bank floodplain area outside of the main channel is minimal (Tetra Tech 2006). With more substantial vegetation growth, the areas of overbank flooding would primarily comprise the San Joaquin Marsh, a small portion of the MWRP site, and the UCNRS Freshwater Marsh Reserve properties. No business or residential areas would be inundated. With respect to the relative amount of overbank flooding, the Tetra Tech (2006) analysis showed that during the 100-year event approximately 30 cfs would flow over the right bank at the MWRP site, while approximately 3,000 cfs and from 2,000 to 4,700 cfs would escape over the right bank adjacent to the San Joaquin Marsh and UCNRS Freshwater Marsh Reserve, respectively. Adjacent to the San Joaquin Marsh where flooding would occur, the predicted water surface elevations in San Diego Creek exceed the right bank elevations by less than one foot, and adjacent to the UCNRS Freshwater Marsh Reserve the predicted water surface elevations exceed the right bank elevations by 0.6 feet to 1.4 feet during a 100-year event (Tetra Tech 2006). Given the volume of San Diego Creek as described in Section 6.4.1 above), substantial flooding is likely only to occur during infrequent storm events.

From the UCNRS Freshwater Marsh Reserve downstream to Newport Bay, the 100-year storm would result in widespread inundation of the left overbank areas, both from flow in San Diego Creek as well as from other flooded areas upstream. Many low-lying areas, including University Drive and the low areas under the bridges at MacArthur and Highway 73, would be flooded. The right bank would also overtop near Jamboree Road, resulting in water inundating a low vegetated area and spilling into a detention pond (Tetra Tech 2006).

To protect the MWRP from potential flood damage, a floodwall was constructed around most of the facility in 2013 (see Figure 1). The floodwall was designed to provide protection from the 200-year flood event (VA Consulting 2013).

IRWD is proposing to install an interim discharge system to accommodate discharge of approximately 22.5 mgd and a permanent discharge system to accommodate discharge up to 33 mgd. Under the proposed interim discharge system, up to 22.5 mgd (35 cfs) of recycled water would be discharged through an existing MWRP outfall (DP Storm-007) into San Diego Creek following diversion of a minimum of 5.5 mgd to other recycled water outlets. This existing outfall has a capacity of 26 mgd. In the event that recycled water is discharged through this outfall, stormwater would be redirected back into the MWRP for treatment. As such, there would be no net increase in potential discharge capacity at the existing outfall, and the impact to flooding associated with the interim discharge system would be less than significant.

Under the proposed permanent discharge system, up 33 mgd (51 cfs) of recycled water would be discharged to San Diego Creek if Phase 3 of the MWRP Expansion Project is implemented. The permanent discharge system may include a new outfall to San Diego Creek within IRWD's property boundary. As such, associated additional discharge to the creek would be up to 33 mgd (51cfs).

The existing capacity of San Diego Creek in the vicinity of the MWRP ranges between approximately the 25,000 to 35,000 cfs, and flooding is predicted to occur only during relatively infrequent events (e.g., the 100-year flood). Data is collected by the Orange County Flood Control District (OCFCD) from a flow gage installed within the creek at its intersection with Campus Drive, which is located in Reach 1 immediately downstream from the MWRP. As shown in **Table 4,** below, during winter when most storms occur (December 21 through March 20) and peak flows occur, average maximum daily flows from 2013-2016 ranged from approximately 56 cfs to 144 cfs. Maximum daily flows (which represent flows during storm events) ranged from 2,290 cfs to 6,560 cfs. Under these conditions, San Diego Creek would have adequate capacity to accommodate the proposed additional discharge of up to 51cfs from the MWRP without exceeding the existing channel capacity and causing flooding. During a 100-year flood that would result in inundation of areas outside the channel, the proposed discharge would represent an extremely small fraction of the overall flow. Given the capacity and dimensions of San Diego Creek, an addition of approximately 35 to 51 cfs during flood flows would increase the water surface elevation by less than three one-hundredths of a foot. As such, the impact to flooding associated with the permanent discharge system would be less than significant.

TABLE 4
WINTER FLOWS IN SAN DIEGO CREEK AT CAMPUS DRIVE
DECEMBER 21 TO MARCH 20 (CFS)

	2013-2014	2014-2015	2015-2016
Average Mean Daily Flow	24	18	38
Average Maximum Daily Flow	97	56	144
Maximum Daily Flow	6,560	2290	4190

Source: OCFCD 2017

Therefore, the proposed modifications would not change the conclusions reached in the MWRP Final EIR. Impacts of the proposed modifications to flooding similarly would not be significant.

Water Quality

To analyze the effects of the proposed discharge of tertiary-treated water to Reach 1 of San Diego Creek, IRWD's water quality monitoring data for effluent generated at the MWRP was reviewed from 2014, 2015 and 2016 for the parameters that have water quality objectives (WQOs) per the Water Quality Control Plan (Basin Plan), Total Maximum Daily Loads (TMDLs), and effluent limitations per the NPDES permit. A Water Quality Evaluation (see **Appendix B** of this Addendum) specifically examined water quality impacts with respect to nutrients in upper Newport Bay (HDR, 2018). The Water Quality Evaluation incorporated creek flow data and nutrient data, bay nutrient data, and MWRP effluent data into a hydrodynamic model that assessed downstream mixing and dilution of the proposed discharge during winter storm periods and upper Newport Bay flushing times over a range of creek flows. The flushing time of an estuary is defined as the turnover time of freshwater, meaning the time required to replace the freshwater contained in the estuary with freshwater inflow (Dettmann, 2015).

Basin Plan and NPDES/WDR Permit

Table 5 shows the highest maximum and highest average values measured for the water quality parameters in MWRP effluent compared to the applicable WQOs for Reach 1 of San Diego Creek, as well as effluent limitations in the Permit. The final column states whether the water quality parameters for MWRP recycled water would comply with the WQOs or effluent limitations.

As shown in Table 5, IRWD's monitoring data demonstrates that the water quality of the MWRP effluent is below the Basin Plan WQOs for TIN, chemical oxygen demand, and total dissolved solids for Reach 1 of San Diego Creek on an annual average basis. Therefore, direct discharges of recycled water to Reach 1 at DP Storm-007 or a new adjacent outfall would not degrade water quality or adversely affect beneficial uses. In addition, IRWD's monitoring data (Table 5) confirms that the existing water quality of the MWRP effluent also meets all the MWRP Permit effluent limits.

TABLE 5
EFFLUENT ANALYSIS FOR MWRP RECYCLED WATER, 2014-2016

Parameter	Units	Highest Max	Highest Average	San Diego Creek Reach 1 WQO	WDR Permit Effluent Limitation	Compliance with WQO/Effluent Limitation?
Total Inorganic Nitrogen (Annual Avg)	mg/L	12.6	--	13	--	Yes
Chemical Oxygen Demand (Annual Avg)	mg/L	15.2	--	90	--	Yes
Total Dissolved Solids (12-Month Avg)	mg/L	678	668	1,500	720	Yes
Biochemical Oxygen Demand (Daily Max)	mg/L	9.60	3.53	--	30	Yes
Biochemical Oxygen Demand (Monthly Avg)	mg/L	<2.2	<2.2	--	20	Yes
Biochemical Oxygen Demand (Daily Max)	lbs/day	369.90	431.20	--	7,006	Yes
Biochemical Oxygen Demand (Monthly Avg)	lbs/day	0	0	--	4,670 l	Yes
Total Suspended Solids (Monthly Avg)	mg/L	0.80	0.56	--	100	Yes
Total Suspended Solids (Daily Max)	mg/L	5.00	1.64	--	400	Yes
Total Suspended Solids (Monthly Avg)	lbs/day	101.91	68.61	--	4,670	Yes
Total Suspended Solids (Daily Max)	lbs/day	774.00	257.50	--	7,006	Yes
Ammonia-Nitrogen (Monthly Avg)	mg/L	0.36 mg/L	0.13 mg/L	--	0.75	Yes
Dichlorobromomethane (Monthly Avg)	µg/L	44.00	30.44	--	46	Yes
Dichlorobromomethane (Daily Max)	µg/L	54.00	36.50	--	71	Yes
pH (Instantaneous Min)	standard units	6.50	6.75	--	6.5	Yes
pH (Instantaneous Max)	standard units	8.00	7.40	--	8.5	Yes

The existing NPDES Permit currently does not cover the discharge of tertiary-treated effluent to San Diego Creek. However, the Permit does allow for emergency releases from the reservoirs; therefore, recycled water discharged to the reservoirs has the potential to eventually be released to tributaries and upper reaches of San Diego Creek during an emergency, which eventually flows to Reach 1. In addition, Rattlesnake, Sand Canyon and Syphon reservoirs are classified as "waters of the United States" and discharges to these reservoirs primarily have the same water quality objectives as those for the San Diego Creek to which they are tributary. The Basin Plan beneficial use designations for the reservoirs include agricultural supply as well as the same beneficial uses as Reach 1 of San Diego Creek, including water contact recreation, non-contact water recreation, warm freshwater habitat, and wildlife habitat. Therefore, it is reasonable to assume that the Permit effluent limitations for the reservoirs also would apply to direct discharge to San Diego Creek in order to protect the same beneficial uses. Given that the water quality of the MWRP recycled water currently meets the Permit effluent requirements and protects beneficial uses of the reservoirs, it would be expected that MWRP recycled water discharged to San Diego Creek also would not adversely affect water quality or beneficial uses.

Total Maximum Daily Loads

There are currently four TMDLs in place for Reach 1 of San Diego Creek (nutrients, pesticides, sediment, selenium) and four TMDLs in place for Newport Bay (nutrients, sediment, toxics, and fecal coliform) (OCPW 2018). The proposed project would result in the discharge of MWRP recycled water during storm/wet season conditions, when many TMDLs do not apply. Regardless, each TMDL is addressed below.

Nutrient TMDL: The 1998 nutrient TMDL for Newport Bay and San Diego Creek (SWRCB 1998) excludes nitrogen loads from sources during storm events that result in mean daily flows of 50 cfs or more in San Diego Creek at Campus Drive, which is just downstream of the MWRP. During all other times, discharges to San Diego Creek must comply with a TN effluent limit of 1 mg/L. All discharges in excess of 1 mg/L must be offset by nitrogen reductions. In addition, the nutrient TMDL requires that discharge shall not contribute to excessive algal growth in inland receiving waters or Newport Bay.

The proposed MWRP recycled water discharges to San Diego Creek are expected to occur during wet weather events in winter months, which is when mean daily flow in the creek is typically greater than 50 cfs at Campus Drive (HDR, 2018a). As a result, IRWD would not need to comply with the 1 mg/L TN effluent limit during such discharges to the creek.

Regarding algal growth, there are no quantitative thresholds for nutrients (nitrogen or phosphorus) related to algal growth for Newport Bay. As such, a Water Quality Evaluation (**Appendix B**) was conducted to review recent historical water quality data for San Diego Creek and Upper Newport Bay, compare this data to MWRP effluent water quality, qualitatively evaluate conditions that promote algal growth, and model how the proposed MWRP recycled water discharges of up to 33 mgd would affect nutrients in these receiving waters and thus potentially affect algal growth.

A review of water quality data from 2000 through 2017 indicates that TN, total inorganic nitrogen (TIN), and TP in San Diego Creek are positively correlated with creek flow (i.e., increasing concentrations at higher creek flows). Once San Diego Creek enters Upper Newport Bay, TN and TP concentrations decrease by about 75 and 62 percent, respectively. This decrease is due to freshwater and tidal dilution. It is estimated that flushing of nutrients in Upper Newport Bay occurs within approximately 1 to 2 weeks during low flow (5 to 50 cfs) and less than one week during high flow (500 to 1000 cfs) (HDR, 2018a).

Over the period of 2000 to 2017, both TN and TP concentrations in San Diego Creek and Newport Bay decreased, but TP relatively more so (HDR, 2018a). Over this same period, macroalgal biomass in Newport Bay showed a declining trend (HDR, 2018b). Average dry biomass remained low and steady from 2007 to 2012; and biomass has been non-detectable at all monitoring stations since 2013 (HDR, 2018b). Correlating the declines in TN and TP with declining macroalgal biomass suggests that algal growth in the bay is more limited by phosphorus than nitrogen, which supports the importance of the phosphorus removal system to be incorporated into the proposed interim discharge system (HDR 2018a).

Macroalgae growth and biomass in upper Newport Bay typically is the greatest during July through September, which is the index period used in the Newport Bay Watershed Nutrient TMDL Annual Data Reports (HDR, 2018a). This is due to water temperatures that are more favorable to their growth (e.g., greater than 20°C). Based on upper bay monitoring data at Jamboree Road, Santa Ana-Delhi Channel, Northstar Beach and Coast Highway Bridge, water temperatures are less than 20°C during the months of October through April (HDR, 2018a).

The Water Quality Evaluation used a calibrated hydrodynamic model to estimate nutrient impacts in Newport Bay for proposed MWRP recycled water discharges to San Diego Creek of 14.5 mgd and 33 mgd over three time periods: 1, 7 and 14 days. A discharge of 33 mgd represents the maximum recycled water treatment capacity of MWRP following Phase 3 Capacity Expansion, although there is no schedule for implementation of Phase 3. The proposed effluent quality used to characterize MWRP recycled water was 10 mgN/L TN and 0.3 mg P/L TP, based on effluent data from 2007 through 2017. TN and TP data from monitoring stations in Newport Bay for the period from 2007 through 2017 were analyzed to determine concentrations that reflect the low to non-detectable macroalgal biomass in the bay. That is, TN and TP concentrations were developed that reflect concentrations to measure potential changes against due to the proposed MWRP discharge. Overall TN and TP averages were developed from the yearly seasonal averages, and an upper bound concentration was set as the overall average plus one standard deviation. In addition, a maximum average concentration was also developed for evaluating short-term perturbations in the bay (HDR, 2018b). (Note: these parameters were developed for purposes of this analysis, in the absence of quantitative thresholds in the TMDL, and are not regulatory thresholds.) Model-calculated TN and TP increases due to the proposed MWRP discharges were added to the overall averages; and then model results were compared to the upper bound and maximum average concentrations to assess potential water quality impacts in Newport Bay.

The 1-day, 7-day and 14-day MWRP recycled water discharges of 14.5 mgd and 33 mgd were analyzed over averaging periods of 30, 60 and 90 days, which are biologically relevant to addressing nutrient impacts on macroalgae biomass (HDR 2018b). The Water Quality Evaluation results showed that with the exception of recycled water discharges of 33 mgd for 14 days and then averaged over 30 days, TN would be below the 2007-2017 maximum average concentrations and upper bound concentrations (overall average plus one standard deviation) (HDR, 2018b). When 14 days of recycled water discharges at 33 mgd are averaged over 60 and 90 days, TN drops below these thresholds. For TP, both 14.5 mgd and 33 mgd discharges were below the 2007-2017 maximum average concentrations and upper bound concentrations for all durations and all 30/60/90-day averaging periods.

Although the 33-mgd 14-day discharge results in TN that is greater than the upper bound and maximum average concentrations identified for purposes of this analysis, such water quality impacts would not contribute to excessive algal growth in Newport Bay. When considered together with the following conditions and project operating criteria, there would be no significant impact to algal growth in Newport Bay:

- Phosphorus is considered by the RWQCB be more of a limiting factor than nitrogen for algal growth in Newport Bay. The Water Quality Evaluation results indicate that the slight increase in TP concentrations in Newport Bay due to the MWRP discharges would not cause excessive algal growth.

- The proposed MWRP recycled water discharges would occur during winter months when water temperatures are typically below 20°C, which is not conducive to algal growth. Macroalgal growth and biomass are typically the greatest during July and August when water temperatures are above 20°C and more favorable to growth.

- The proposed MWRP recycled water discharges to San Diego Creek and Newport Bay would primarily contain dissolved forms of TN and TP, which unlike particulate nitrogen and phosphorus will not settle to the sediments and return as dissolved nutrients during warmer summer months of the year. As such, dissolved nutrients discharged during winter months would not cause excessive algal growth during summer months.

- The proposed MWRP recycled water discharges would occur during winter months when flow is above 50 cfs and flushing times are short (i.e., less than 1 week). The discharges would be diluted by high creek flows and would decrease flushing time in Newport Bay even further. The 33-mgd discharge was modeled to reduce flushing in Newport Bay by 1 to 2 days. This would minimize the potential algal response due to water quality impacts in Newport Bay since the MWRP effluent would be transported out of the bay.

- MWRP recycled water discharges are not anticipated to occur more than once every 3 to 5 years. This frequency of occurrence would not significantly affect water quality and algal growth in Newport Bay (HDR, 2018b).

Sediment TMDL: With regard to the 1998 sediment TMDL for Newport Bay and San Diego Creek (SWRCB 2014), the proposed flow would represent a small percentage of the flow in the creek under wet weather/season flow conditions and wouldn't transport any significant percentage of sediment to the Newport Bay beyond what is in the creek during storm/wet season flows. However, low-level transport does occur year-round under normal flow conditions. IRWD is a funding partner of the Newport Bay Watershed Executive Committee that is charged with implementing the provisions of the sediment TMDL and conducts monitoring and surveys to ensure compliance and sediment loading targets are being met. Additionally, the sediment reduction target is expressed as a 10-year running annual average due to the fact that weather and other conditions can widely vary the rate of sediment deposition. IRWD does not intend for the discharge of recycled water to be a routine occurrence and short term in nature when it does occur. As described for the nutrient TMDL above, the timing of the proposed diversions to San Diego Creek during high flow periods of the year would increase dilution of the diversion and flushing in Newport Bay, and IRWD diversions would occur during short flushing times (i.e., less than 1 week), minimizing potential impacts. It is not expected that this discharge will impact the 10-year running annual average load allocations to San Diego Creek and Newport Bay.

Toxics/Selenium TMDLs: A toxic pollutant TMDL was established for San Diego Creek and Newport Bay in 2002 (USEPA 2002) for selenium, several heavy metals and organic chemicals, including modern pesticides, legacy pesticides and polychlorinated biphenyls (USEPA 2002). The selenium TMDL was recently adopted in August of 2017 for freshwater in the Newport Bay watershed (SWRCB 2017b). Past reasonable potential analyses conducted for IRWD discharges would still apply to this new discharge; these analyses did not indicate levels of concern. A separate TMDL was established for diazinon and chlorpyrifos (SARWQCB 2003), which are also toxic substances. The same aforementioned reasonable potential analyses conducted for IRWD discharges did not indicate presence of diazinon and chlorpyrifos at significant concentrations. IRWD is part of the Nutrient and Selenium Management Program (NSMP) Working Group that consists of stakeholders who have agreed to fund and implement a work plan to address selenium in the watershed. While IRWD has the ability to participate in the offset program (i.e. Peters Canyon Pipeline) for any discharges of selenium in excess of the numeric water column effluent limit of 5 µg/L, it is expected that MWRP's recycled water will comply with the selenium effluent limit; levels for 2014, 2015, 2016 and the first three months of 2017 were 2.39, 2.05, 1.97 and 1.42 µg/L, respectively. Further, diversions would occur during high flow periods in San Diego Creek and would be highly diluted and flushed out of Newport Bay, thereby minimizing potential impacts related to toxics present in MWRP effluent discharged to San Diego Creek.

Fecal Coliform TMDL: A TMDL was approved in 1999 to control the bacterial quality in Newport Bay, as bacterial contamination of the bay can directly affect two beneficial uses (water-contact recreation and shellfish harvesting) (SARWQCB 1999). The TMDL states the geometric mean of 5 samples over 30 days must have less than 200 organisms/100 mL. Since the proposed effluent would be tertiary treated to target the removal of materials including fecal coliform, the discharge of effluent from MWRP to San Diego Creek is not expected to affect existing water quality of San Diego Creek or Newport Bay with respect to fecal coliform.

Based on the information above, discharge of effluent from MWRP to Reach 1 of San Diego Creek and downstream to Newport Bay would comply with all applicable water quality requirements would protect beneficial uses and standards, and would not have significant adverse effects to water quality.

6.4.3 Applicable Mitigation Measures

None required.

6.4.4 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to hydrology and water quality due to proposed modifications would be less than significant**.**

6.5 Noise

The MWRP Final EIR assessed potential impacts to sensitive receptors due to Project noise and vibration and concluded that construction and operation of the Project would have a less than significant impact. The following discussion addresses potential impacts from the modified Project.

6.5.1 Setting

As described in the MWRP Final EIR, the primary noise sources in the area are vehicular traffic along Michelson Drive and Harvard Avenue. Apart from noise sources associated with operation of the existing MWRP facility, other noise sources include background traffic along Jamboree Road and Interstate 405, as well as aircraft noise from the John Wayne Airport. Residential land uses are located in the vicinity of the MWRP. The nearby residences qualify as noise sensitive receptors; however, the closest construction activities to these residences are those that would occur in San Diego Creek; these activities would be approximately 1,400 feet away from the residences.

6.5.2 Summary of Potential Impact

The MWRP Final EIR concluded that construction-related traffic would result in a less than significant noise impact. Operation of the Project facilities including noise from new equipment and additional truck trips was not anticipated to substantially increase the ambient noise level and resultant impacts were concluded to be less than significant.

Similar to the Project, the proposed interim and permanent discharge systems would be constructed onsite at the MWRP during the City of Irvine’s allowable construction hours and days. Approximately 10 daily vehicle trips would be required during construction of the proposed interim and permanent discharge systems, which is less than the 50 vehicle trips required for the Project construction and evaluated in the MWRP Final EIR. Therefore, construction of the proposed modifications also would result in a less than significant noise impact.

The proposed pipelines associated with the interim and permanent discharge systems would not generate noise nor require vehicle trips during operation. Operation of the dechlorination system and the phosphorus removal system would generate a negligible amount of noise, but would require approximately six vehicle trips per year for deliveries of sodium bisulfite and iron salts during operation. However, these vehicle trips would be less than the one to two additional truck trips per month generated by the Project as described in the MWRP Final EIR. Therefore, impacts to noise during operation of the proposed modification would be less than significant.

6.5.3 Applicable Mitigation Measures

None required.

6.5.4 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. Noise impacts to sensitive receptors due to the proposed modifications would be less than significant.

6.6 Public Health and Safety

The MWRP Final EIR (Chapter 4.4) assessed potential impacts to public health and safety and concluded that construction and operation of the Project would have a less than significant impact with incorporation of mitigation. The following discussion addresses potential impacts from the proposed modifications.

6.6.1 Setting

The MWRP site contains some hazardous materials and hazardous wastes, which are listed by the site's existing Hazardous Materials Business Plan (HMBP). The amount of chlorine stored and used at the MWRP (up to 50,000 pounds) exceeds the threshold quantity listed in 40 CFR 68 and Occupational Safety and Health Act (OSHA) 1910.119 for regulated toxic substances. A Process Safety Management (PSMP) and Risk Management Plan (RMP) was implemented onsite to cover the bulk storage and handling of chlorine in the 50,000-lb cylinder. The PSMP and RMP include programs to reduce the probability of an accidental release of a regulated substance, and to mitigate impacts in the event of an accidental release. The chlorine tank is located within a chlorine bulk storage building equipped with a scrubber system designed to neutralize chlorine releases should they occur. The scrubber system would reduce the release of chlorine that could reach a distance of 5.4 miles from the facility to 0.2 mile from the facility. Materials delivered to the facility, including bulk chlorine that is delivered every two weeks, are transported in Department of Transportation (DOT)-regulated containers by drivers licensed and trained for the handling of hazardous materials. Hazardous wastes generated at the facility are minor and are generally confined to waste oils and paints; they are disposed in accordance with California regulations, which require that oily wastes be collected for either recycling or disposal at a Class I hazardous waste landfill. Sensitive receptors within one-quarter mile include residences and a church.

6.6.2 Summary of Potential Impact

The MWRP Final EIR required implementation of Mitigation Measures HAZ-1a through HAZ-1d to reduce potentially significant impacts associated with hazardous substance spills during construction to less than significant. Mitigation Measure HAZ-1a requires hazardous material-related training for construction personnel, and Mitigation Measure HAZ-1b ensures appropriate hazardous waste disposal. Mitigation Measure HAZ-1c require the preparation of a hazardous substance management, handling, storage, disposal and emergency response plan for construction activities. Mitigation Measure HAZ-1d requires that hazardous materials spill kits are maintained onsite. The MWRP Final EIR concluded that since the Project would not increase the hazardous materials or hazardous wastes stored on site and compliance with the existing HMBP, PSMP and RMP would continue during operation, impacts related to the release of hazardous materials during operation would be less than significant. The MWRP Final EIR stated that the Project would increase the frequency of bulk chlorine deliveries to approximately one delivery per week; however, this would not represent a significant change from current operations and would not occur within one-quarter mile of an existing or proposed school. The MWRP Final EIR determined that impacts related to hazardous materials release during delivery would be less than significant.

During operation, the proposed highline would transport treated recycled water to an existing stormwater pipeline; its operation would not involve the use of hazardous materials. The proposed dechlorination facility would use sodium bisulfite to dechlorinate recycled water prior to its release into San Diego Creek. Sodium bisulfite is a hazardous substance that can cause eye, skin, nose and throat irritation (NJDH 2008). The phosphorus removal facility would use iron salts (either ferric chloride or aluminum sulfate) during its effluent treatment. Ferric chloride and aluminum sulfate are both considered hazardous substances and can cause cough and eye and skin redness in humans (CDC 2015a; CDC 2015b). However, compliance with the existing HMBP, PSMP and RMP would reduce impacts related to the potential release of sodium bisulfite or iron salts during operation of the proposed modifications. Implementation of MWRP Final EIR Mitigation Measures HAZ-1a through HAZ-1d would reduce impacts associated with hazardous substance spills during construction to less than significant.

6.6.3 Applicable Mitigation Measures

Mitigation Measure HAZ-1a: Prior to construction, all contractor and subcontractor project personnel shall receive training regarding the appropriate work practices necessary to effectively comply with the applicable environmental laws and regulations, including, without limitation, hazardous materials spill prevention and response measures.

Mitigation Measure HAZ-1b: Hazardous materials shall not be disposed of or released onto the ground, the underlying groundwater, or any surface water. Totally enclosed containment shall be provided for all trash. All construction waste, including trash and litter, garbage, other solid waste, petroleum products and other potentially hazardous materials, shall be removed to a hazardous waste facility permitted or otherwise authorized to treat, store, or dispose of such materials.

Mitigation Measure HAZ-1c: A hazardous substance management, handling, storage, disposal, and emergency response plan shall be prepared and implemented.

Mitigation Measure HAZ-1d: Hazardous materials spill kits shall be maintained onsite for small spills.

6.6.4 Conclusion

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. Impacts to public health and safety would be less than significant with mitigation.

7.0 Summary of Environmental Effects

As discussed in this Addendum No. 4, the proposed modifications would not change the conclusions of the certified Final EIR, Supplemental EIR and Addenda Nos. 1, 2, and 3. The proposed modifications would allow for the discharge of recycled water to San Diego Creek during rare and infrequent emergency situations. This would avoid sewage overflows at the MWRP and associated impacts to the environment, and would allow for the continued operation of the biosolids processing facilities at the MWRP. Therefore, the proposed modifications would not affect the Project's ability to achieve its objectives of expanding recycled water production, enhancing water supply reliability, minimizing the need for purchases of freshwater, and optimizing water supply, wastewater treatment, life cycle and construction cost economics.

The proposed modifications would not result in a new significant impact or substantially increase the severity of a previously identified significant impact. No mitigation is required beyond the existing commitments contained within the MMRP. The proposed modifications to the previously-approved Project do not meet any of the conditions that would require the preparation of a subsequent or supplemental EIR as set forth in Sections 15162 and 15163 of the CEQA Guidelines.

8.0 References

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9.0 Determination

Section 15164(a) of the CEQA Guidelines states the following:

> *The lead agency or responsible agency shall prepare an addendum to a previously certified EIR if some changes or additions are necessary but none of the conditions described in Section 15162 calling for the preparation of subsequent EIR have occurred.*

The proposed modifications to the original Project would not result in new significant environmental effects or a substantial increase in the severity of previously identified significant effects. Furthermore, new information associated with the proposed modifications does not indicate that: the Project will have one or more significant effects not discussed in the adopted MWRP Final EIR; significant effects previously examined will be substantially more severe than shown in the adopted MWRP Final EIR; mitigation measures or alternatives previously found not to be feasible would in fact be feasible; or mitigation measures or alternatives which are considerably different from those analyzed in the adopted MWRP Final EIR would substantially reduce one or more significant effects on the environment, but the Project proponents decline to adopt the mitigation measures or alternative. Accordingly, an addendum has been prepared as opposed to a supplemental or subsequent EIR. IRWD is adopting this Addendum No. 4 in accordance with the CEQA Guidelines Section 15164.

Irvine Ranch Water District

[signature]	3/19/18
Signature	Date
Jo Ann Corey	Environmental Compliance Specialist
Printed Name	Title

Appendix A
Phosphorus Removal Memo

INTEGRATED
PERFORMANCE
CONSULTANTS

December 10, 2017

Jose Zepeda
Director of Water Recycling Operations
Irvine Ranch Water District – Michelson Water Recycling Plant
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BACKGROUND:

Phosphorous Removal at MWRP

The implementation of advanced phosphorous removal is currently being planned at the MWRP to significantly reduce the Total Phosphorous (TP) levels in the recycled water. Integrated Performance Consultants, Inc. (IPC), is a proven industry expert on Membrane Bioreactor (MBR) design and operation, nutrient removal system pilot testing, and full scale treatment system implementation. IRWD has retained IPC to achieve the most effective strategy for TP removal at MWRP.

Phosphorous Removal Methods

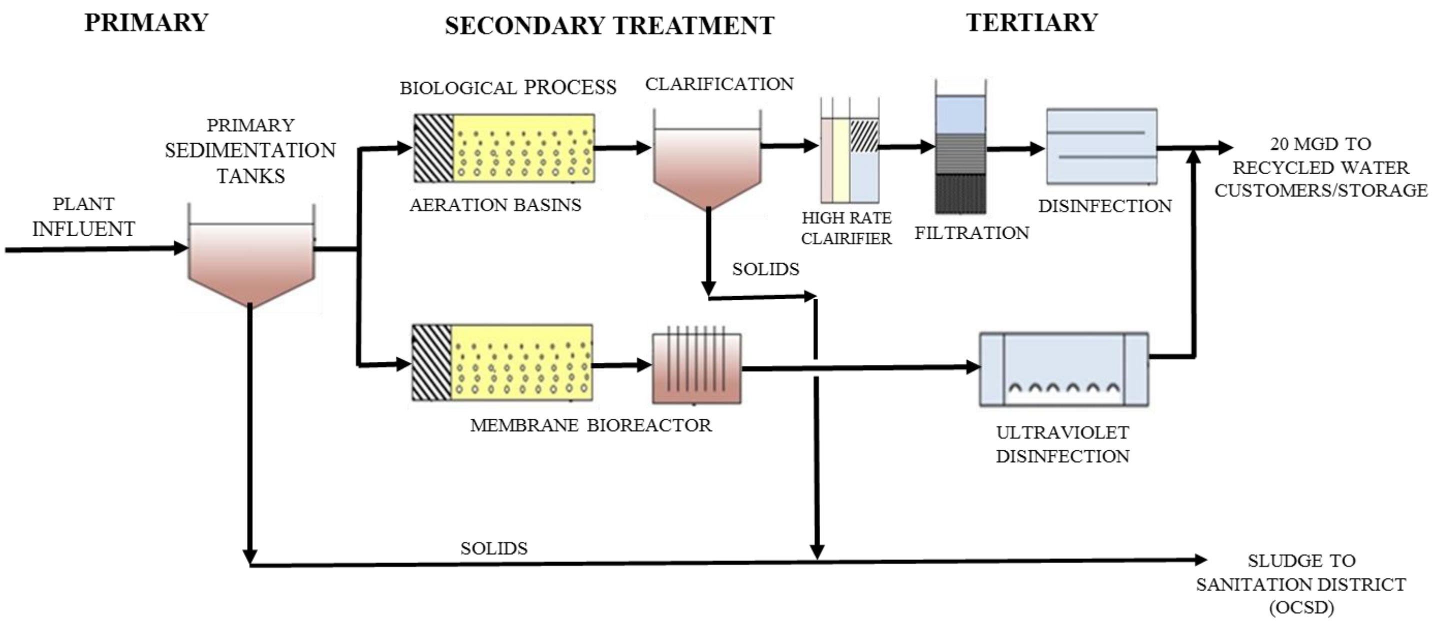
Significant phosphorous removal can be achieved at Water Recycling Plants by various means, both biological and chemical. Biological methods typically require specific physical design elements that are not currently available at MWRP. Although this may be worthy of consideration in the future, it is not currently possible, and was therefore not considered as a viable option.

Several commonly used chemicals have proven capable of removing phosphorous, specifically the iron salts ferric chloride and alum (aluminum sulfate).

Historical Phosphorous Removal at MWRP

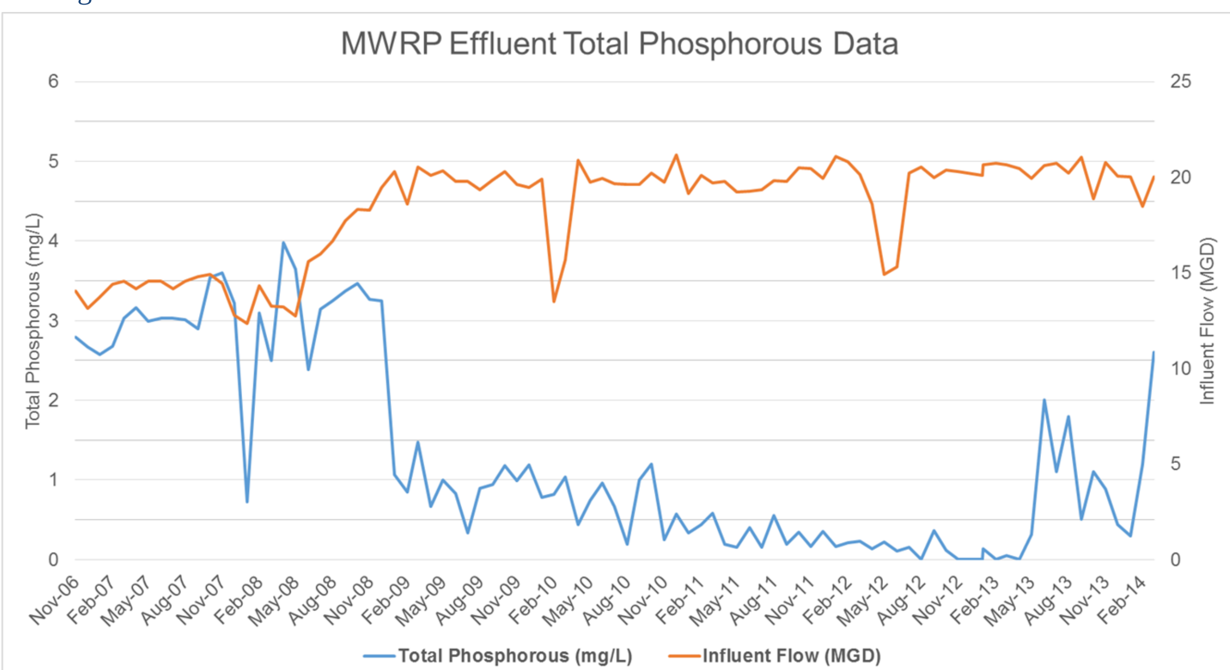
MWRP has demonstrated the ability to remove TP through iron salt addition in the past. Throughout a period from November 2008 through March 2014, ferric chloride was added to the primary sedimentation tanks to enhance conventional treatment such as BOD and TSS removal during the plant's Phase II expansion project. A schematic of the MWRP treatment process is shown in Figure 1.

Figure 1 – Michelson Water Recycling Plant Treatment Schematic



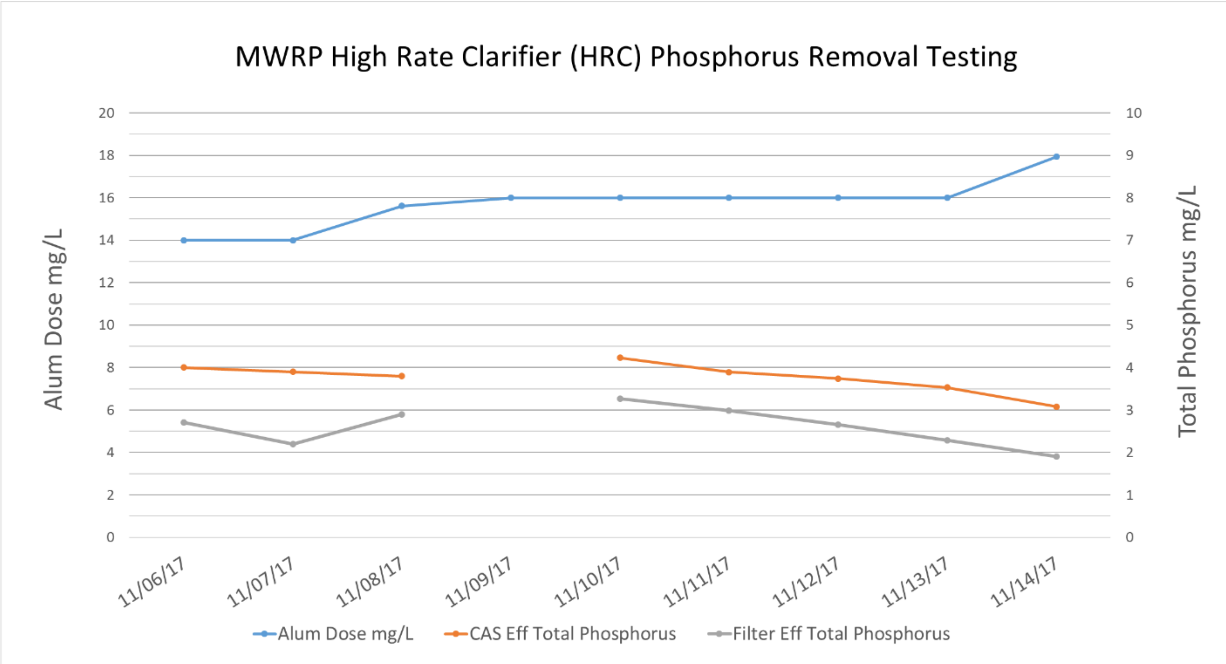
Coincidentally, a substantial degree of phosphorous removal was also achieved. At ferric chloride dosages between 25 and 30 mg/L, TP was reliably reduced from 3 to less than 1 mg/L. Historical TP removal data via ferric chloride addition to the primary sedimentation tanks is shown in Figure 2.

Figure 2 – Historic TP Removal Data



As part of the MWRP Expansion Project, a High Rate Clarification process, as shown in Figure 1, was added upstream of the tertiary gravity filters to reduce solids loading on the filters. Recently, the High Rate Clarifier (HRC) was tested for its ability to remove TP by elevating the alum dose. At alum dosages between 20 and 25 mg/L, TP was reduced from 4 to 2 mg/L, this assessment is ongoing to determine further TP removal potential. Phosphorous removal data via alum addition to the HRC is shown in Figure 3.

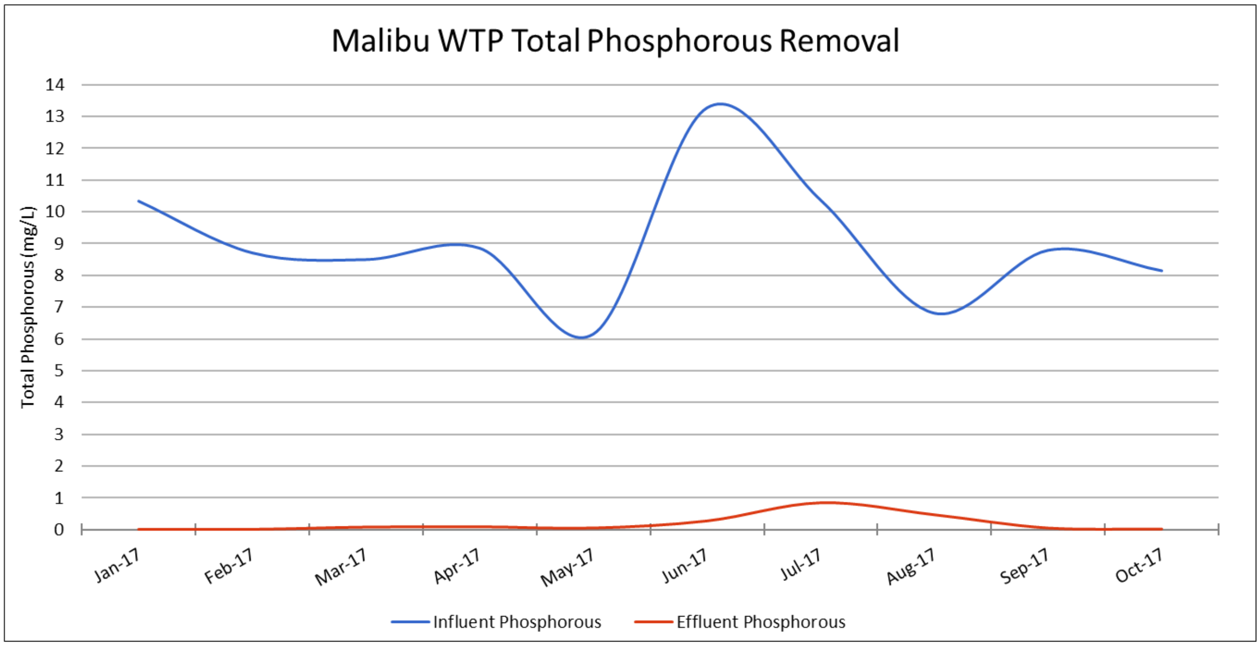
Figure 3 – HRC Phosphorous Removal Data



<u>Phosphorous Removal at Malibu Water Treatment Plant</u>

Malibu WTP is a 20,000 gpd Membrane Bioreactor (MBR), treating a high strength waste flow stream, which has been in operation for 10 years. In comparison to MWRP, influent BOD averages 600 mg/L, and influent TP averages 9 mg/L. Effluent is discharged into the subsurface, but is hydraulically connected to Malibu Creek and Lagoon, which prompted the LARWQCB to apply strict nutrient limits on the discharge. The effluent TP limit is 1.5 mg/L, with alum addition used to achieve the TP limit. Historical phosphorous removal data via alum addition to the Malibu WTP is shown in Figure 4. Note that Malibu WTP's influent TP concentration is 2-3 times higher that than influent TP influent at MWRP.

Figure 4 - TP Removal at Malibu WTP



<u>Phosphorous Removal Pilot Testing</u>

In order to determine the most effective strategy for phosphorous removal by chemical precipitation, pilot testing will be performed at MWRP. Jar testing has been performed on samples taken from various locations in the treatment process. The testing was done in order to determine the initial start dose during pilot testing needed to reduce TP concentrations. The pilot testing will begin in mid-December and is scheduled to last for 8 weeks as shown in Table 1. The schedule and duration may be modified depending on results.

Table 1 – Pilot Testing Schedule

	ALUM				FERRIC CHLORIDE			
WEEK	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*
MBR	DOSE A	DOSE B	DOSE C	DOSE D	DOSE A	DOSE B	DOSE C	DOSE D
CAS	DOSE A	DOSE B	DOSE C	DOSE D	DOSE A	DOSE B	DOSE C	DOSE D

<u>MBR Train Pilot Testing</u>

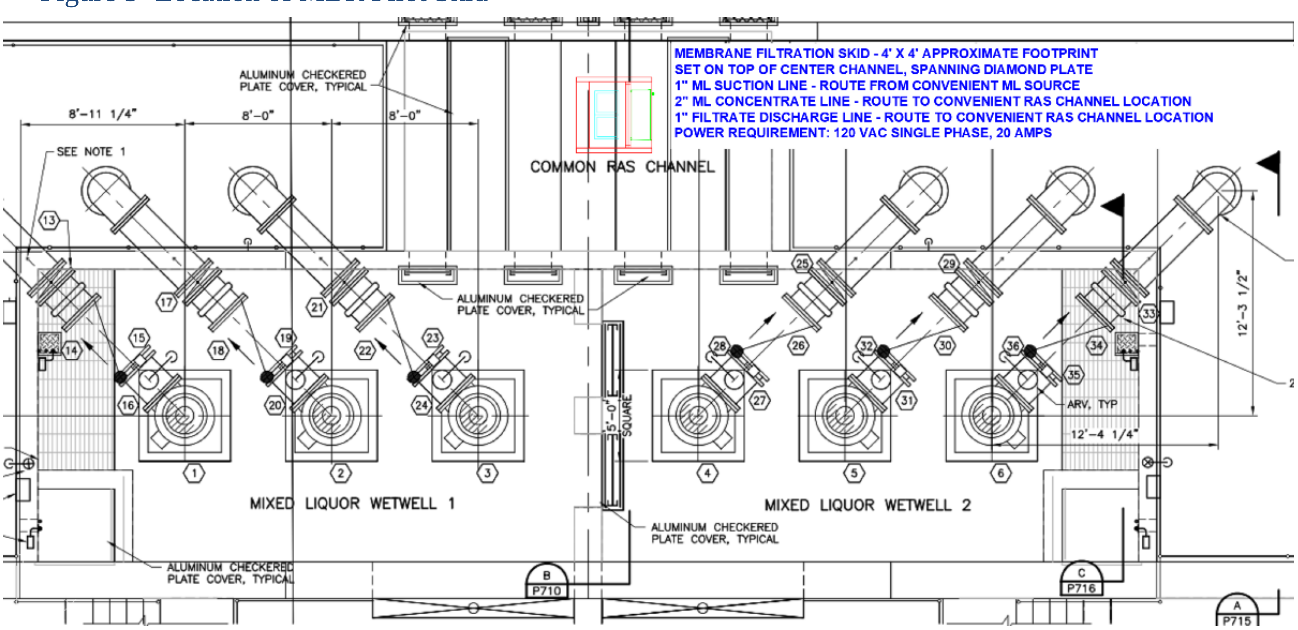
For the MBR process, a small membrane filtration pilot system will be used prior to implementing full scale chemical addition. The pilot membrane filter is designed to closely mimic physical characteristics (flow rates, tank volumes, mixing energy, and detention times) of the MWRP MBR. Iron salts will be added at various dose rates during the pilot test, with continuous online phosphorous monitoring to provide feedback of iron salt dose effectiveness. Membrane permeability, alkalinity, and pH will also be continuously monitored. Performance data will be available on the local Human-Machine-Interface (HMI) of the pilot system, and also made available for monitoring by the MWRP SCADA system.

The membrane filtration pilot skid includes the following equipment:

- Membrane Tank (84 gal)
- Filtrate Tank (7 gal)
- Chlorine Tank (7 gal)
- Iron Salt Tank (7 gal)
- Base Tank (7 gal)
- Variable Speed Self Priming Reversible Membrane Feed Pump
- Variable Speed Self Priming Reversible Filtrate / Backwash Pump
- Variable Speed Regenerative Membrane Air Scour Blower
- Chemical Feed Pump 1 – Chlorine
- Chemical Feed Pump 2 – Iron Salt
- Chemical Feed Pump 3 – Base
- Feed Flow Meter
- Filtrate Flow Meter
- Membrane Air Scour Flow Meter
- Membrane Tank Level Transmitter
- Filtrate Tank Level Transmitter
- Chlorine Tank Level Transmitter
- Iron Salt Tank Level Transmitter
- Base Tank Level Transmitter
- Transmembrane Pressure Transmitter
- Online Phosphorous Monitor
- Online Alkalinity Monitor
- Online pH Monitor
- Control Panel with Local HMI and Remote Monitoring and Control Capability

The membrane filtration skid will be set on the common Return Activated Sludge (RAS) channel between the membrane feed pumps as shown in Figure 5.

Figure 5- Location of MBR Pilot Skid



MBR Train pilot testing will be performed using both alum and ferric chloride (separate tests), at a range of dosages required to achieve < 0.5 mg/L total phosphorous in the filtrate. Data gained during pilot testing will be analyzed to determine the optimum specifications for full scale implementation.

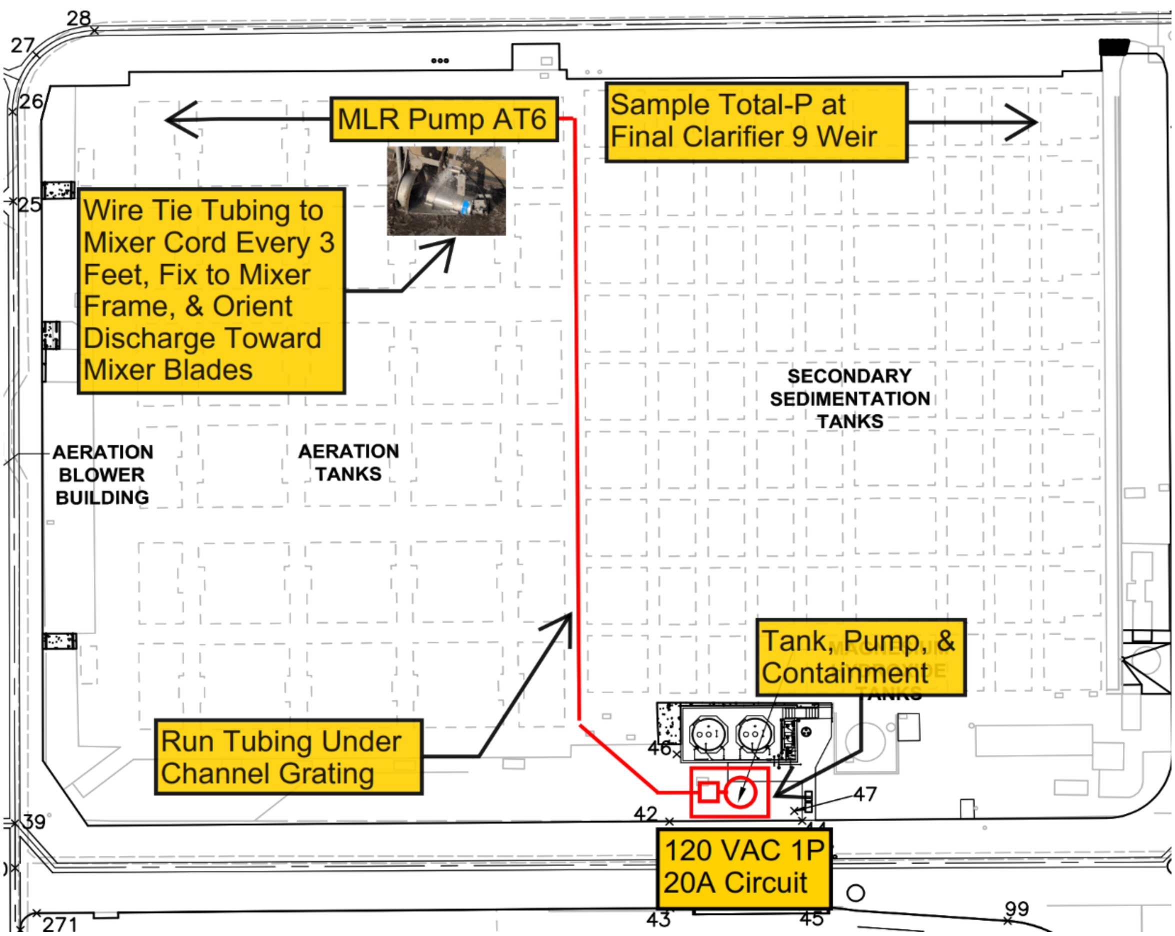
Conventional Activated Sludge (CAS) Train Pilot Testing

The pilot testing for the CAS treatment process will be performed by dosing chemical into one of the system's aeration tanks and secondary clarifier. Chemicals will be dosed by a metering pump from a chemical storage tank with secondary containment. The equipment will be controlled and monitored by field instrumentation components and a programmable logic controller (PLC) system. This system will collect field data and transmit it to the MWRP SCADA system.

The dose set point will be entered and the PLC will calculate the required pump speed to achieve the desired chemical addition. Phosphorous sampling will be conducted at the Final Clarifier launder. Samples will either be manual grabs analyzed in the laboratory, or pumped to the MBR Pilot phosphorous analyzer.

CAS pilot testing will be done using both alum and ferric chloride (separate tests), at a range of dosages required to achieve < 0.5 mg/L TP in the filtrate. Results from the testing will be analyzed to determine the optimum specifications for full scale implementation. The CAS pilot system will be configured and laid out as shown in Figure 6.

Figure 6 – CAS Pilot System Layout



Implementation of Full Scale TP Removal

Once MBR and CAS pilot testing is complete, IPC will document the results in a technical memorandum and also provide recommendations for full scale implantation.

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Appendix B
Water Quality Evaluation

Water Quality Evaluation

Michelson Water Recycling Plant Proposed Diversions to San Diego Creek and Newport Bay

Irvine Ranch Water District

January 5, 2018

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Introduction

The Irvine Ranch Water District (IRWD) is an independent special district serving Central Orange County, California. IRWD provides high-quality drinking water, reliable sewage collection and treatment, ground-breaking recycled water programs, and environmentally sound urban runoff treatment to more than 380,000 residents. IRWD's Michelson Water Recycling Plant (MWRP) provides tertiary treatment of sewage resulting in an excellent quality of recycled water that is used for landscape and agricultural irrigation, and for industrial and commercial needs.

A challenge for IRWD is the management of recycled water during extreme rainfall events. Extremely wet conditions can result in low demand for recycled water, storage reservoirs at full capacity, and limited ability to divert sewage to neighboring utilities for relief. IRWD is seeking solutions to these challenges while continuing to be a good steward of the Newport Bay watershed.

Objectives

IRWD's goal is to utilize all of the recycled water produced at the MWRP. However, during extreme wet conditions, and as an option of last resort, IRWD seeks a permit amendment to allow diversion of recycled water to the San Diego Creek watershed to prevent harm to the environment.

Background

Heavy rainfall in the winter of 2016-2017 reduced the demand for recycled water and resulted in storage reservoirs filled to capacity. Despite employing all available management options, IRWD exhausted all outlets for recycled water. Diversion of sewage away from MWRP is also a non-reliable option for relief from such circumstances since wet weather conditions also limit available capacity in neighboring utility systems. Further, the operation of the new biosolids processing facility at MWRP must be sustained by continuous processing of incoming sewage.

Proposed Diversion

The proposed diversion of high quality recycled water would occur infrequently and be of short duration, predicted to be in the range of approximately 1 to 14 days. The diversion would be approximately 14.5 million gallons per day (MGD) based on current conditions, and approximately 22.5 MGD based on anticipated future conditions. Phosphorus concentrations in the recycled water will be reduced by advanced treatment with chemical coagulant addition. These objectives were considered in the evaluation of potential water quality impacts resulting from the diversion.

Approach

This report examines the conditions which may result in the need for a diversion of recycled water from the MWRP. San Diego Creek flow and Newport Bay water quality conditions have been investigated during historical wet weather events. Rainfall data and San Diego Creek flows have been analyzed during notable peak storm events. Creek flow and water quality data were compiled and data analysis performed. To assess the potential for water quality impacts, the diversion of recycled water from the MWRP has been superimposed upon historical flow and water quality conditions. An initial loading analysis was refined and used as the basis for modeling the diversion of recycled water to San Diego Creek and Newport Bay. This approach provided a scientific basis for assessing the potential impact on water quality.

Watershed Water Quality Objectives

The Regional Monitoring Program for the Newport Bay Nutrient TMDL (Resolution 99-77, revised by Resolution No. R8-2014-0079) objectives are to demonstrate attainment of the following TMDL nutrient endpoints: nutrient concentrations in San Diego Creek (Reaches 1 and 2); seasonal nutrient loads from the watershed to the bay; and the extent, magnitude and duration of macroalgal blooms in San Diego Creek and Newport Bay.

The Regional Water Board Basin Plan Water Quality Objective (WQO) in Reach 1 of San Diego Creek is a not to exceed total inorganic nitrogen (TIN) concentration of 13 mg/L. TIN is the sum of ammonia and nitrite plus nitrate nitrogen. Recent creek TIN data indicates that the WQO is being attained as presented in the Data Section of this report.

The Newport Bay Nutrient TMDL established nutrient load allocations for improving water quality. The watershed nutrient load allocations to Newport Bay are: 153,861 lbs TN in the summer; 144,364 lbs TN in the winter; and 62,080 lbs TP annually. Current loads are much less than the TMDL load allocations based on 2015-2016 data. It should be noted that winter TN loads are calculated for TMDL purposes only when the creek flows are less than 50 cfs (i.e., loads are excluded when creek flows exceed 50 cfs).

Historical Information and Observations

Location

The location of the MWRP within the Newport Bay watershed is shown in Figure 1. The MWRP is located northwest of the University of California Irvine campus. The discharge from the MWRP would be to San Diego Creek near Campus Drive. Various monitoring programs have used this location for data collection. From this point, water in San Diego Creek flows approximately 1.5 miles to upper Newport Bay (i.e., Back Bay). Lower Newport Bay (i.e., Newport Harbor) includes multiple channels, reaches, and basins before the water reaches Corona Del Mar Bend and the Pacific Ocean.

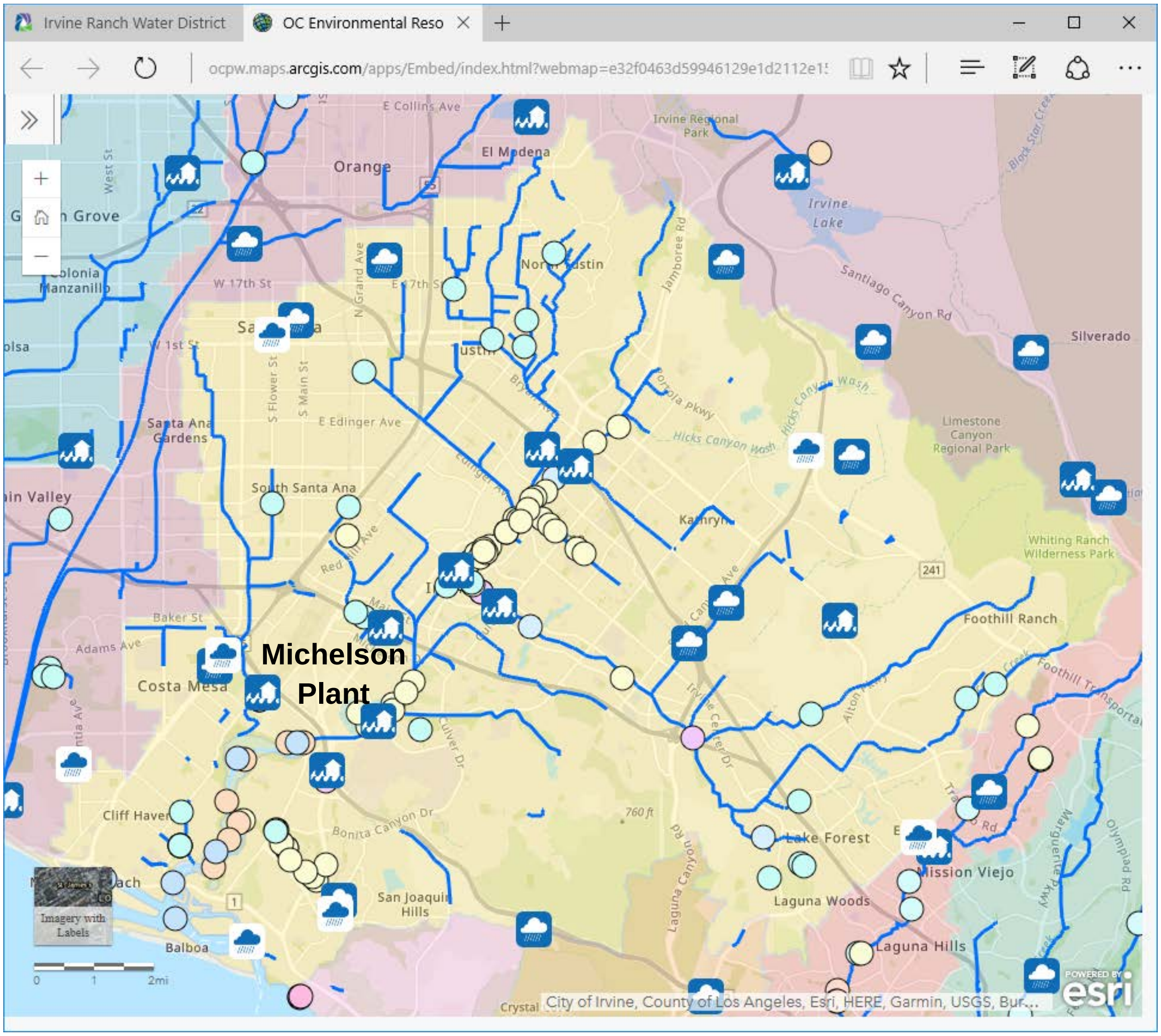


Figure 1. Map of Newport Bay watershed from Orange County Environmental Department

Meteorological

Annual average precipitation is about 11 inches per year in the area. The winter months of December, January and February are typically the wettest, averaging about 2 inches of precipitation during each month. Extreme events during these months are of greatest concern to the IRWD. Two relatively recent extreme events occurred in December 2010 and January 2017.

December 17-23, 2010 Rainfall Events

Intense precipitation occurred over the Newport Bay watershed and surrounding area in December 2010. This event was examined as part of a sewer collection system master plan (IRWD 2016). “In order to create the existing peak wet weather scenario, influent flow data at MWRP and LAWRP were reviewed for the last significant wet weather event, which occurred in December 2010. The inflow and infiltration was estimated from this data. The base loads were globally increased to match a total of 26.8 MGD at MWRP and 6.4 MGD at LAWRP. For areas that are not tributary to MWRP or

LAWRP, the calibration base loads were increased by 26.4 percent. This percentage increase is the same as what was used to match the highest influent flow calculated at MWRP in 2010 (wet weather conditions)" (IRWD 2016).

The storm total precipitation (STP) is shown in Figure 2. The Doppler radar STP map and the rain gauge data for this storm were used, along with the NOAA Atlas 14, to determine approximate return frequencies of this storm event at various locations in the region and storm durations. The general consensus of these findings indicates that this storm had a recurrence interval of about 2-years for a 24-hour event.

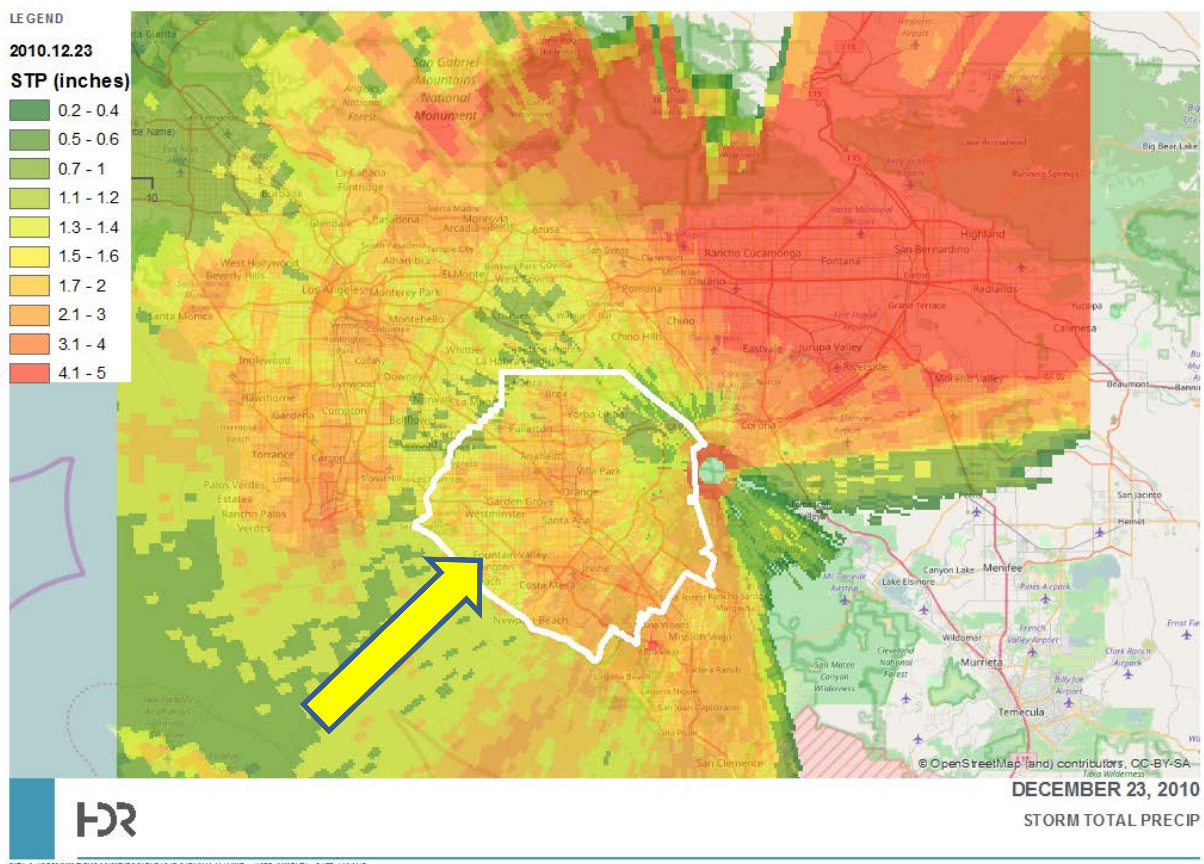


Figure 2. Storm total precipitation map of rainfall from Doppler radar for the storm event of December 17 to 23, 2010. The yellow arrow is indicative of general storm movement (SW).

January 20-22, 2017 Rainfall Events

The storms of January 2017 arrived in four separate waves with the most intense rainfall occurring in a 6 hour period on January 22nd between the hours of noon and 6 pm. The storm total precipitation analysis below from a gauge-adjusted radar rainfall reconstruction of the event shows the south to north increase in rainfall accumulations as is typical with storms of this nature within the OCSD service area. According to NOAA Atlas 14, Volume 6, this storm equated to a 6-hour, 10-15-year storm event, a 12-hour, 10-year storm event, and a 5-10-year 24, 48, or 72-hour storm event over most of the service region.

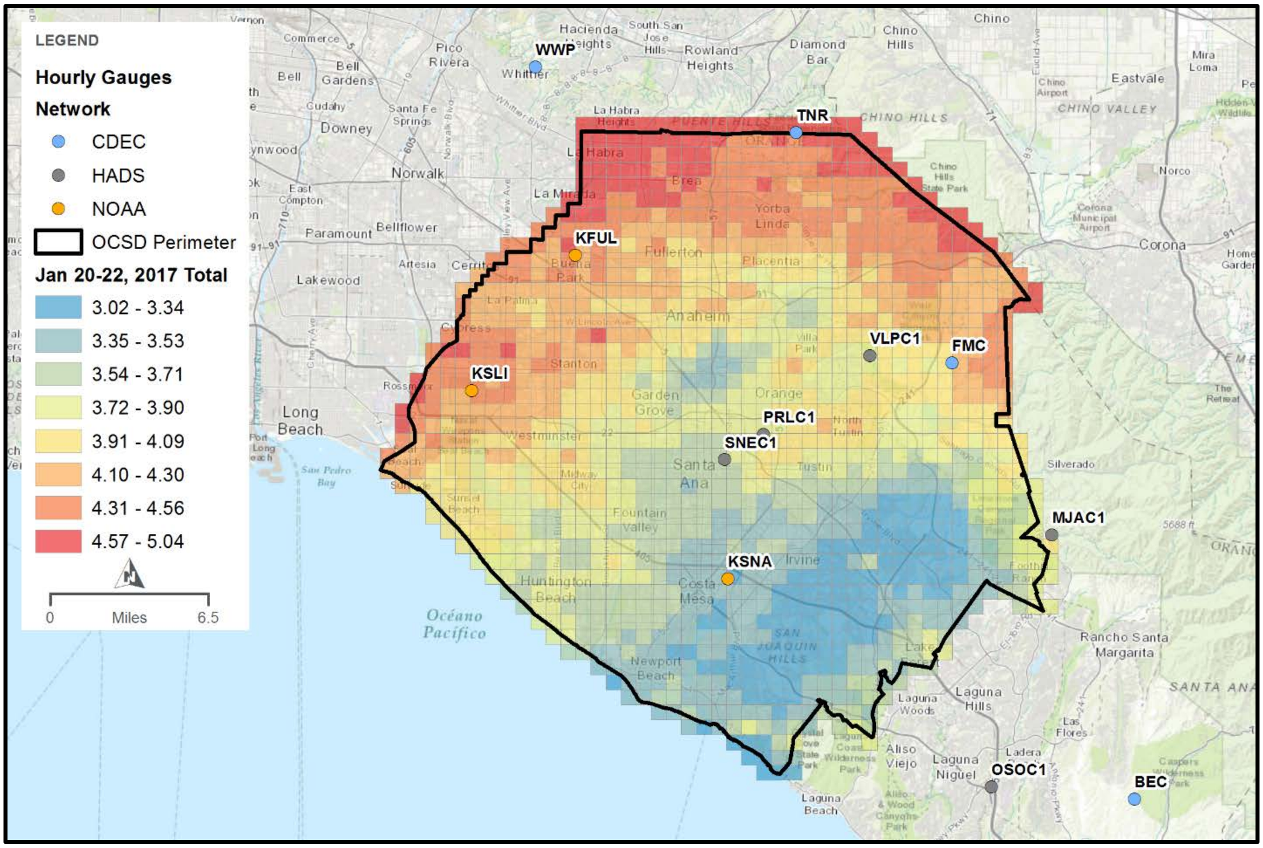


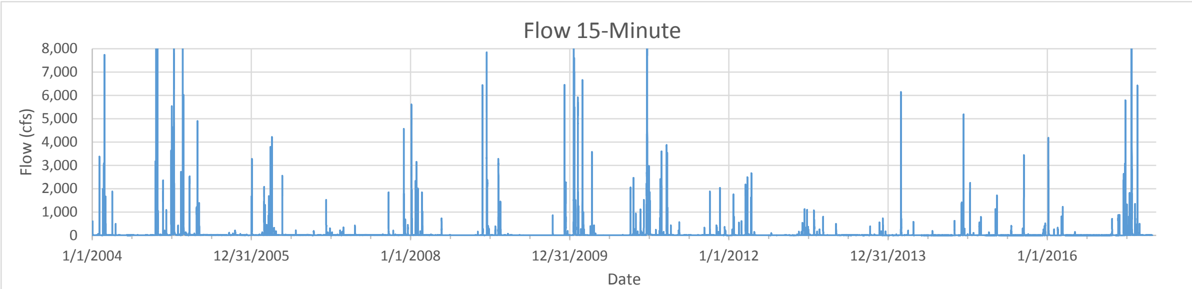
Figure 3. Storm total precipitation map of rainfall from Doppler radar for the storm event of January 20 to 22, 2017.

Stream Flow

Flow data at San Diego Creek at Campus Drive were obtained from Orange County. The data were recorded at 15-minute intervals for the period of record, January 1, 2000 through April 27, 2017.

The 15-minute flow data were averaged daily and are shown in Figure 4. The higher peaks in the 15-minute data illustrate the responsiveness of the watershed to rainfall and how flows can vary significantly, even within a single day. The minimum creek flow is about 0.1 cubic feet second (cfs). The maximum flow in the period of record is 37,300 cfs for 15-minutes and 8,000 cfs for daily average. For a creek with typical flows of less than 30 cfs, these are extreme, almost flash flood events.

A log-Pearson Type III distribution analysis was performed on the annual peak flow data (OSU 2017). This analysis was performed to determine the flow at given return periods or frequencies. These values are of interest since IRWD seeks to divert recycled water during events occurring at frequencies greater than about 5 or 10-years. The resulting peak flow to return period for San Diego Creek is shown in Figure 5. The results indicate a 5-year recurrence for peak flows of about 10,500 cfs and a 10-year recurrence for peak flows of about 15,700 cfs. This does not mean these flows will only occur once every 5 or 10 years, but rather that in a long term record, on average these flows will occur every 5 or 10 years. However, peaks could occur in back-to-back years, or not again for 20 years.



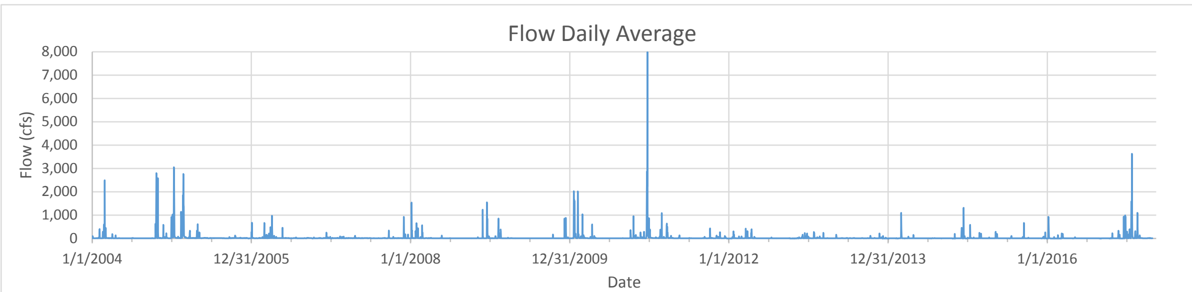


Figure 4. San Diego Creek Stream Flow for January 2000 through April 2017. The graph has been set to a maximum of 8,000 cfs although there are peak 15-minute flows that are greater

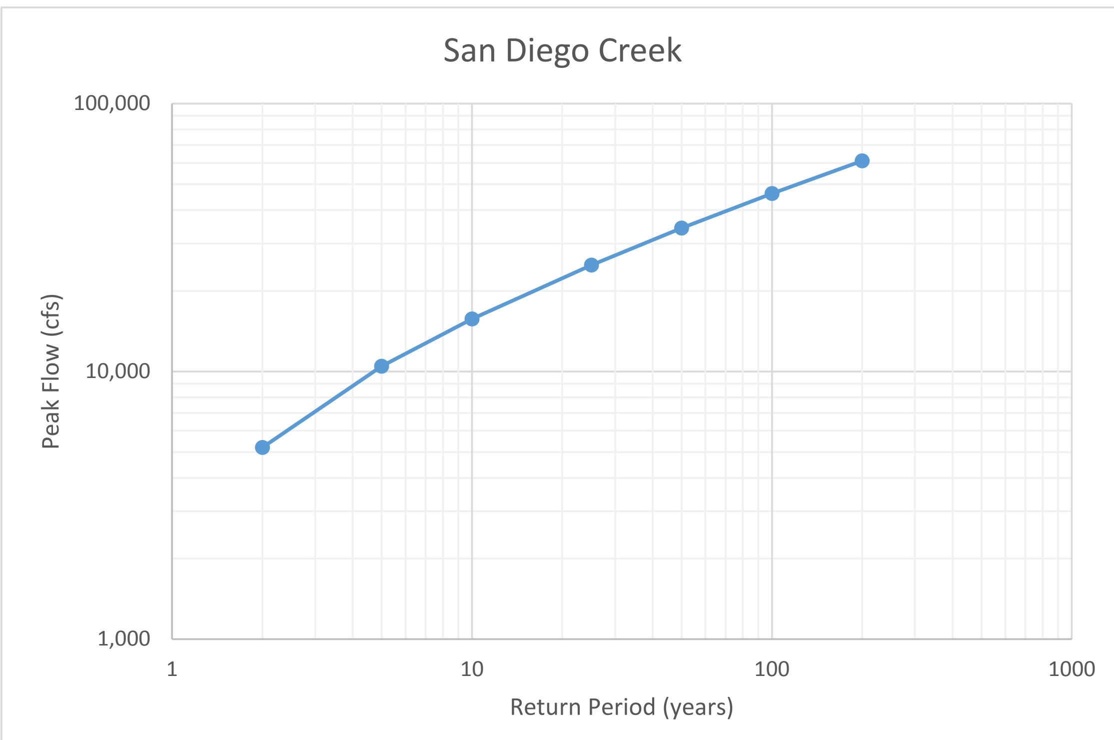


Figure 5. San Diego Creek and Campus Drive Peak Flow Frequency Curve

The flow data were then examined for the periods when the peak flow was greater than 10,500 cfs. Four periods were identified within the historical record. These are shown in Figure 6. Flows being greater than 50 cfs are important in terms of mixing with the IRWD diversion and TMDL seasonal load allocations.

- 10/20/2004 Peak 11,900 cfs >50 cfs for 54 total hours, 40 hours after peak
- 1/18/2010 Peak 21,900 cfs >50 cfs for 175 total hours, 158 hours after peak
- 12/20-22/2010 Peak 37,300 cfs >50 cfs for 116 hours after peak
- 1/23/2017 Peak 17,600 cfs >50 cfs for 80 hours after peak.

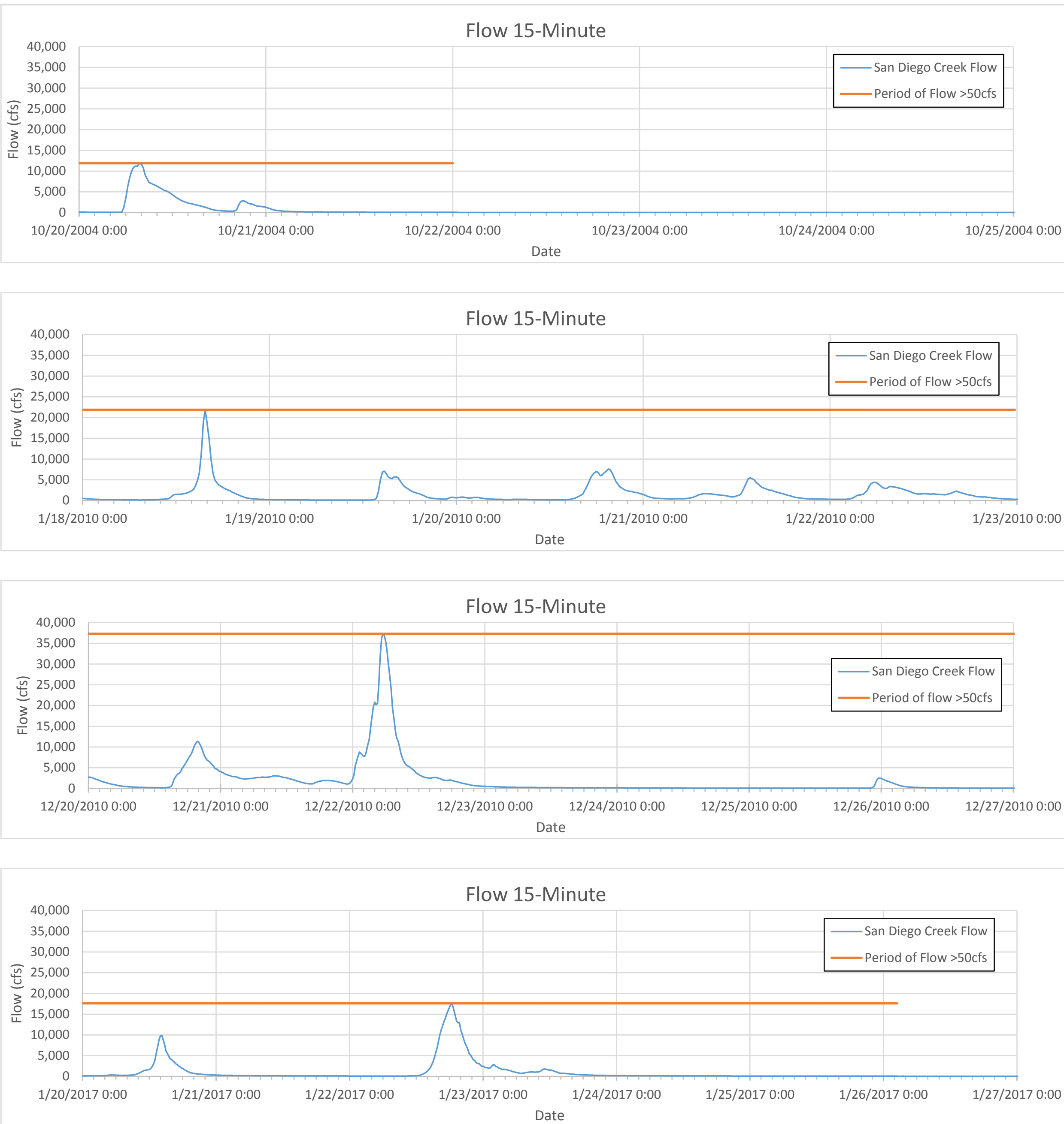


Figure 6. San Diego Creek 15-Minute Data for Four Extreme Stream Flow Events

During these historical storm events, flows in San Diego Creek exceeded 50 cfs from between 40 and 175 hours.

Water Quality Concentrations

Multiple water quality constituents are monitored at various locations along San Diego Creek and in Newport Bay. The focus of this discharge investigation is primarily on nutrients, nitrogen and phosphorus. Monitoring locations in the vicinity of MWRP were investigated to explore the availability of potential data of interest. The initial data compilation and analysis is summarized in Table 1.

Table 1. Summary of Data Sources for Initial Data Compilation and Analysis

Data Source	Location	Period	Analysis
Flow: Orange County email	San Diego Creek at Campus Drive	1/1/2000 to 4/27/2017	Flow patterns, load calculations.
Water Quality: Orange County Environmental Resource Weblink			
SAR Mass Emissions Monitoring, TMDL Newport Watershed	SDMF05 – at IRWD WYLSED - upstream	2004 to 2015	Statistics on all parameters. Time series and box plots of ammoniaN, dissolved oxygen, nitrate-nitriteNO3, orthophosphateP, pH, TKN, total phosphorus PO4, water temperature.
TMDL Newport Algae	ALG 2, 4, 7, 9, 13, 16, 19, 24	2004 to 2011	Statistics on all parameters. Time series algae dry weight.
AR Estuary/Wetlands Monitoring, TMDL Newport Bay	Upper Newport Bay UNBJAM	2001 to 2015	Statistics on all parameters. Time series and box plots.
NSMP Nitrogen and Selenium Management Program	IRWD SDCWeir	2008 to 2015	No nutrient data.
IRWD	MWRP	2000 to 9/2017	Statistics, time series, and box plots on nutrient data.

IRWD MWRP Effluent Concentrations

Historical nutrient data from the MWRP effluent from January 2007 to August 2017 were examined, as summarized in Table 2. Effluent nitrogen and phosphorus concentration data are exhibiting upward trends, however, facilities improvements and operational changes may have impacted performance. IRWD is continuing to make substantial investments in improvements to the MWRP and plans to enhance nutrient removal performance in advance of any diversion of recycled water to the watershed. Specifically, phosphorus concentrations in the recycled water will be reduced by advanced treatment with chemical coagulant addition.

Table 2. Summary Statistics of MWRP Nutrient Effluent Data

Statistic	Total Inorganic Nitrogen (mg/L)	Total Nitrogen (mg/L)	Total Phosphorus (mg/L)
Count	423	190	170
Minimum	2.50	4.15	0.05
Median	11.00	10.40	2.18
Mean	10.70	10.23	2.01
90^{th} Percentile	15.00	14.00	3.51
95^{th} Percentile	18.00	15.00	3.70
99^{th} Percentile	20.00	16.33	4.36
Maximum	22.00	20.00	5.00
Standard Deviation	3.73	3.07	1.30

IRWD has undertaken a study of phosphorus removal at the MWRP using chemical coagulants, such as alum or ferric chloride (IPC 2017). Historically, the MWRF plant used ferric chloride addition to enhance primary treatment and demonstrated effective full-scale phosphorus removal. Laboratory jar testing has been conducted recently to investigate chemical addition requirements for phosphorus removal. Pilot testing is scheduled to follow to simulate full-scale performance in the membrane reactor train at the MWRP. Pilot testing will also be performed in a portion of the full-scale activated sludge reactor train at MWRP that includes effluent polishing with high rate clarification and granular media filtration.

The proposed effluent quality used to characterize MWRP recycled water for analysis of water quality impacts is 10 mgN/L TN and 0.3 mgP/L TP.

Research into advanced levels of nutrient removal treatment has revealed new information about nutrient speciation and reduced bioavailability of the nitrogen and phosphorus remaining after advanced treatment, such as coagulant addition and filtration (Li 2012, 2013a,b). Advanced levels of nutrient removal treatment impact effluent quality in multiple ways. First, effluent nitrogen and phosphorus concentrations are reduced. Second, nitrogen and phosphorus speciation is altered as a result of the advanced treatment processes. Third, the bioavailability the remaining effluent nitrogen and phosphorus is reduced in the receiving waters, further reducing the potential for stimulating algal growth (WE&RF 2014, 2016).

Creek and Bay Data Analysis

Monitoring data is available in San Diego Creek and Newport Bay from the Orange County Public Works (OCPW) department at numerous locations. These data include: precipitation; water levels; and water quality. The water quality parameters reported are many but the applicable ones to this analysis include the following: nitrogen (ammonia, nitrite+nitrate, total Kjeldahl); phosphorus (total phosphorus, orthophosphate); macroalgae biomass; and dissolved oxygen.

Creek Flow Data

San Diego Creek flow data available at the Campus Drive monitoring location were obtained from 2000 through 2017. Daily average creek flows varied substantially from a low flow of 0.1 cfs to a high flow of 7,992 cfs. Instantaneous creek flows (i.e., 15-minute) reached a maximum of 37,300 cfs in December 2010 and in January 2010 reached a peak instantaneous flow of 21,900 cfs.

Creek flows greater than 50 cfs (winter cutoff flow for calculating TN loads to the bay) typically occur during the months of October through April. Based on the 2000 through 2017 flow data, creek flows greater than 50 cfs occur about 10 percent of the time from October through April. During the remainder of the year (May through September), creek flows greater than 50 cfs occur less than 1 percent of the time. The proposed IRWD diversion would potentially be required during the winter (high flow) periods of the year and will take advantage of these higher creek flows for diluting the diversion and increasing flushing in Newport Bay.

Creek Nutrient Data

San Diego Creek and Newport Bay monitoring locations are shown in Figure 7. Water quality data from the San Diego Creek at Campus Drive station (SDMF05), located near the MWRP are shown in Figure 8 from 2004 through 2015. These data show a decline in creek total nitrogen (TN) and total inorganic nitrogen (TIN) concentrations starting in 2008. Peak TN and TIN concentrations before 2008 ranged from approximately 10 to 14 mgN/L and 9 to 12 mgN/L, respectively. Total phosphorus (TP) concentrations were relatively steady over the 2004 through 2015 time period with annual average concentrations ranging from 0.1 to 0.4 mgP/L. It should be noted that the TIN concentrations have all been less than the Water Quality Objective (WQO) of 13 mgN/L from the 2004 through 2015 (see red dashed line on Figure 8).

In the TN and TP panels of Figure 8, the creek flow is also presented as the blue line. In general, there appears to be an increase in creek TN, TIN, and TP concentrations with flow, although it is more pronounced for TP. Figure 9 presents the relationship between TN and TP versus creek flow for data from 2009 through 2015 (after creek concentration reductions) that highlights the positive correlation between TN and TP with creek flow (i.e., increasing concentrations at higher creek flows). Again, the stronger relationship is observed for TP, which may be due to the scour of sediment bound phosphorus during periods of high creek flow.

These creek data suggest that proposed IRWD diversions during high flow (storm) periods will be coupled with high creek TN and TP concentrations and loads to Newport Bay; thereby diminishing the potential impact of the proposed IRWD diversion nutrient loads during these high flow periods.

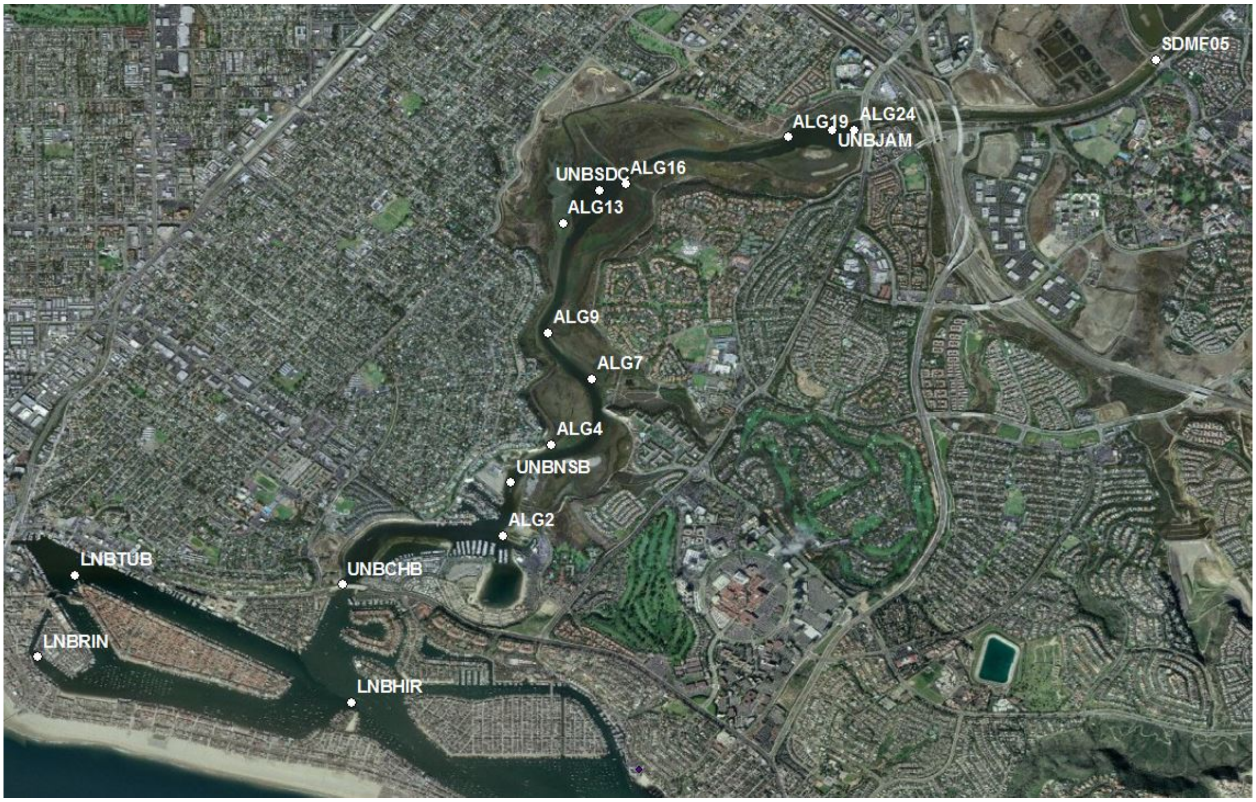


Figure 7. San Diego Creek and Newport Bay Monitoring Locations

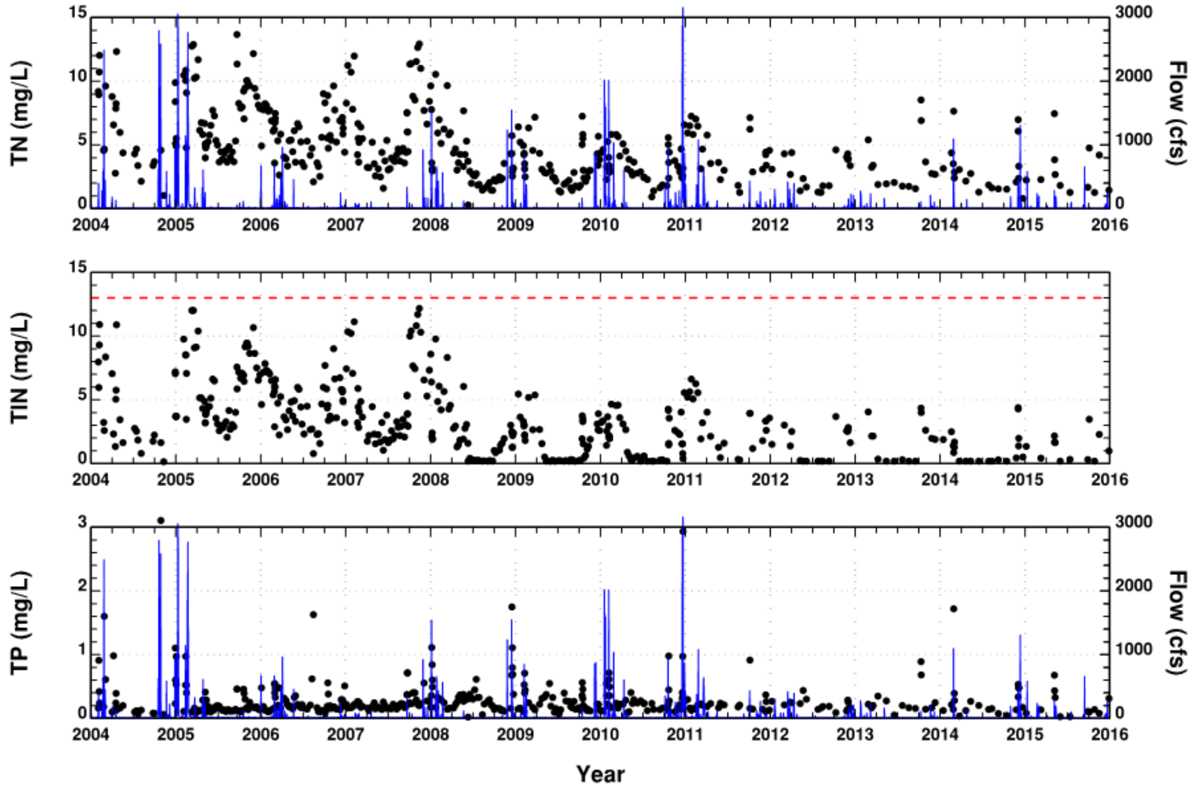


Figure 8. San Diego Creek at Campus Drive (2004-2015)

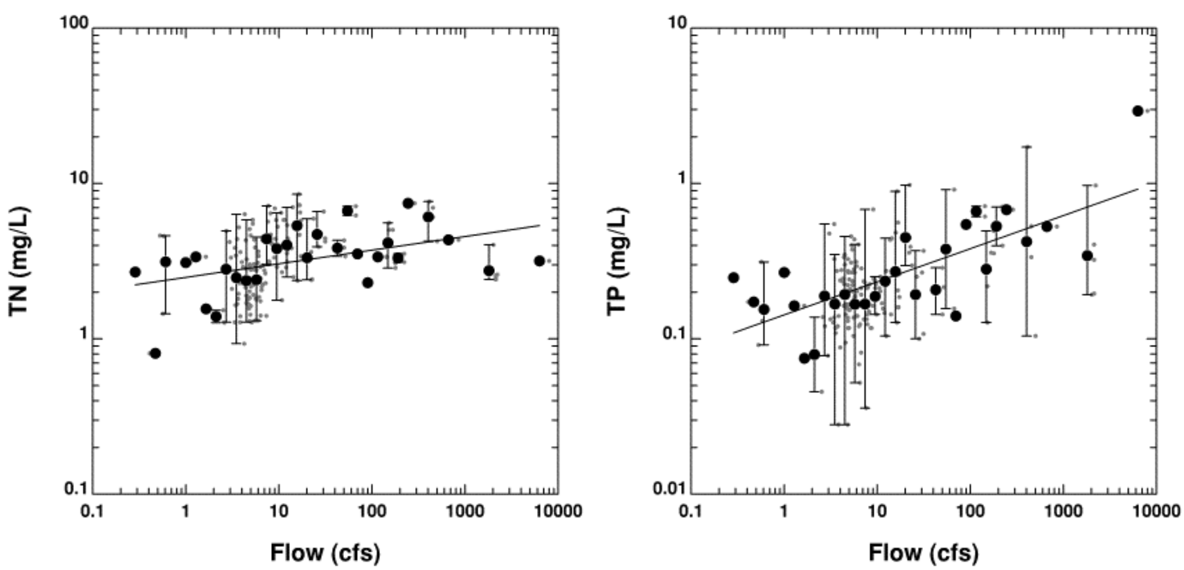


Figure 9. San Diego Creek at Campus Drive (2009-2015)

Bay Nutrient Data

Newport Bay monitoring data are available at the monitoring stations shown in Figure 7. These data reflect the nutrient loadings from the adjacent watershed (including San Diego Creek) and mixing/dilution with the coastal waters of the Pacific Ocean. Figures A1 through A4 (Attachment A) present TN, TIN, TP and orthophosphate (PO4) data for the time period from 2004 through 2016 at locations in the upper part of Newport Bay. The monitoring stations presented are located: in San Diego Creek at Campus Drive (SDMF05); in the upper bay at Jamboree Road (UNBJAM); and in the upper bay at Santa Ana-Delhi Channel (UNBSDC). Figures A5 through A8 (Attachment A) present data at the following stations: ALG9; upper bay at Northstar Beach (UNBNSB); and upper bay at the Coast Highway Bridge (UNBCHB). Once San Diego Creek enters upper Newport Bay, the TN concentrations decrease by about 75 percent between Jamboree Road and Santa Ana-Delhi Channel; and TP concentrations decrease by about 62 percent. This decrease is due to further freshwater and tidal dilution at these upper bay monitoring stations.

The TN and TIN decreases observed in San Diego Creek are observed at the upper bay stations (Jamboree Road and Santa Ana-Delhi Channel), but due to the moderating influence of the downstream connection with the Pacific Ocean, are not as prevalent at the downstream stations (ALG9, Northstar Beach and Coast Highway Bridge). TP and PO4 concentrations are relatively constant in the upper bay, as in the creek, with concentrations decreasing in the downstream direction towards the Pacific Ocean.

Figures A9 and A10 present TN:TP ratios while Figures A11 and A12 present TIN:PO4 ratios for the time period from 2004 through 2016 (see Attachment A). In general, the ratios have been decreasing over time, which is associated with the reduced nitrogen levels entering Newport Bay from San Diego Creek. The decreasing N:P ratios indicate that algal growth in the bay may be more limited by phosphorus than nitrogen.

These bay data also show the effects of nitrogen reductions in San Diego Creek at the upper bay monitoring stations along with the additional decreases due to freshwater and tidal dilution. The decreasing N:P ratios seem to indicate that algal growth in the bay is more limited by phosphorus than nitrogen. Therefore, phosphorus loads from the proposed IRWD diversions may be more important than nitrogen loads. This supports the proposed effort by IRWD to reduce phosphorus levels during the proposed diversions to San Diego Creek.

Macroalgae growth and biomass in upper Newport Bay typically is the greatest during the July through August index period used in the Newport Bay Watershed Nutrient TMDL Annual Data Reports. This is due to water temperatures that are more favorable to their growth (e.g., greater than 20°C) during this July-August index period. This observation will also mitigate water quality (macroalgae) impacts in the bay as the proposed IRWD diversions will occur during the cooler winter months of October through April. Based on upper bay monitoring data at Jamboree Road, Santa Ana-Delhi Channel, Northstar Beach and Coast Highway Bridge, water temperatures are less than 20°C during the months of October through April.

Effluent Data

Effluent TN, TIN, TP, PO4 and flow data from the Michelson Water Reclamation Plant (MWRP) were reviewed for the time period from 2007 through 2017. During this time period, effluent TN concentrations ranged from 4 to 20 mgN/L and TP ranged from 0.05 to 5 mgP/L (see Table 2).

Based on these data, effluent TIN is about 92 percent of effluent TN and effluent PO4 is about 82 percent of effluent TP. The average effluent TN during this time period was 11.7 mgN/L and effluent TP was 1.87 mgP/L.

The primarily dissolved forms of effluent TN and TP will reduce the potential for water quality impacts in Newport Bay resulting from MWRP diversions, since the soluble nutrients will be transported out of the bay. Additionally, the dissolved nutrients in the diversion will not significantly contribute to particulate nitrogen and phosphorus that may settle to the sediments and return as dissolved nutrients during warmer summer months as a result of sediment diagenesis.

Newport Bay Model

HDR's Estuarine, Coastal & Ocean Model (ECOM) was used to assess downstream mixing and dilution of the proposed IRWD diversions during winter storm periods and to calculate upper Newport Bay flushing times over a range of creek flows. The hydrodynamic model calculates tidal circulation (water elevation, currents), salinity and temperature as a function of the following: downstream Pacific Ocean tidal elevations, salinity and temperature; San Diego Creek freshwater inflow; meteorological conditions (e.g., wind speed/direction); coastline and bathymetry (post-dredging) features. The study area modeled includes both upper Newport Bay (to the entrance of San Diego Creek) and lower Newport Bay out into the Pacific Ocean.

Figure 10 and Figure 11 illustrate the model study area and model grid used for Newport Bay hydrodynamic modeling. The modeling time period selected was for the year 2010, which was chosen because it was a high rainfall and flow year with two high flow periods which characterize the conditions when IRWD diversions might occur. The following sections present a description of the ECOM model framework, a summary of the creek flow conditions used for this modeling time period, model inputs, and calibration to observed data.

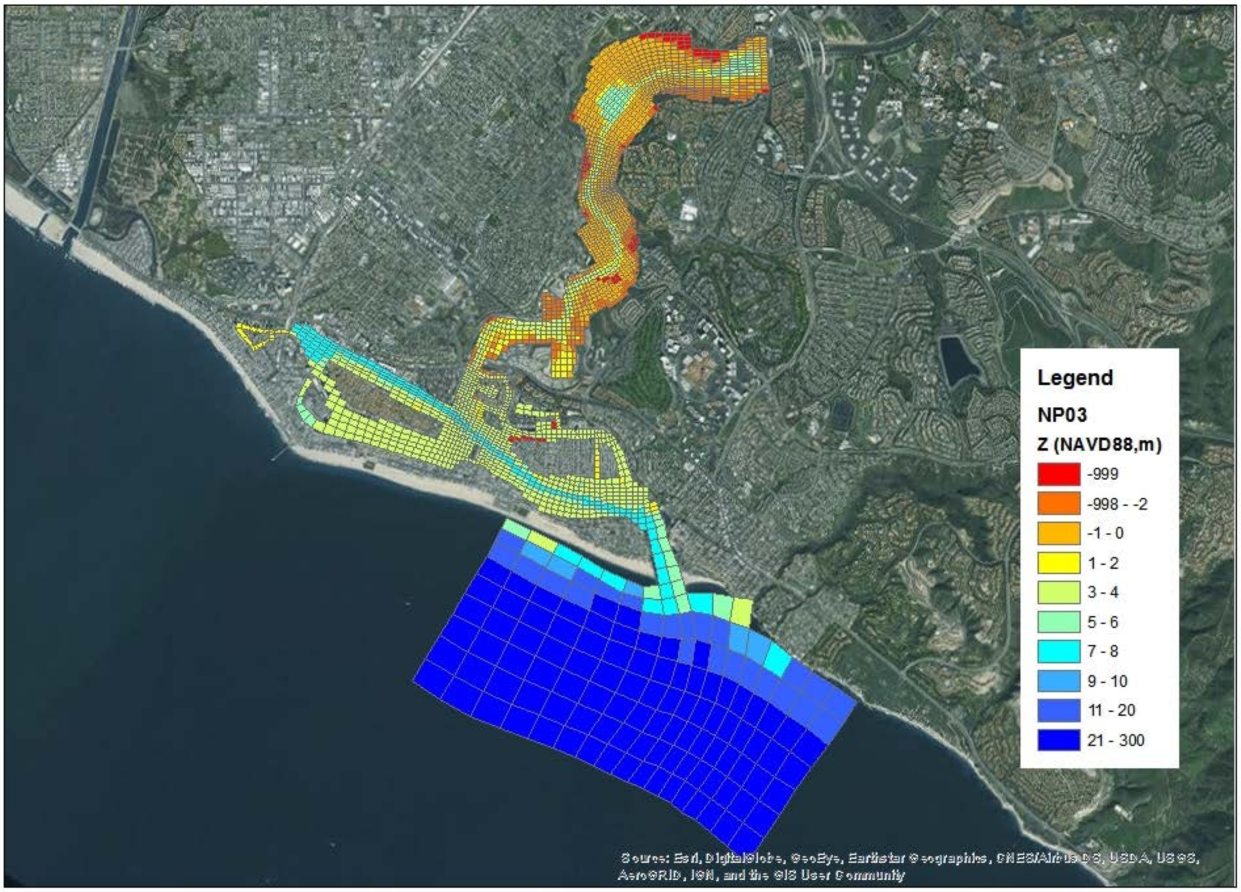


Figure 10. Newport Bay Modeling Study Area & Model Grid

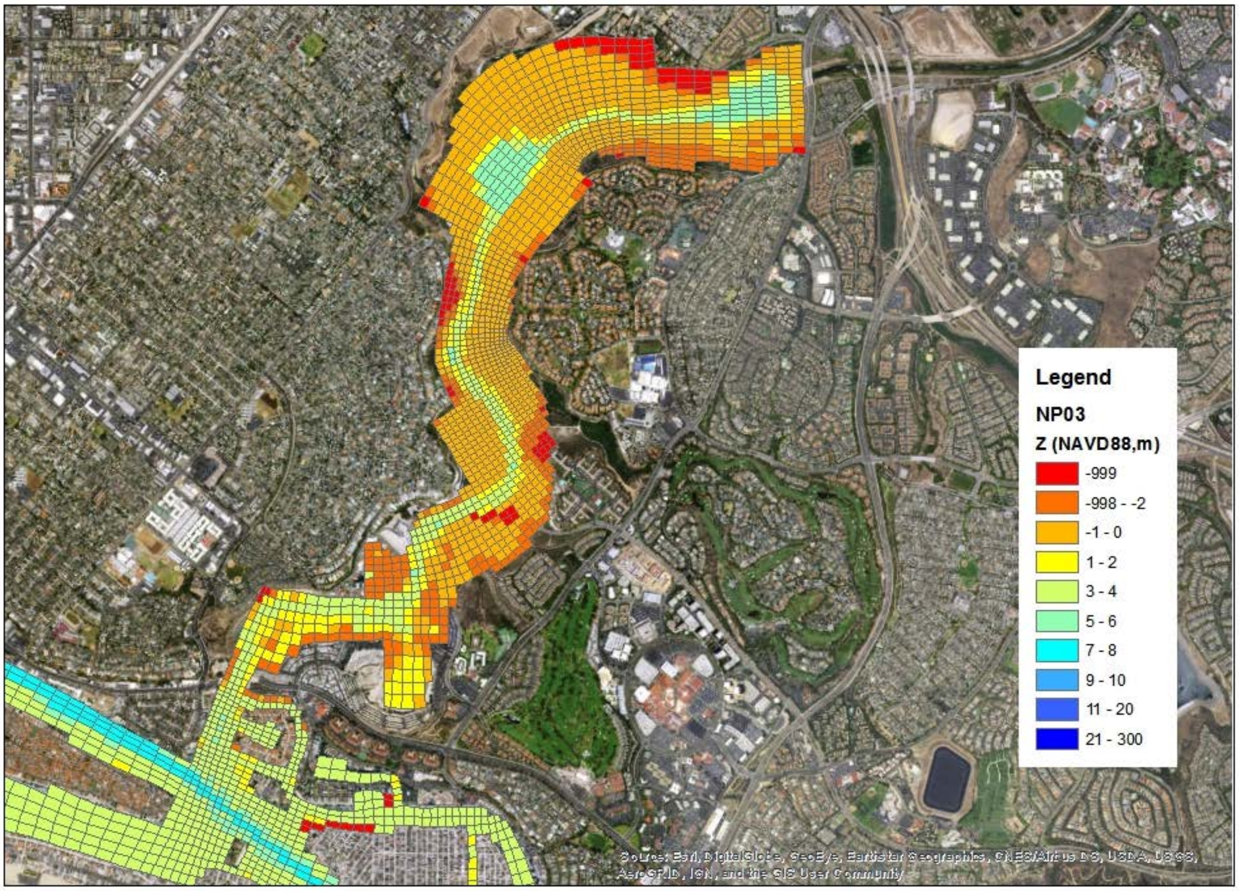


Figure 11. Upper Newport Bay Modeling Study Area & Model Grid

The transport and mixing of nutrient loads introduced to tidal estuaries and coastal water bodies are controlled by the tidal circulation characteristics of the receiving water body. The fate of nutrient loads in tidal marine systems is strongly influenced by advection and turbulent mixing created by the tidal motion and surface wind stress that leads to horizontal dispersion in the longitudinal and lateral directions; and to vertical dispersion throughout the water column. Coupled with turbulent mixing due to wind are heat exchange processes between the water column and the atmosphere. All these mechanisms determine the spatial extent and concentration of nutrient loads introduced to tidal systems.

Hydrodynamic Model (Circulation)

The ECOM hydrodynamic model is a three-dimensional, time-dependent, circulation model developed by Blumberg and Mellor (1987). A system of curvilinear coordinates is used in the horizontal direction, which allows for a smooth and accurate representation of variable shoreline geometry. In the vertical scale, the model uses a transformed coordinate system known as the σ-coordinate transformation to allow for a better representation of bottom topography. In tidal marine systems, water surface elevation, water velocity in three dimensions, salinity, temperature and water turbulence are calculated in response to meteorological conditions (winds and atmospheric heating and cooling), freshwater inflows and salinity/temperature at tidal boundaries connected to the downstream end of the model domain (i.e., Pacific Ocean). The model also incorporates the Mellor and Yamada (1982) level 2-½ turbulent closure scheme to provide a realistic parameterization of vertical mixing.

The model has gained wide acceptance within the modeling community and regulatory agencies, as indicated by the number of applications to important water bodies around the world. It is accepted by the USEPA, USACE and other state and local agencies on numerous projects around the country. These other applications include the: San Joaquin River and Stockton Deep Water Ship Channel for the CALFED Bay-Delta Program (CA); coastal waters of Oahu, Pearl Harbor and Honolulu Harbor for the Mamala Bay Study Commission (HI); Upper Mississippi River and Lake Pepin for the Metropolitan Council Environmental Services (MN); Milwaukee Harbor and Lake Michigan for the Milwaukee Metropolitan Sewerage District (WI); Hudson River and NY/NJ Harbor for the New York City Department of Environmental Protection (NY); Long Island Sound for the Long Island Sound Study (NY/CT); the Hudson Raritan estuary (Oey et al. 1985 a, b, c), the Gulf of Mexico (Blumberg and Mellor 1985), Chesapeake Bay (Blumberg and Goodrich 1990), Massachusetts Bay (Blumberg et al. 1993), St. Andrews Bay (Blumberg and Kim 1998), New York Harbor and Bight (Blumberg et al. 1999), and Onondaga Lake (Ahsan and Blumberg 1999). In all of these studies, model performance was assessed by means of extensive comparisons between predicted and observed data. The predominant physics were realistically reproduced by the model for this wide range of applications.

The model solves a coupled system of differential, prognostic equations describing the conservation of mass, momentum, temperature, salinity, turbulence energy, and turbulence macroscale. The governing equations for velocity $U_i = (u,v,w)$, temperature (T), salinity (S), and $x_i = (x,y,z)$ are as follows:

$$\frac{\partial U_i}{\partial x_i} = 0 \tag{1}$$

$$\frac{\partial}{\partial t}(U,V) + \frac{\partial}{\partial x_i}\left[U_i(u,v) + f(-v,u)\right] = -\frac{1}{\rho_o}\left[\frac{\partial P}{\partial x},\frac{\partial P}{\partial y}\right] + \frac{\partial}{\partial z}\left[K_M \frac{\partial}{\partial z}(u,v)\right] + (F_U,F_V) \tag{2}$$

$$\frac{\partial T}{\partial t} + \frac{\partial}{\partial_i}(U_i T) = \frac{\partial}{\partial z}\left[K_H \frac{\partial T}{\partial z}\right] + F_T \tag{3}$$

$$\frac{\partial S}{\partial t} + \frac{\partial}{\partial x_i}(U_i S) = \frac{\partial}{\partial z}\left[K_H \frac{\partial S}{\partial z}\right] + F_S \tag{4}$$

The horizontal diffusion terms, (FU, FV), FT and FS, in Equations 2 through 4 are calculated using a Smagorinsky (1963) horizontal diffusion formulation (Mellor and Blumberg 1985). Under the shallow water assumption, the vertical momentum equation is reduced to a hydrostatic pressure equation.

Vertical accelerations due to buoyancy effects and sudden variations in bottom topography are not taken into account. The hydrostatic approximation yields:

$$\frac{P}{\rho_o} = g(\eta - z) + \int_z^{\eta} g \frac{\rho' - \rho_o}{\rho_o} \partial z' \tag{5}$$

where P is pressure, z is water depth, η (x,y,t) is the free surface elevation, ρo is a reference density, and ρ = ρ (T,S) is the density.

The vertical mixing coefficients, KM and KH, in Equations 2 through 4 are obtained by appealing to a level 2-½ turbulence closure scheme and are given by:

$$K_M = \widehat{K}_M + \upsilon_M, K_H = \widehat{K}_H + \upsilon_H \tag{6}$$

$$\widehat{K}_M = q\ell S_M,\ \widehat{K}_H = q\ell S_H \tag{7}$$

where q2/2 is the turbulent kinetic energy, ℓ is a turbulence length scale, SM and SH are stability functions defined by solutions to algebraic equations given by Mellor and Yamada (1982) as modified by Galperin et al. (1988), and υM and υH are constants. The variables q2 and ℓ are determined from the following equations:

$$\frac{\partial q^2}{\partial t} + \frac{\partial(uq^2)}{\partial x} + \frac{\partial(vq^2)}{\partial y} + \frac{\partial(wq^2)}{\partial z} =$$

$$\frac{\partial}{\partial z}\left[K_q \frac{\partial q^2}{\partial z}\right] + 2K_M\left[\left(\frac{\partial u}{\partial z}\right)^2 + \left(\frac{\partial v}{\partial z}\right)^2\right] + \frac{2g}{\rho_o} K_H \frac{\partial \rho}{\partial z} - 2\frac{q^3}{B_1 \ell} + F_q \tag{8}$$

$$\frac{\partial(q^2\ell)}{\partial t} + \frac{\partial(uq^2\ell)}{\partial x} + \frac{\partial(vq^2\ell)}{\partial y} + \frac{\partial(wq^2\ell)}{\partial z} =$$

$$\frac{\partial}{\partial z}\left[K_q \frac{\partial(q^2\ell)}{\partial z}\right] + E_1\ell\left\{K_M\left[\left(\frac{\partial u}{\partial z}\right)^2 + \left(\frac{\partial v}{\partial z}\right)^2\right] + \frac{g}{\rho_o} K_H \frac{\partial \rho}{\partial z}\right\} - \frac{q^3}{B_1 \widetilde{\omega}} + F_\ell \tag{9}$$

where Kq = 0.2qℓ, the eddy diffusion coefficient for turbulent kinetic energy; Fq and Fℓ represent horizontal diffusion of the turbulent kinetic energy and turbulence length scale and are parameterized in a manner analogous to either Equation 8 or 9 ; w is a wall proximity function defined as w = 1 + E2 (ℓ/κ L)2, (L)-1 = (η - z)-1 + (H + z)-1; κ is the von Karman constant; H is the water depth, η is the free surface elevation; and E1, E2 and B1 are empirical constants set in the closure model.

The basic Equations, 1 through 9, are transformed into a terrain following σ-coordinate system in the vertical scale and an orthogonal curvilinear coordinate system in the horizontal scale. The resulting equations are vertically integrated to extract barotropic variables, and a mode splitting technique is introduced such that the fast-moving, external barotropic modes and relatively much-slower internal baroclinic modes are calculated by prognostic equations with different time steps. Detailed solution techniques are described in Blumberg and Mellor (1987).

Atmospheric Heat Exchange Model

The heat content and thermal regime in Newport Bay is primarily governed by tidal transport of water from the Pacific Ocean, surface heat exchange with the atmosphere, and inputs of heat from the watershed (e.g., tributaries). The processes that control the heat exchange between water and atmosphere are well documented and are included in the ECOM hydrodynamic model (Ahsan and Blumberg, 1999; Cole and Buchak, 1995). All of these works relied mostly on the bulk formulae to evaluate the components of the heat budget.

Four major heat flux components (i.e., short-wave solar radiation (typically measured or estimated from cloud cover); long-wave atmospheric radiation; sensible (conductive) heat; and latent (evaporative) heat) are incorporated into the model. They are based on the formulae reported in Ahsan and Blumberg (1999) and Cole and Buchak (1995), as suggested by Edinger et al. (1974).

Modeling Time Period

A model calibration period was set up for the full year of 2010, which was chosen because it was a high flow year with two high flow periods which characterize the type of conditions which might necessitate a MWRP diversion. A probability distribution of annual average flows in San Diego Creek at Campus Drive from January 2000 through April 2017 is presented in Figure 12, which illustrates the high creek flows that occurred in 2010, in comparison to flows in other years. Also, a time-series of creek flow for the year 2010 is presented in Figure 13 on both a logarithmic and arithmetic scale with the two high flow periods in January and December highlighted in red. Additional flow characteristics during these periods are summarized in Table 3.

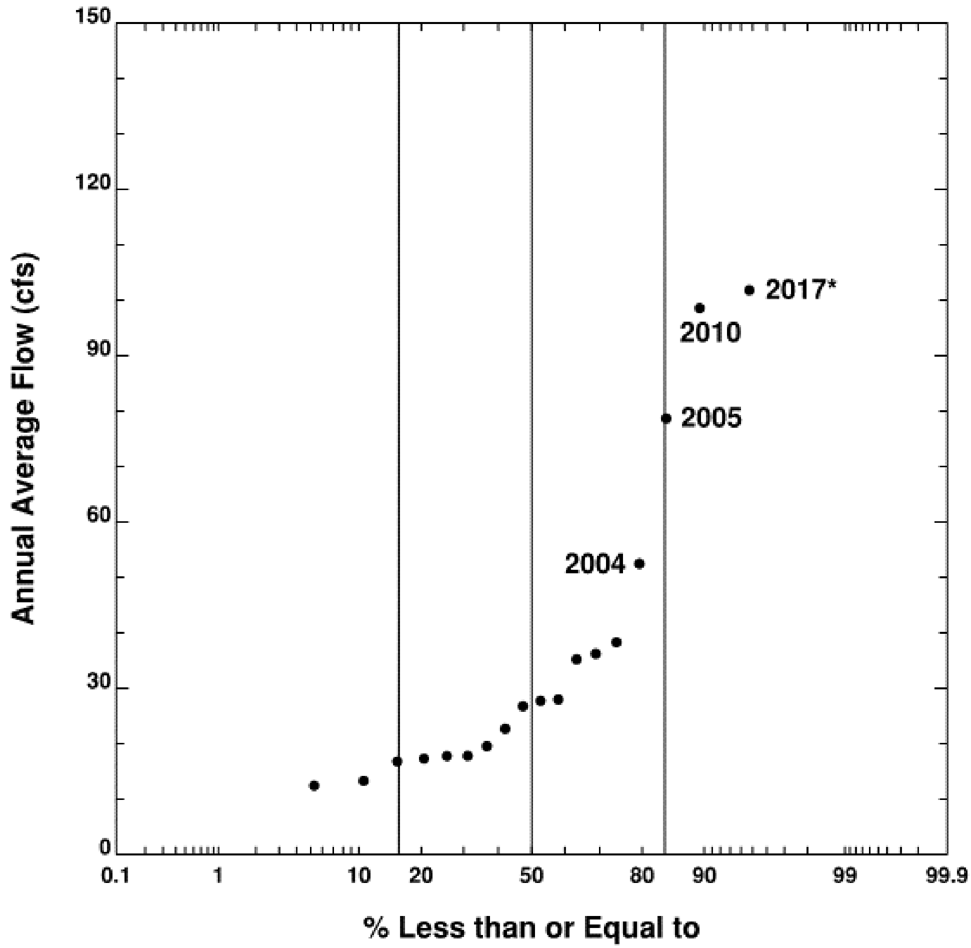


Figure 12. San Diego Creek Annual Average Flow (2000 to 2017)

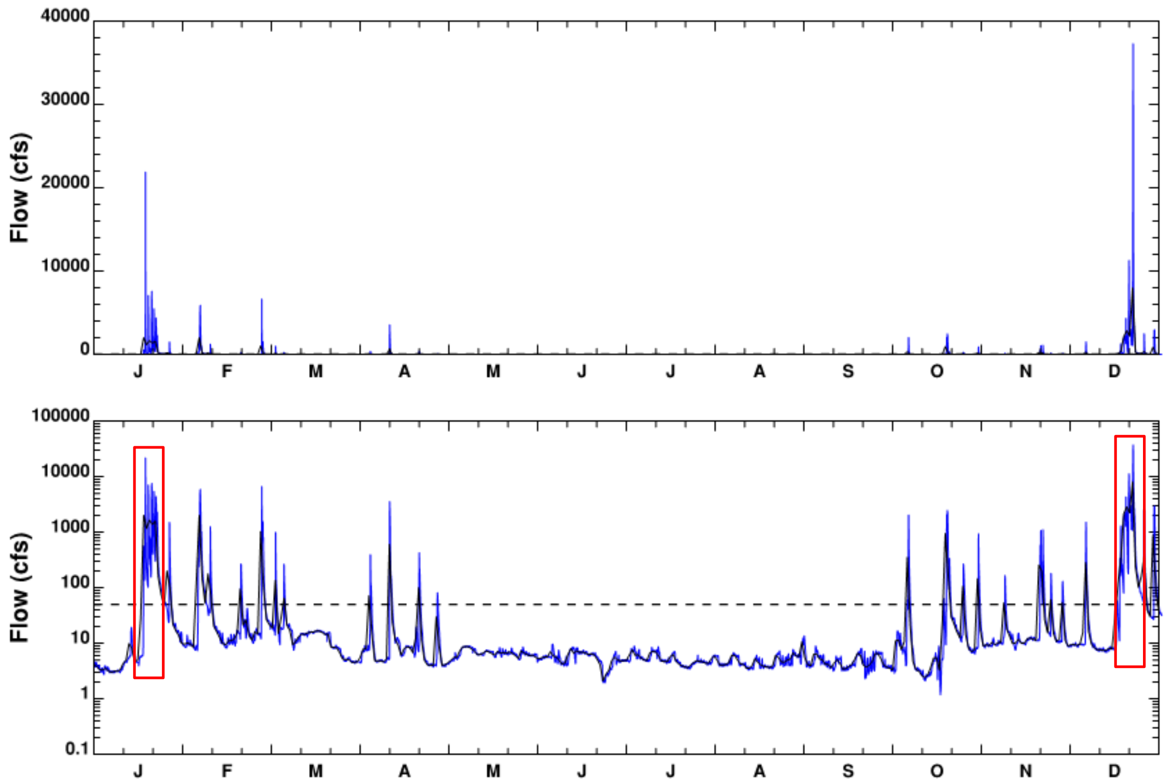


Figure 13. **San Diego Creek Flow (2010)**

Table 3. Modeling Period High Flow Events

Time Period	Total Time Flow > 50 cfs (hrs)	Peak Flow (cfs)	Average Flow (cfs)
1/18/2010-1/24/2010	175	21,900	1,105
12/18/2010-12/26/2010	226	37,300	1,746

Study Area Model Grid

A computational model grid was developed for the hydrodynamic modeling of Newport Bay. The model domain includes upper and lower Newport Bay and the offshore boundary extends into the Pacific Ocean. The northern extent of the model grid extends to the entrance of San Diego Creek to the bay. The full extent of the orthogonal curvilinear grid system used in the present study is shown in Figure 10 (entire model grid) and Figure 11 (upper bay model grid). The model grid has 82 rows, 144 columns and 10 layers for a total number of 25,600 water cells. The average grid size is around 100 square feet in the upper bay and includes model grid cells that can wet and dry to represent the tidal flats found in the upper bay.

Three different post-dredging bathymetry data sources were used to establish water depths in each of the model grid cells. USGS bathymetry data in the upper bay collected from 2012-2013 were used; and OCPW LiDAR data collected from 2011-2012 were used to establish water depths in the shallow nearshore/wetland areas. Finally, NOAA bathymetry data (Chart 18754, updated 2016/17) covering the entire bay and out into the Pacific Ocean were also used to assign water depths to the model grid cells.

Model Inputs

The following types of data were used for model inputs to the hydrodynamic model: ocean tidal water elevations; San Diego Creek flow; water temperature and salinity for the creek and ocean; and meteorological conditions.

Tidal water elevation measurements were available at NOAA station #9410660 (Los Angeles) and were used as the water elevation boundary conditions in the Pacific Ocean for the Newport Bay model. The upstream creek boundary condition was specified from the measured creek flows at Campus Drive (SDMF05). The ocean salinity and temperature boundary condition was established using data available from the NOAA World Ocean Atlas 2013 and the Newport Beach Shore Station Program.

The model used meteorological data from the John Wayne Orange County Airport, which includes measurements of wind speed/direction, air temperature, relative humidity, cloud cover, and atmospheric pressure. These meteorological data are presented in Figure 14 for the year 2010.

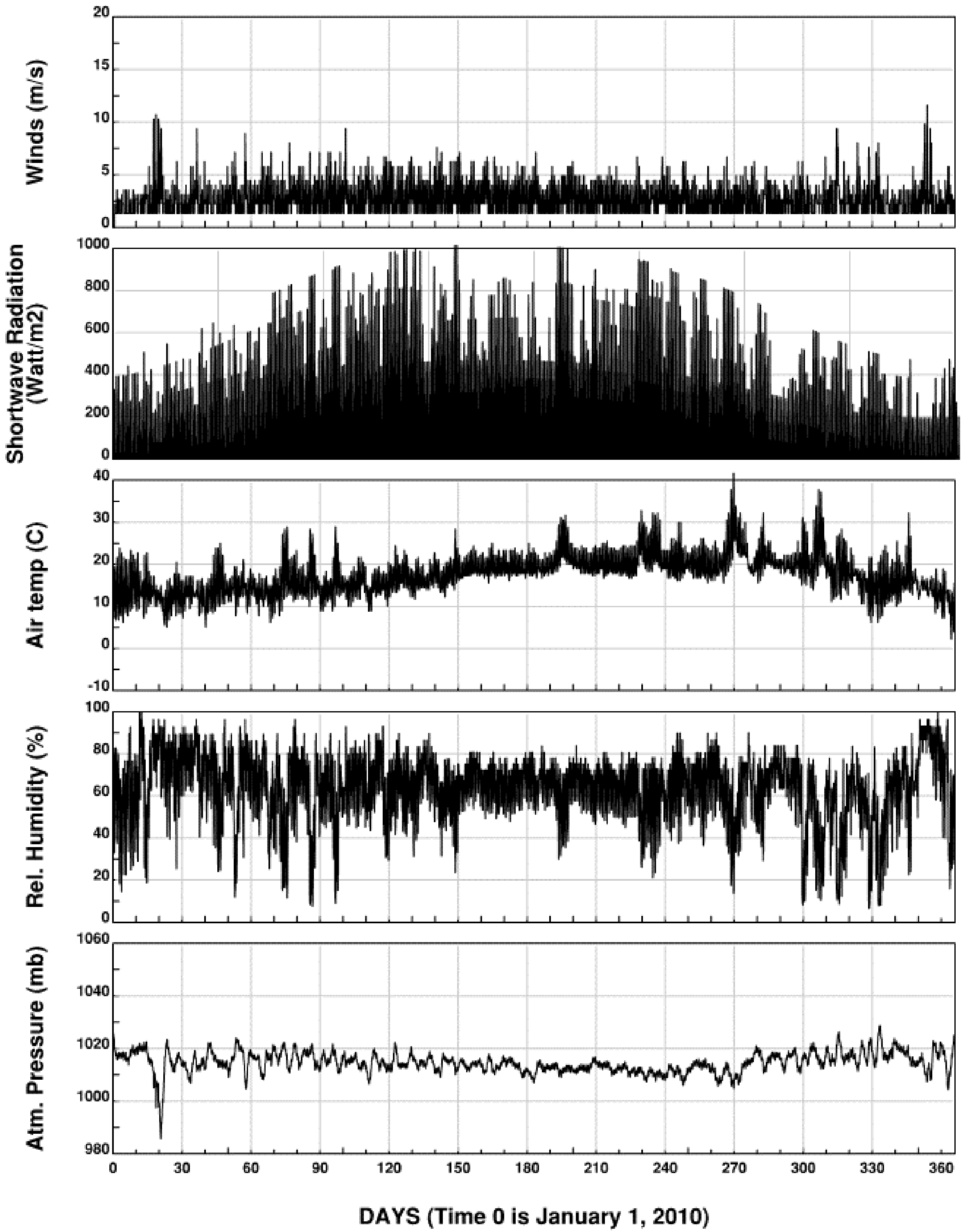


Figure 14. Meteorological Data Used for Model Inputs (2010)

Model Calibration

Available salinity (converted from specific conductivity and temperature) and temperature data in Newport Bay were used for model calibration as obtained from the Orange County Watersheds (a division in OCPW) monitoring program. A total of 15 monitoring stations were used for the salinity and temperature model calibration throughout Newport Bay. NOAA tidal elevation predictions are available at the Newport Beach, Newport Bay Entrance station (#9410580) and were used for the model water elevation calibration at this location.

Figure 15 (salinity) and Figure 16 (temperature) present the observed data and model output for the year 2010 in the upper part of Newport Bay. Model calibration figures for all bay monitoring stations are presented in Attachment B. The red circles in these figures represent the measured data. The blue line represents the surface model output and the black line represents the bottom model output. These model calibration figures demonstrate a reasonable comparison between model output and observed data throughout 2010 for all of the monitoring stations in Newport Bay. In general, the seasonal temperature cycle is well represented throughout the bay. The model is also able to calculate the large decreases and recovery in salinity during and after high creek flow (storm) events observed from January through April and October through December.

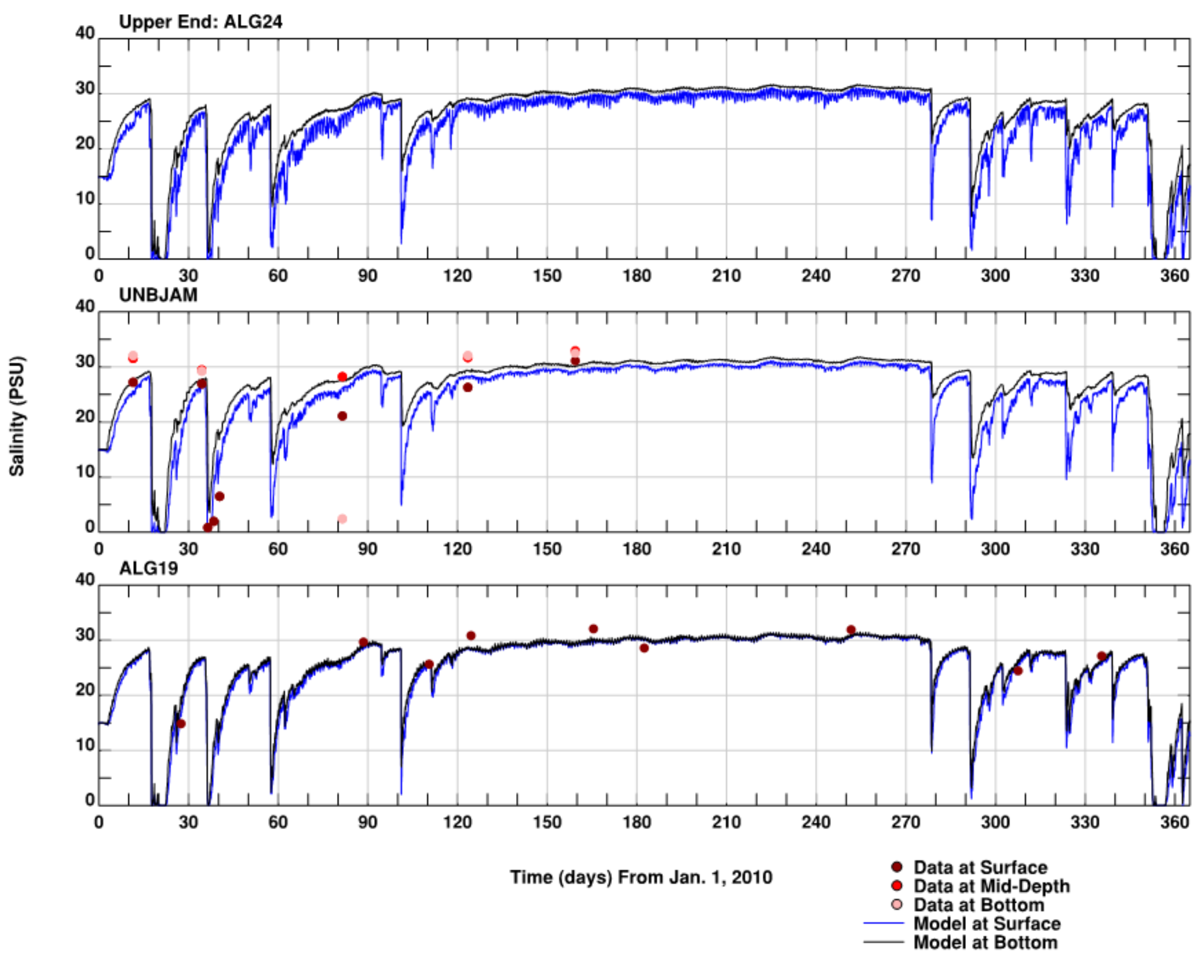


Figure 15. Model Salinity Calibration

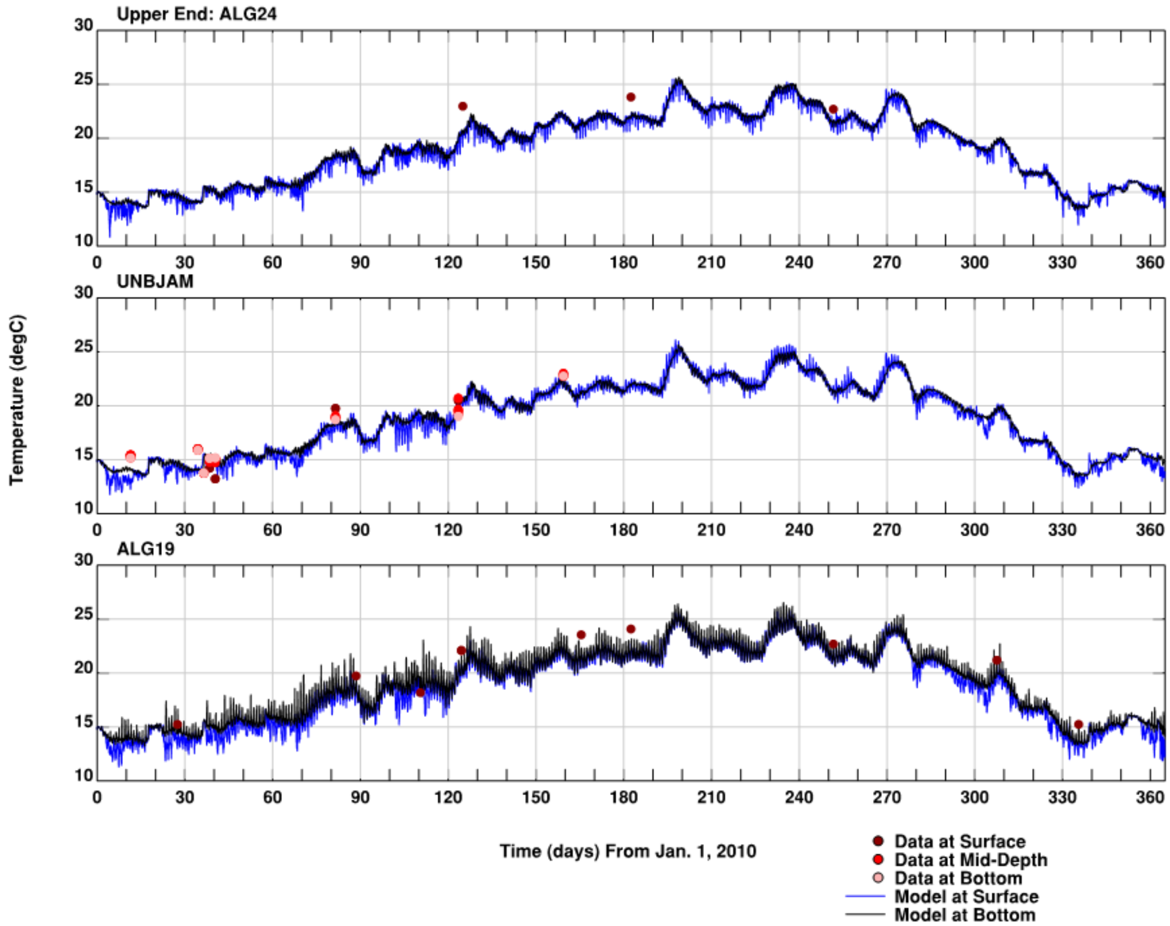


Figure 16. Model Temperature Calibration

Figure 17 and Figure 18 present the model water elevation calibration to the NOAA tidal predictions at the Newport Bay Entrance station. The red line in this figure represents the NOAA tidal predictions and the blue line represents the model output. Overall, the model reproduces the mixed tidal signal at this location well for the year 2010.

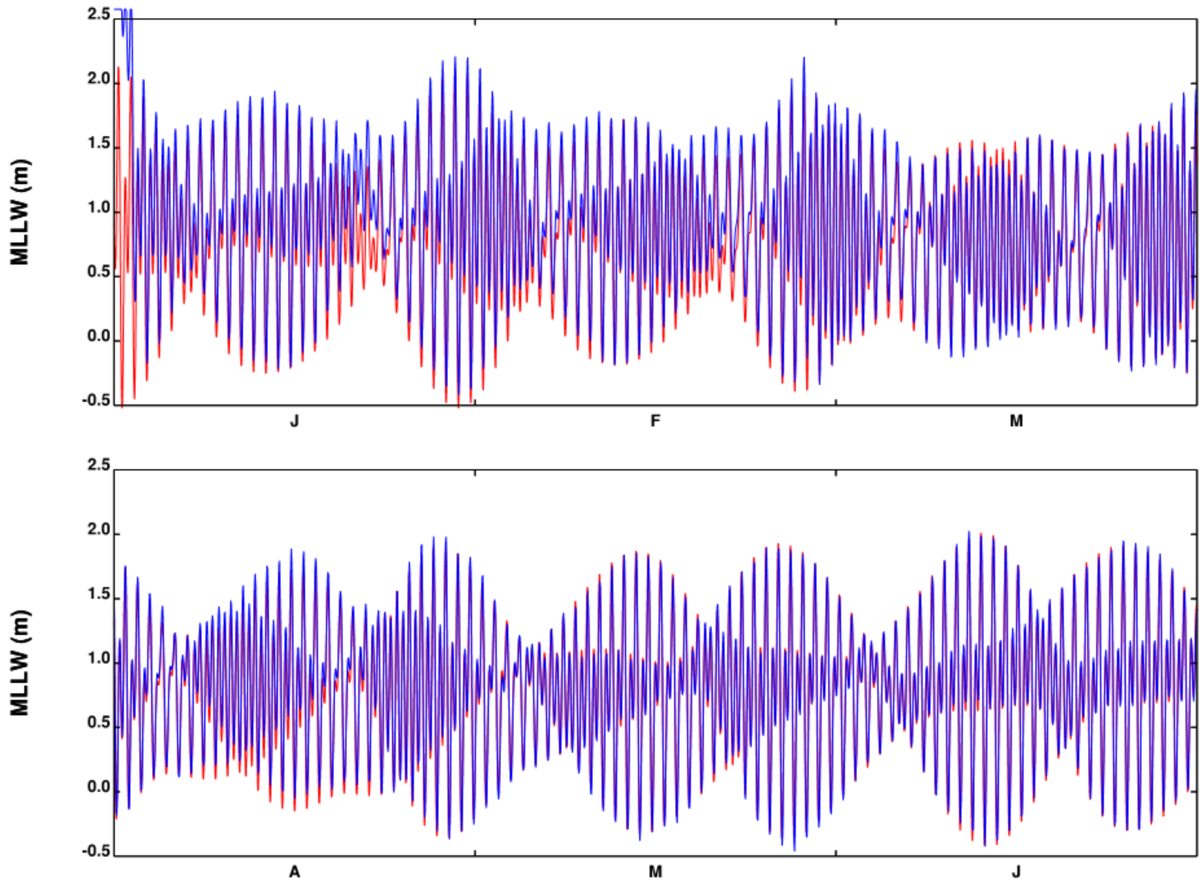


Figure 17. Model Water Elevation Calibration (Jan-Jun 2010)

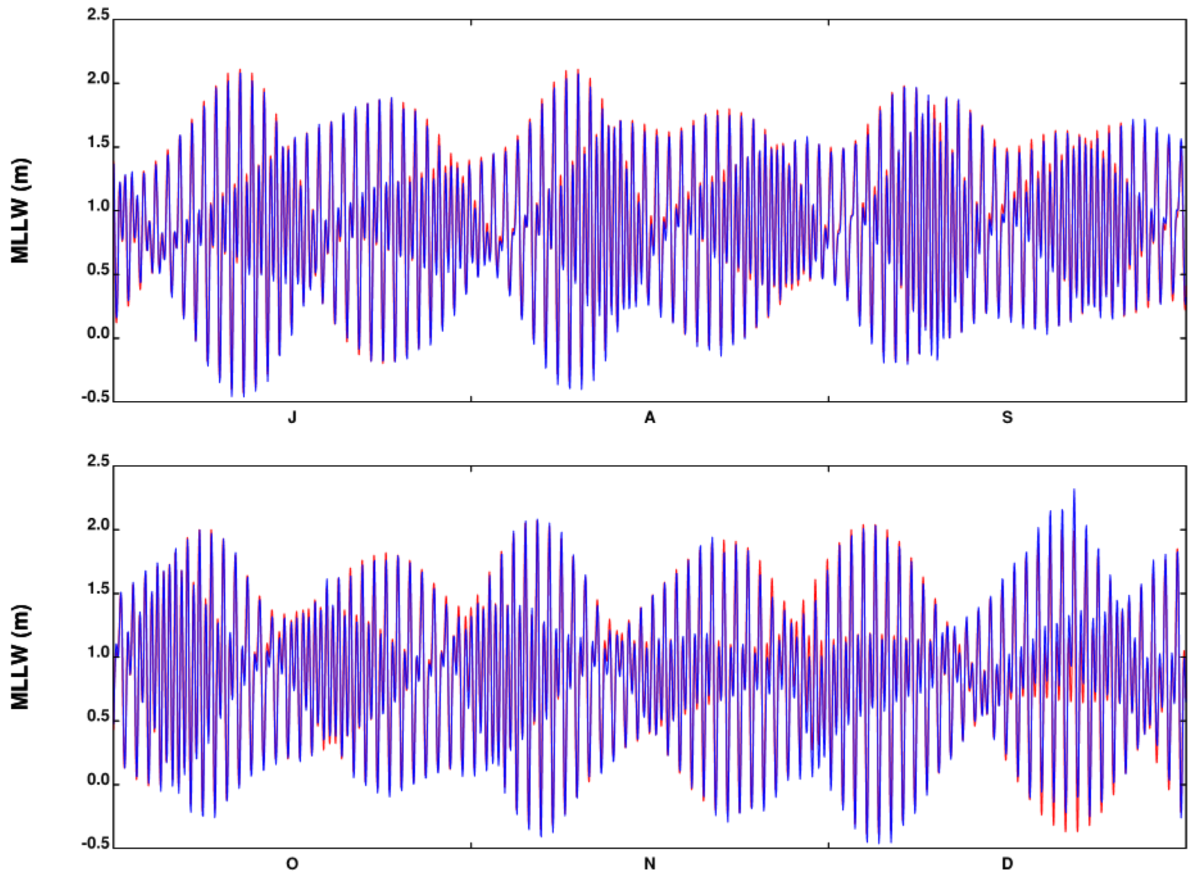


Figure 18. Model Water Elevation Calibration (Jul-Dec 2010)

IRWD Diversion Evaluation

The calibrated hydrodynamic model was used to estimate nutrient impacts in Newport Bay for a proposed IRWD diversion to San Diego creek of 14.5 MGD over three time periods: 1-day release; 7-day release; and 14-day release. The proposed effluent quality used to characterize MWRP recycled water is 10 mgN/L TN and 0.3 mg P/L TP. These diversion model runs were all started on 1/18/2010 at 1000 hours, which was the start of the January winter storm noted in Table 3. TN and TP were modeled as a conservative tracer in the hydrodynamic model (i.e., no nutrient processing) with only mixing and dilution associated with creek flow and tidal mixing. This approach provides the calculated increase in TN and TP due to the proposed diversion over existing (background) levels that are present in the bay.

Attachments C (TN) and D (TP) present time-series figures at 15 locations in Newport Bay of the surface (blue line) and bottom (black line) model output of the calculated TN and TP increases for the three proposed IRWD diversion time periods. The average and maximum increases during the diversion period are also posted on each panel of these figures. Table 4 presents the calculated TN and TP increases during the diversion period for the different IRWD diversions. The ranges in this table reflect the calculated increases at the Jamboree Road, Santa Ana-Delhi Channel and Northstar Beach monitoring locations. It should be noted that these calculated increases are for the 1-day, 7-

day and 14-day diversion periods and may not reflect appropriate averaging time periods for evaluating impacts on bay macroalgae growth because of their short duration.

Table 4. TN & TP Bay Increases due to Diversions (Short Term)

Diversion Period	Location	TN Increase (mgN/L)	TP Increase (mgP/L)
1-day	Jamboree Road	0.22	0.007
	Santa Ana-Delhi Channel	0.06	0.002
	Northstar Beach	0.02	0.001
7-days	Jamboree Road	0.39	0.012
	Santa Ana-Delhi Channel	0.20	0.006
	Northstar Beach	0.12	0.004
14-days	Jamboree Road	0.73	0.022
	Santa Ana-Delhi Channel	0.41	0.012
	Northstar Beach	0.21	0.006

In order to address an averaging time period that better reflects the potential impact on macroalgae growth in the bay, Table 5 presents calculated TN and TP increases for averaging periods of 30, 60 and 90 days that may be more relevant to addressing nutrient impacts on macroalgae biomass. This table presents the calculated range in increases for the three locations used in Table 4 for the 30, 60 and 90 day averaging periods that are more biologically relevant. The concentration increases for TN and TP over these longer averaging periods are very small.

Table 5. TN and TP Bay Increases due to Diversions (Long Term)

Diversion Period	Averaging Period	TN Increase (mgN/L)	TP Increase (mgP/L)
1-day	30 days	≤0.01	<0.001
	60 days	<0.01	<0.001
	90 days	<0.01	<0.001
7-days	30 days	0.07-0.15	0.002-0.005
	60 days	0.03-0.08	0.001-0.002
	90 days	0.02-0.05	0.001-0.002

Diversion Period	Averaging Period	TN Increase (mgN/L)	TP Increase (mgP/L)
14-days	30 days	0.17-0.45	0.005-0.014
	60 days	0.09-0.23	0.003-0.007
	90 days	0.06-0.15	0.002-0.005

Figure 19 through Figure 24 present surface maps of the average increase in TN and TP during the diversion periods (i.e., 1-day, 7-days and 14-days). The figures show that the area of increased TN and TP concentrations due to the diversions is limited to locations upstream from Northstar Beach for TN and from the ALG9 station (see Figure 7) for TP.

It is anticipated that the calculated TN and TP increases due to the proposed IRWD diversions will not affect macroalgae levels in upper Newport Bay for the following reasons.

- Diversions are proposed during high flow periods when creek flow dilution of the diversion and short flushing times in the bay will reduce any potential impacts.
- The winter period diversions (October-April) will occur when bay water temperatures are low and not supportive of macroalgae growth (i.e., July-August).
- Diversion effluent TN and TP concentrations are primarily in the dissolved form (>80 percent) and will not significantly contribute to particulate nitrogen and phosphorus that may settle to the sediments and return as dissolved nutrients during warmer summer months (July-August) due to sediment diagenesis.
- TN increases over biologically relevant averaging periods (e.g., 30-90 days) ranged from <0.01 to 0.45 mgN/L and TP increases ranged from <0.001 to 0.014 mgP/L. These increases are not considered significant when compared to background TN and TP levels (particularly for TP).

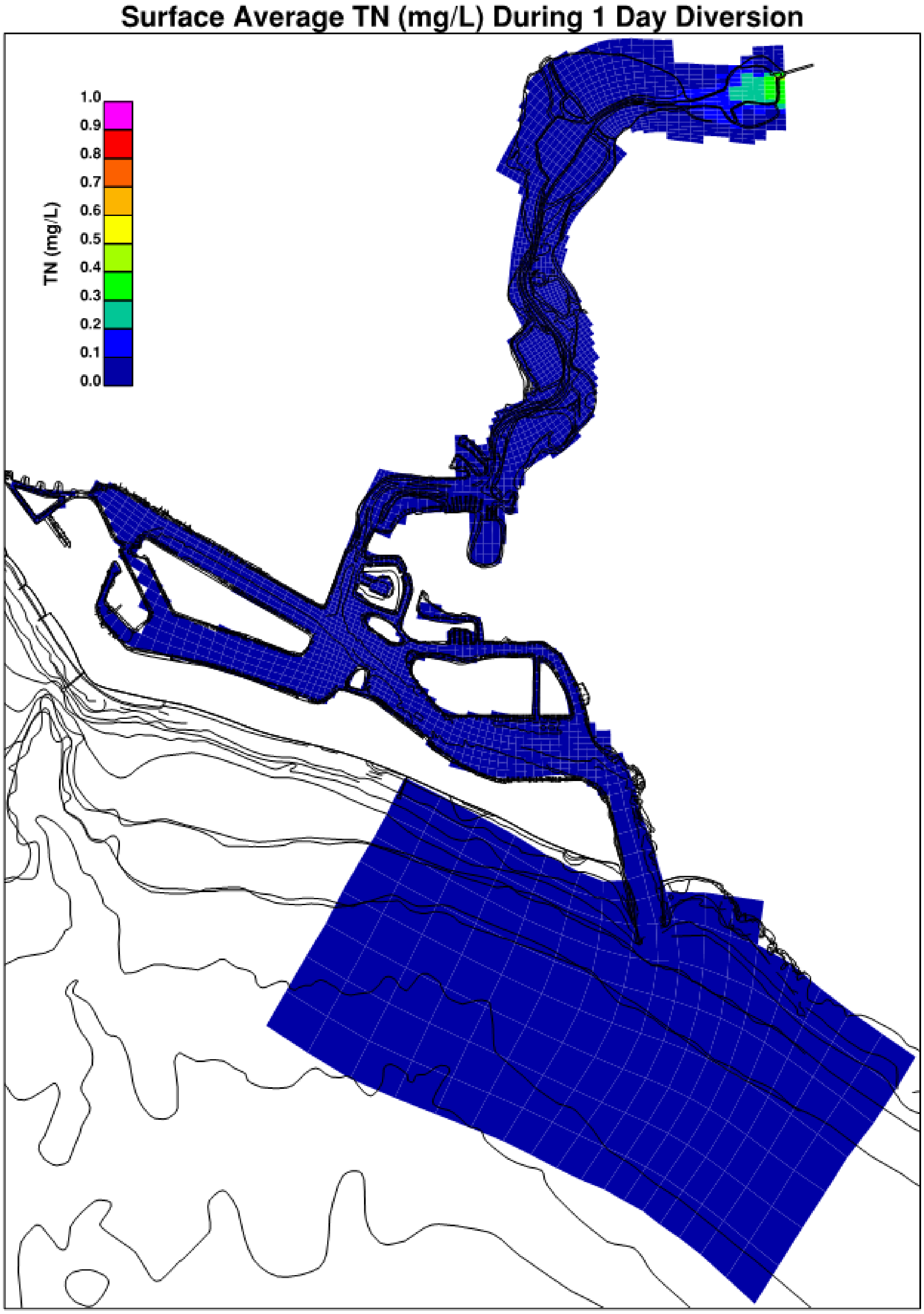


Figure 19. Surface TN Increase Due to IRWD Diversion (1-day)

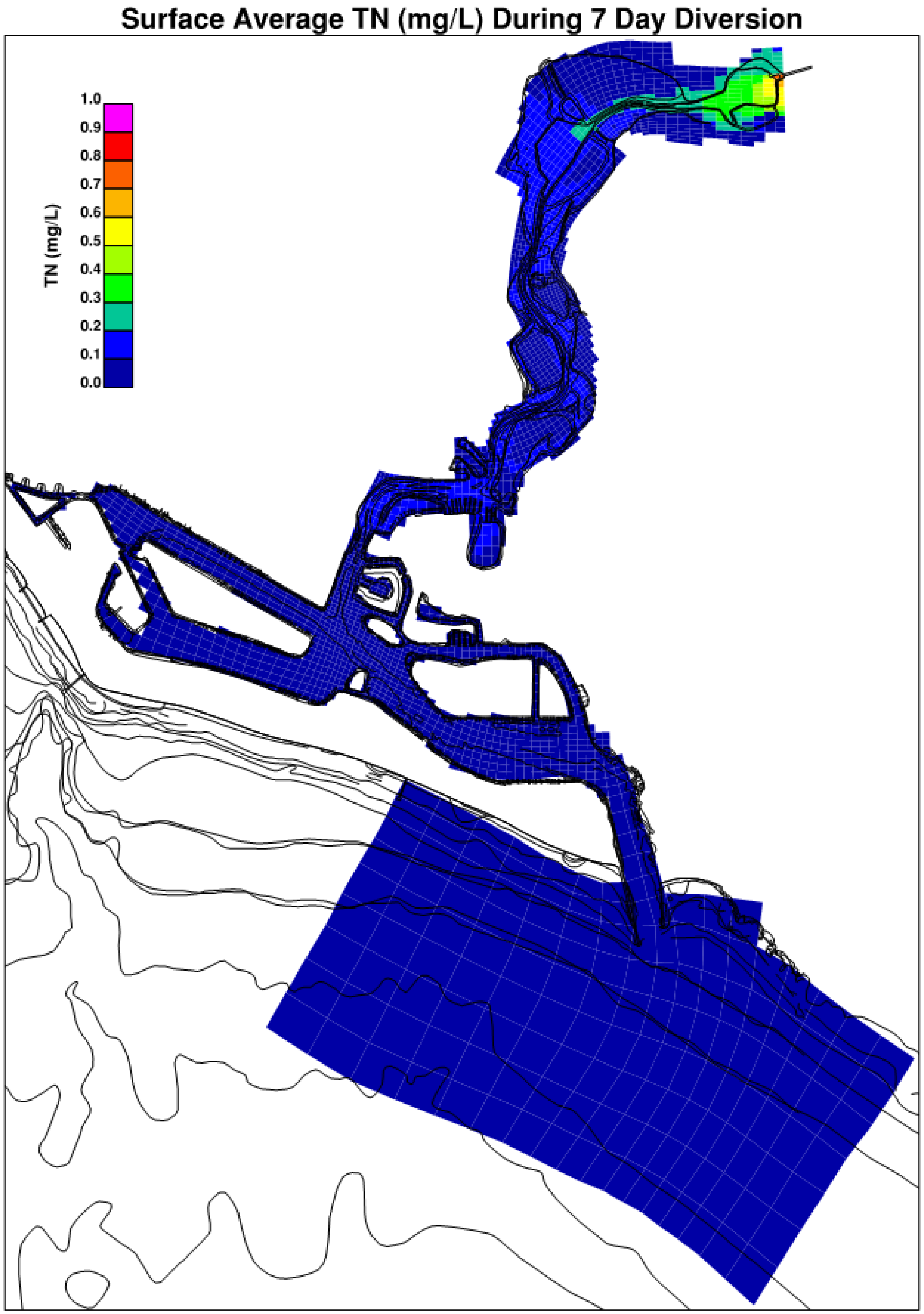


Figure 20. Surface TN Increase Due to IRWD Diversion (7-day)

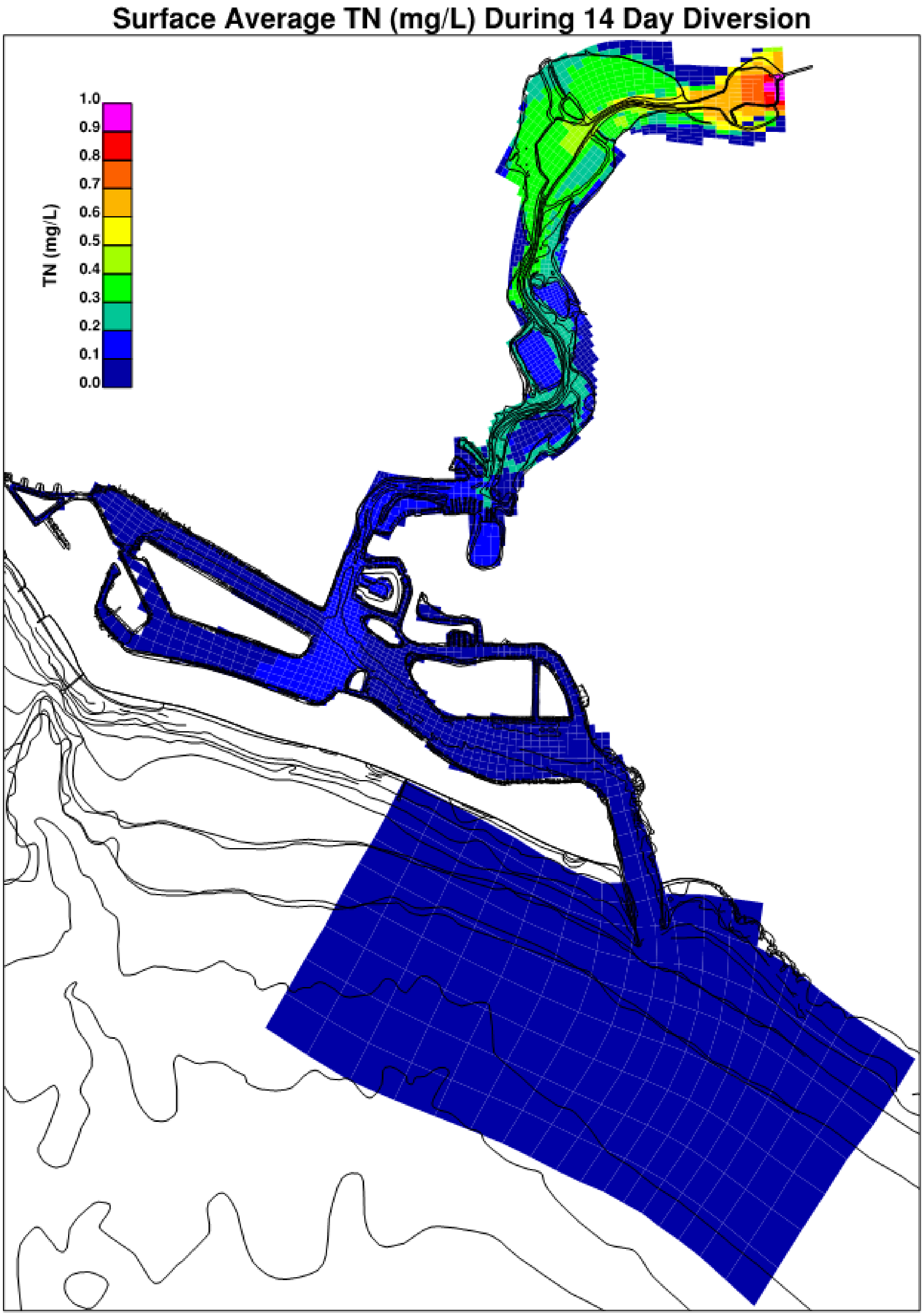


Figure 21. Surface TN Increase Due to IRWD Diversion (14-day)

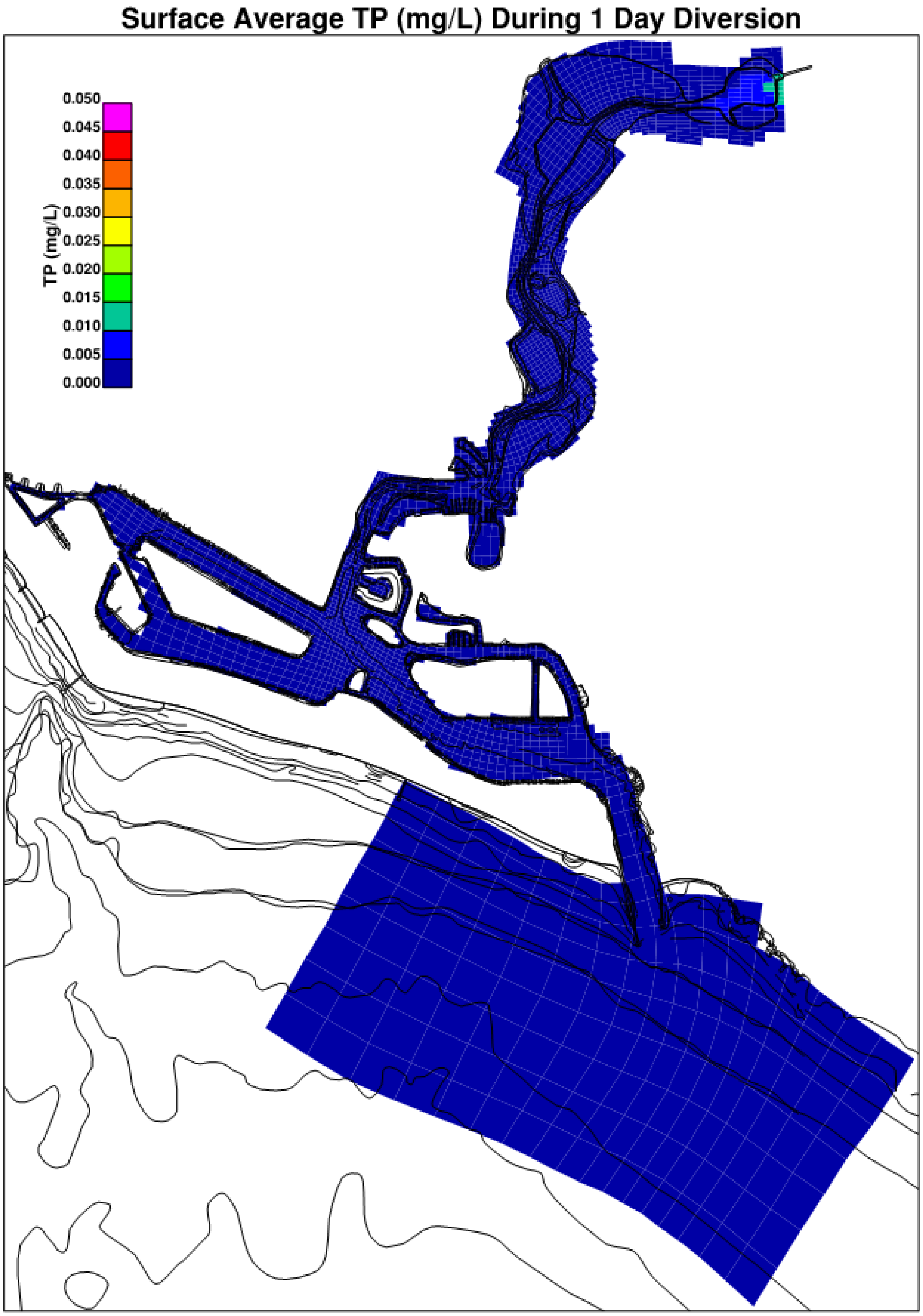


Figure 22. Surface TP Increase Due to IRWD Diversion (1-day)

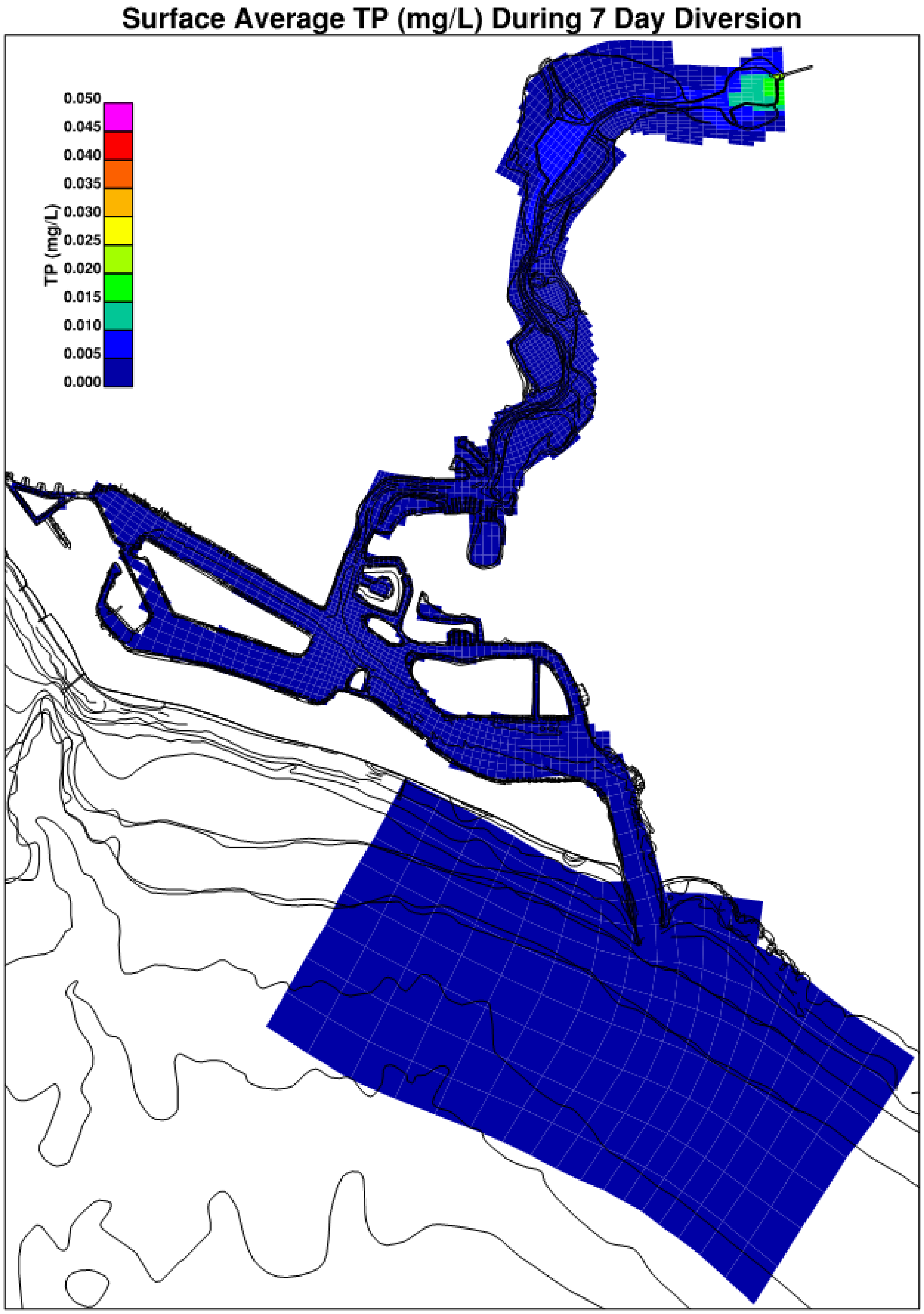


Figure 23. Surface TP Increase Due to IRWD Diversion (7-day)

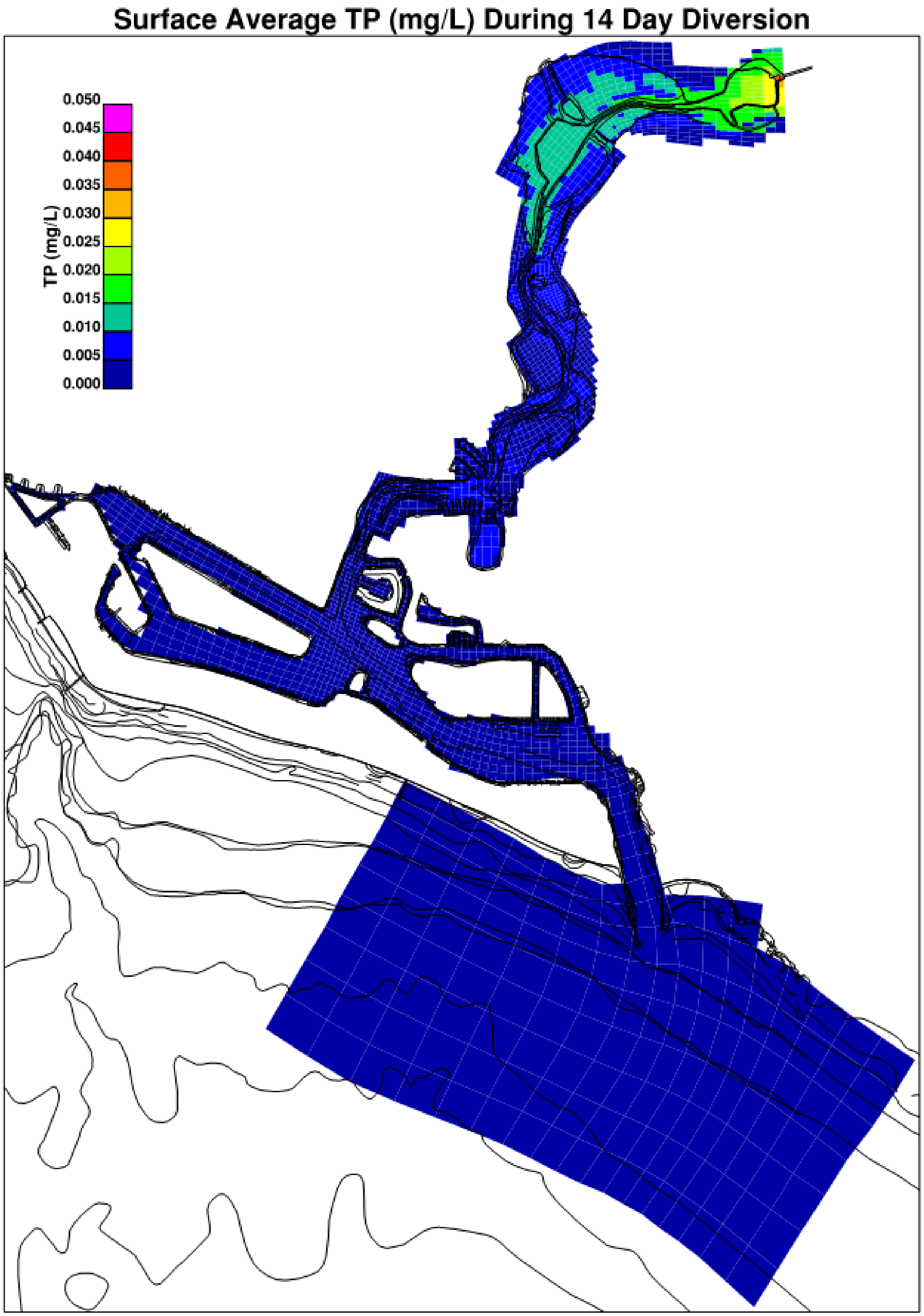


Figure 24. Surface TP Increase Due to IRWD Diversion (14-day)

Flushing Time Analysis

The calibrated hydrodynamic model was used to calculate flushing times of upper Newport Bay for a range of constant creek flows starting at both neap tide (low tidal range) and spring tide (high tidal range) conditions. For this analysis, the spatial area of the upper bay was defined as from the Coast Highway Bridge to the mouth of San Diego Creek. The creek flows assigned were 5, 15, 50, 500 and 1,000 cfs. Flushing times were calculated by starting the model simulation with an initial tracer concentration of 100 mg/L in all model grid cells in the upper bay; and then running the model and tracking the decrease in tracer concentration over time due to the creek flows and tidal mixing. The flushing time was calculated when the initial tracer mass was reduced by 63 percent, or to 37 percent of the initial tracer mass (i.e., 1 e-folding time or 1/e). This definition of flushing time (i.e., 1 e-folding time) is routinely used to calculate flushing times in tidal systems.

Figure 25 (neap tide start) and Figure 26 (spring tide start) present the fraction of upper bay tracer mass as compared to the initial tracer mass over time for each of the assigned creek flows. The horizontal red line represents the e-folding fraction of 0.37 (37 percent of initial tracer mass).

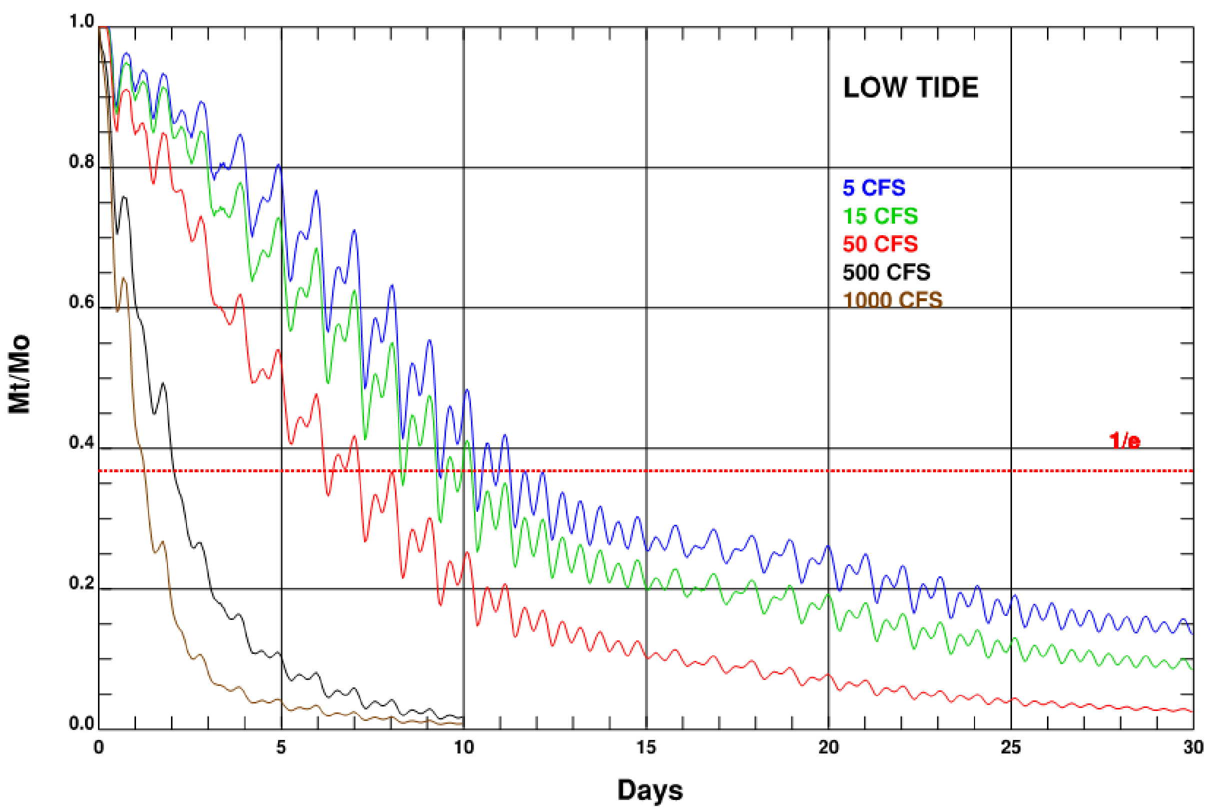


Figure 25. Model Calculated Tracer Mass for Neap (Low) Tide Flushing Times

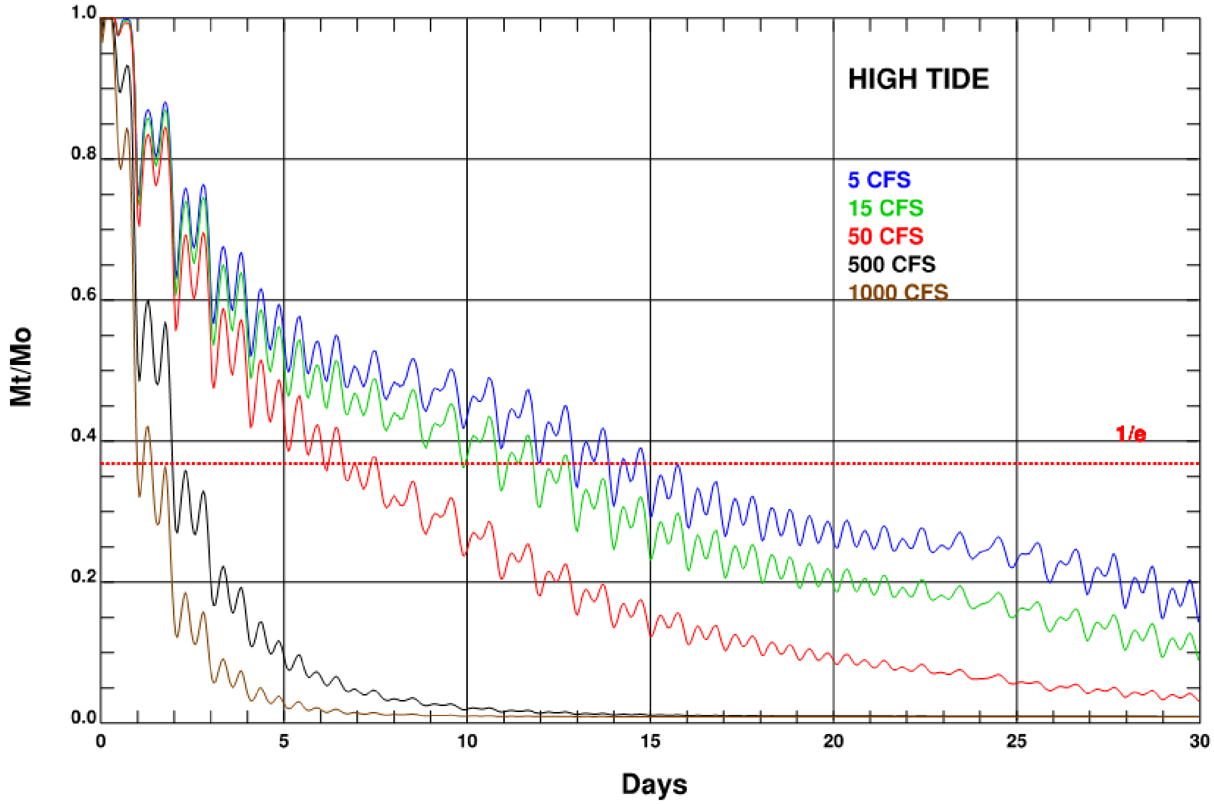


Figure 26. Model Calculated Tracer Mass for Spring (High) Tide Flushing Times

Table 6 presents the calculated flushing times for each of the assumed creek flows in the analysis. Low flow (i.e., 5 to 50 cfs) flushing times ranged from 1 to 2 weeks; and high flow (500 to 1,000 cfs) flushing times range from 1 to 2 days

Given that these upper bay flushing times are of short duration (particularly at the high creek flows when diversions may occur), any potential water quality impacts in the bay due to the proposed IRWD diversions will be minimized. That is, the increased TN and TP concentrations due to the proposed IRWD diversions will typically occur during time periods when flushing times are short (i.e., less than 1 week).

Table 6. Upper Bay Flushing Time Results

Creek Flow (cfs)	Flushing Time (days)	
	Neap Tide	Spring Tide
5	11.2	14.9
15	10.2	12.8
50	7.1	7.6
500	2.1	2.0
1,000	1.2	1.3

Conclusions

This report presents an analysis of available San Diego Creek and Newport Bay water quality data, and the development and application of a hydrodynamic model to evaluate the potential water quality impacts in upper Newport Bay due to proposed IRWD diversions to San Diego Creek. The following conclusions from this analysis are as follows:

- The proposed IRWD diversions would potentially be required during the winter (high flow) periods of the year and, therefore, will take advantage of higher creek flows for diluting the diversion and increasing flushing in Newport Bay.
- San Diego Creek data suggest that proposed IRWD diversions during high flow (storm) periods will be coupled with high creek TN and TP concentrations and loads to Newport Bay; thereby diminishing the potential impact of the proposed IRWD diversion nutrient loads during these high flow periods.
- Newport Bay data show the effects of nitrogen reductions to San Diego Creek at the upper bay monitoring stations, along with additional decreases due to freshwater and tidal dilution. The observed decreases in N:P ratios seem to indicate that algal growth in the bay is more limited by phosphorus than nitrogen. Therefore, phosphorus loads from the proposed IRWD diversions may be more important than nitrogen loads. This supports the proposed effort by IRWD to reduce phosphorus levels during the proposed diversions to San Diego Creek.
- Macroalgae growth and biomass in upper Newport Bay typically is the greatest during the July through August index period used in the Newport Bay Watershed Nutrient TMDL Annual Data Reports when bay water temperatures are more favorable to growth (e.g., greater than 20°C). Therefore, the proposed IRWD diversions during high flow, cooler winter months, will mitigate water quality (macroalgae) impacts in the bay.
- The MWRP effluent to be diverted to San Diego Creek is primarily in the dissolved form of TN and TP. This will minimize the potential water quality impacts in Newport Bay since the diversion release will be transported out of the bay. In addition, the dissolved nutrients in the diversion will not significantly contribute to particulate nitrogen and phosphorus that may settle to the sediments and return as dissolved nutrients during warmer summer months of the year.
- A hydrodynamic model of Newport Bay was developed and successfully calibrated to available salinity, temperature and water elevation data in the bay. The hydrodynamic model represents the freshwater and tidal mixing that occurs in the bay and that controls the movement and dispersion of constituents introduced to the bay.
- The calibrated hydrodynamic model was used to evaluate proposed IRWD diversions to San Diego Creek and the effect on TN and TP in Newport Bay. Calculated TN increases that may have an effect on bay macroalgae levels over biologically relevant average periods ranged from <0.01 to 0.45 mgN/L and TP increases ranged from <0.001 to 0.014 mgP/L. These increases are not considered significant when compared to background TN and TP levels (particularly for TP).
- The calibrated hydrodynamic model was used to calculate flushing times for upper Newport Bay for creek flows of 5, 15, 50, 500 and 1,000 cfs. Low flow (i.e., 5 to 50 cfs) flushing times ranged from 1 to 2 weeks; and high flow (500 to 1,000 cfs) flushing times range from 1 to 2 days.

- Given that upper bay flushing times are of short duration, any potential water quality impacts in the bay due to the proposed IRWD diversions will be minimized. That is, the increased TN and TP concentrations due to the proposed IRWD diversions will typically occur during time periods when flushing times are short (i.e., less than 1 week).

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Attachment A. Newport Bay Nutrient Data

Attachment B. Model Salinity and Temperature Calibration Figures

Attachment C. Calculated TN Increases due to IWRD Diversions

Attachment D. Calculated TP Increases due to IWRD Diversions

Attachment A. Newport Bay Nutrient Data

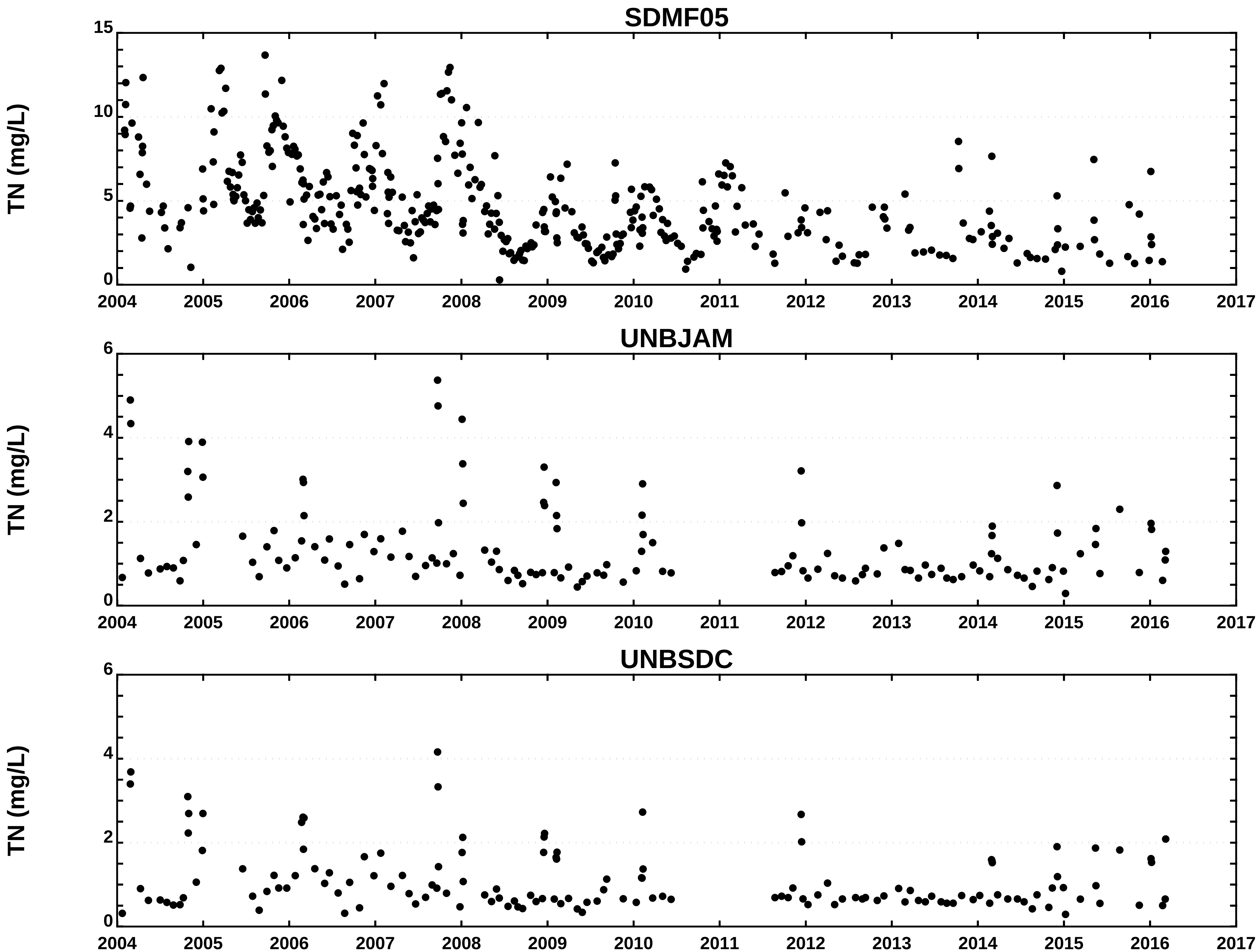


Figure A1. Newport Bay TN Data

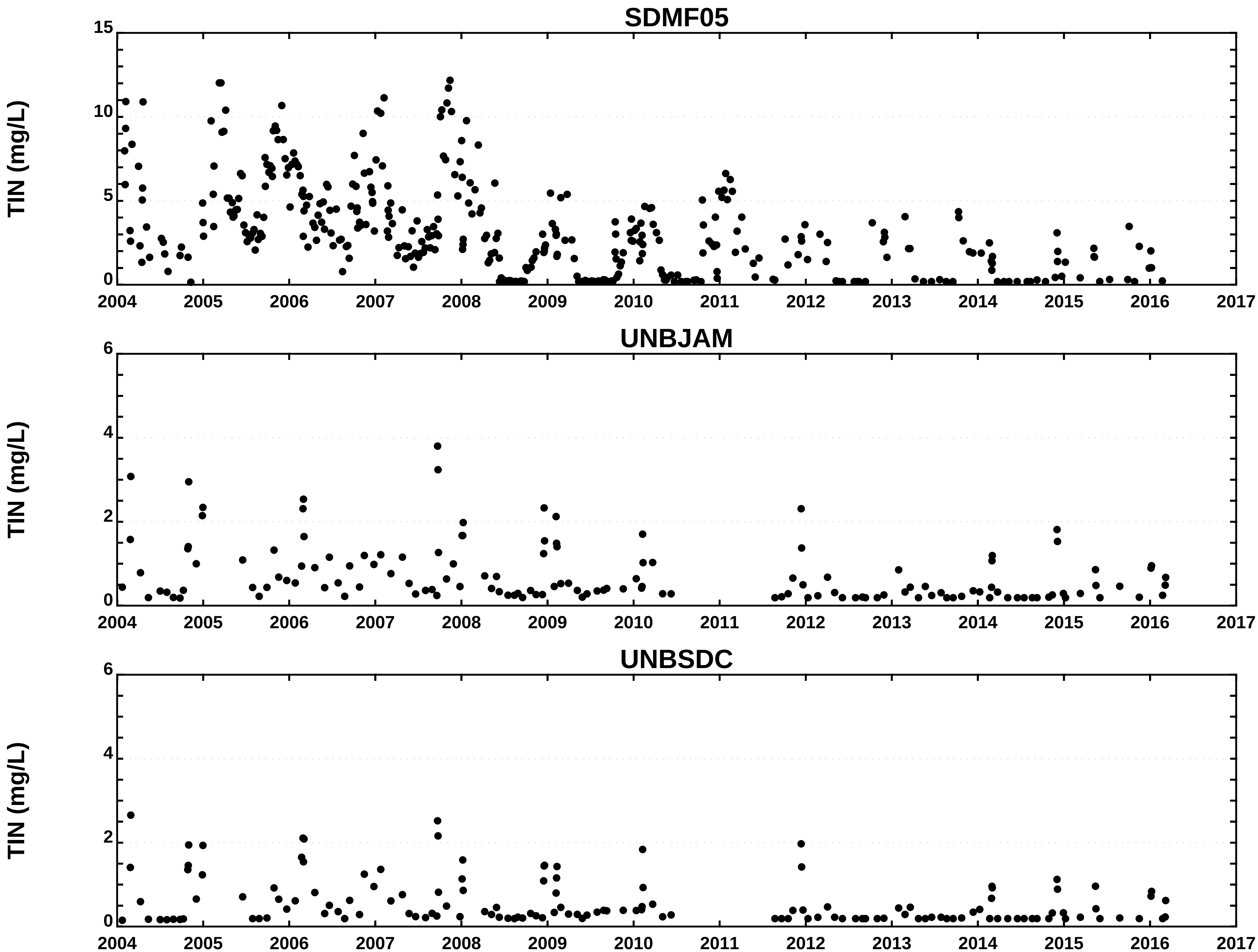


Figure A2. Newport Bay TN Data

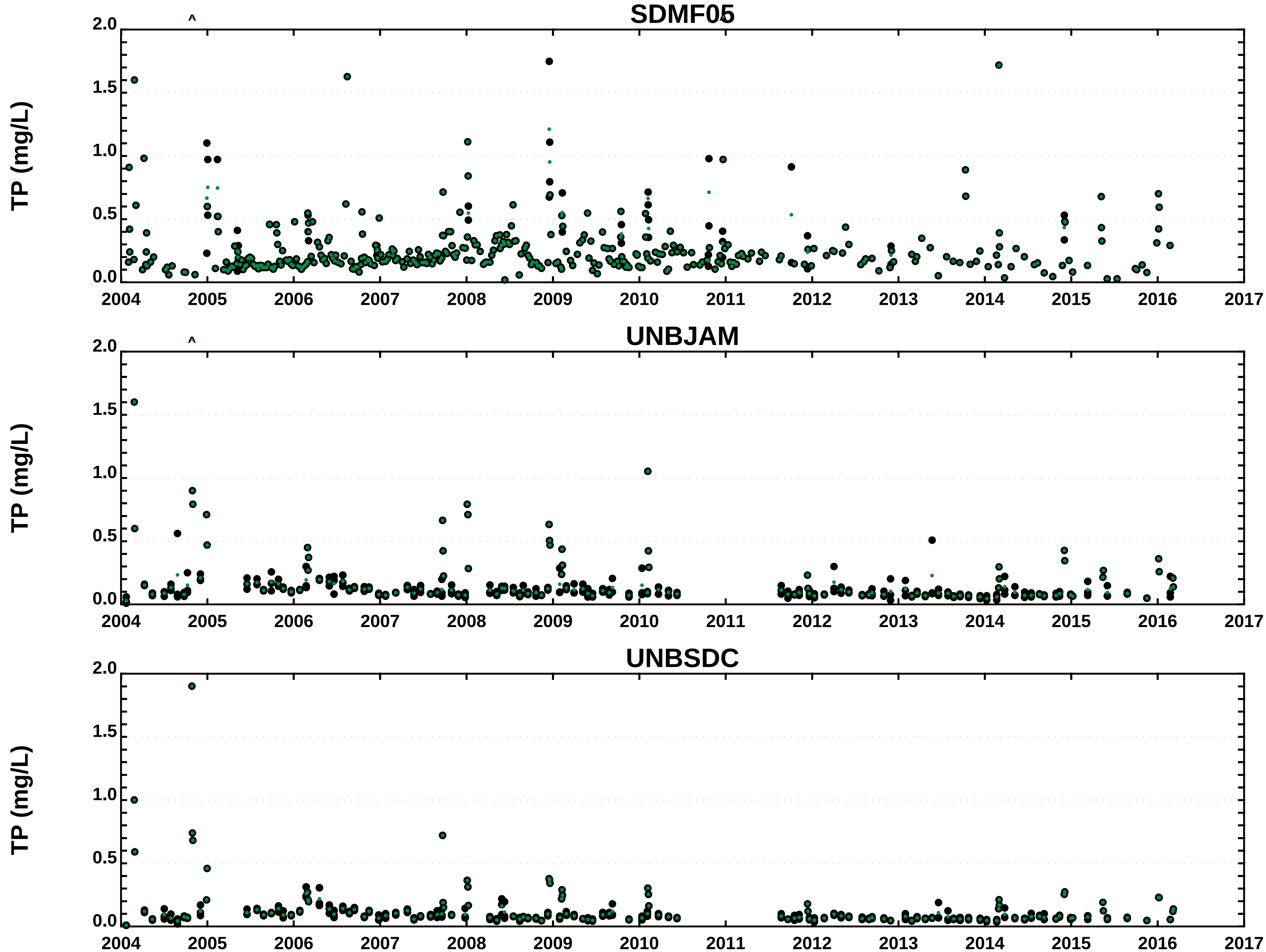


Figure A3. Newport Bay TN Data

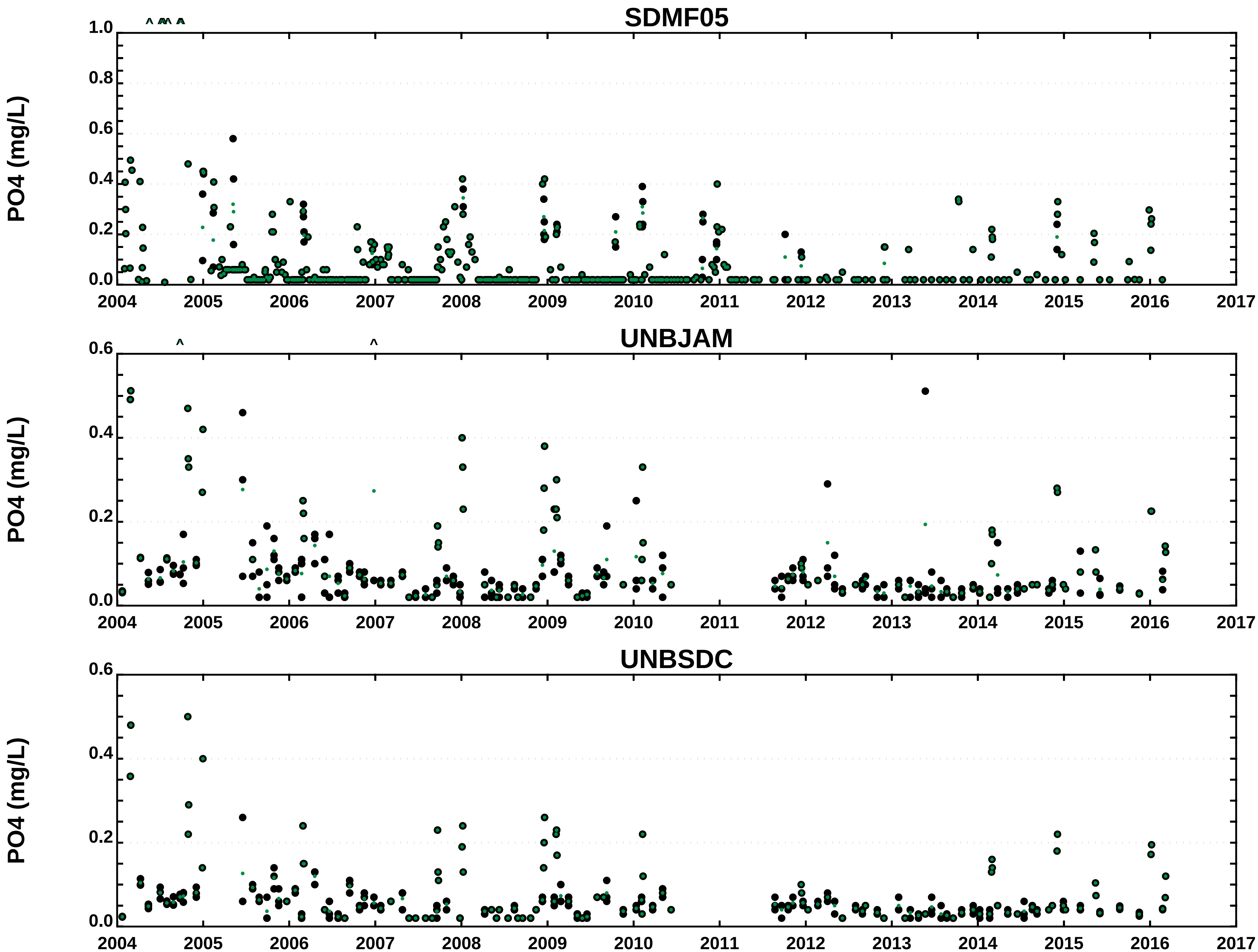


Figure A4. Newport Bay TN Data

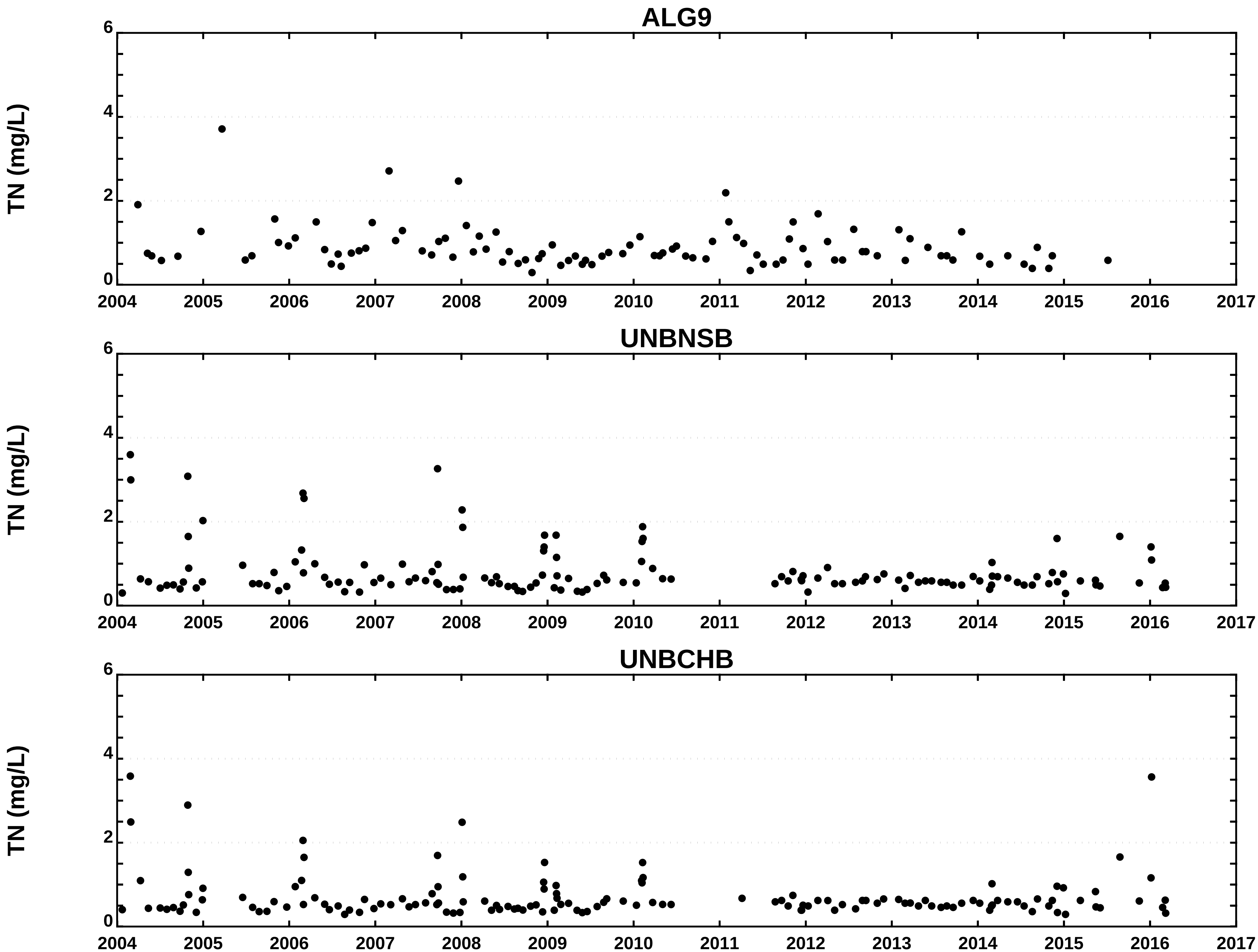


Figure A5. Newport Bay TN Data

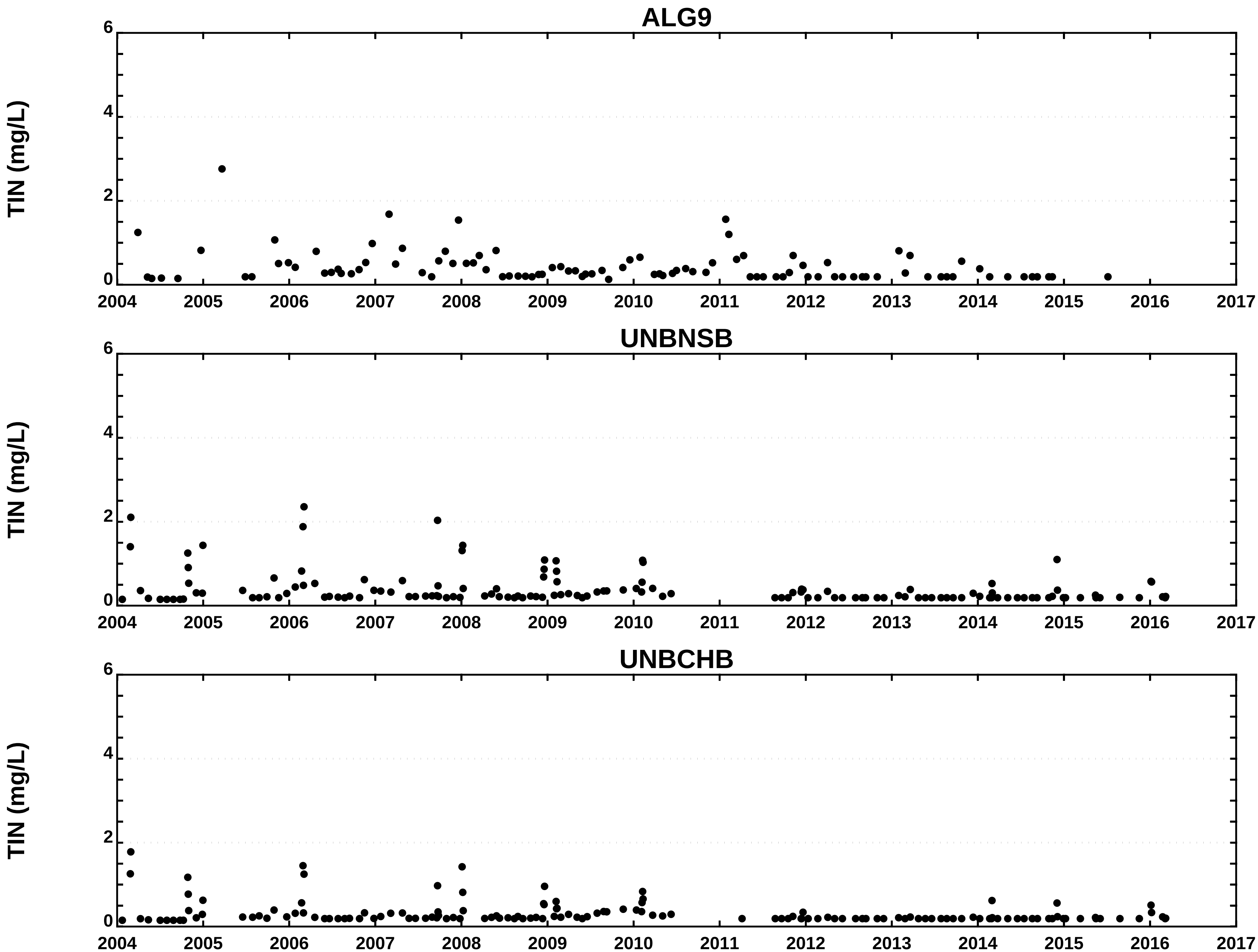


Figure A6. Newport Bay TN Data

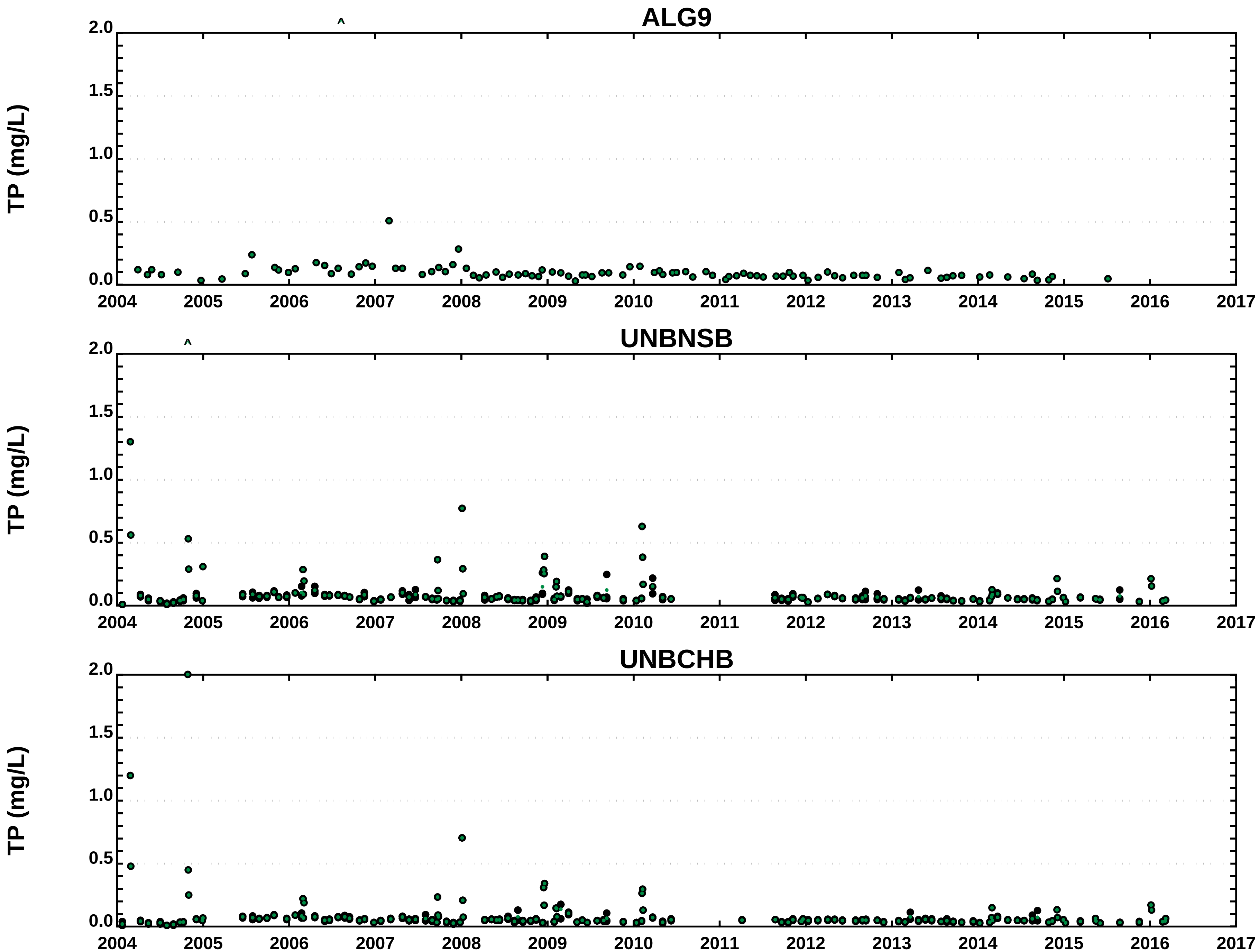


Figure A7. Newport Bay TN Data

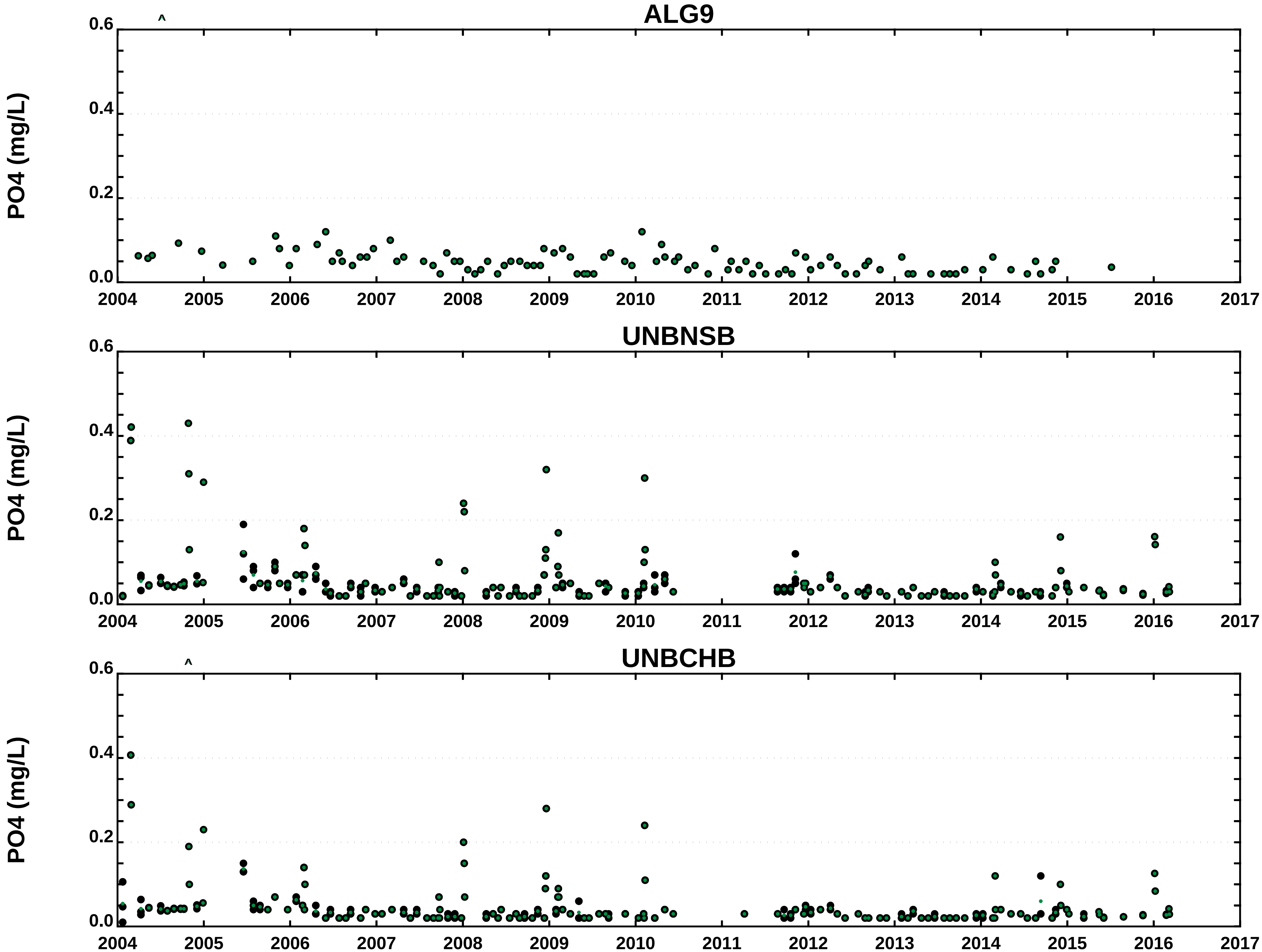


Figure A8. Newport Bay TN Data

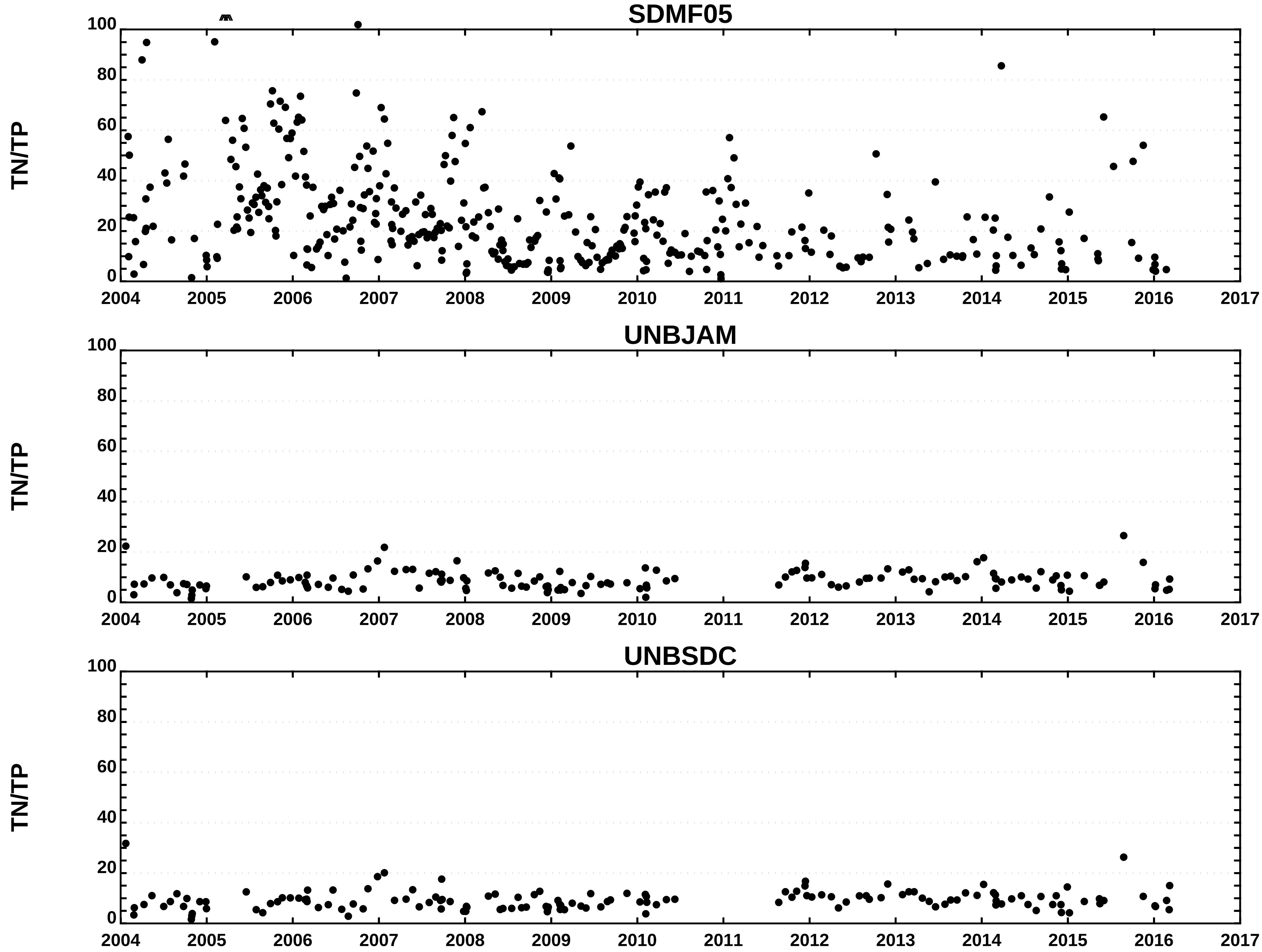


Figure A9. Newport Bay TN Data

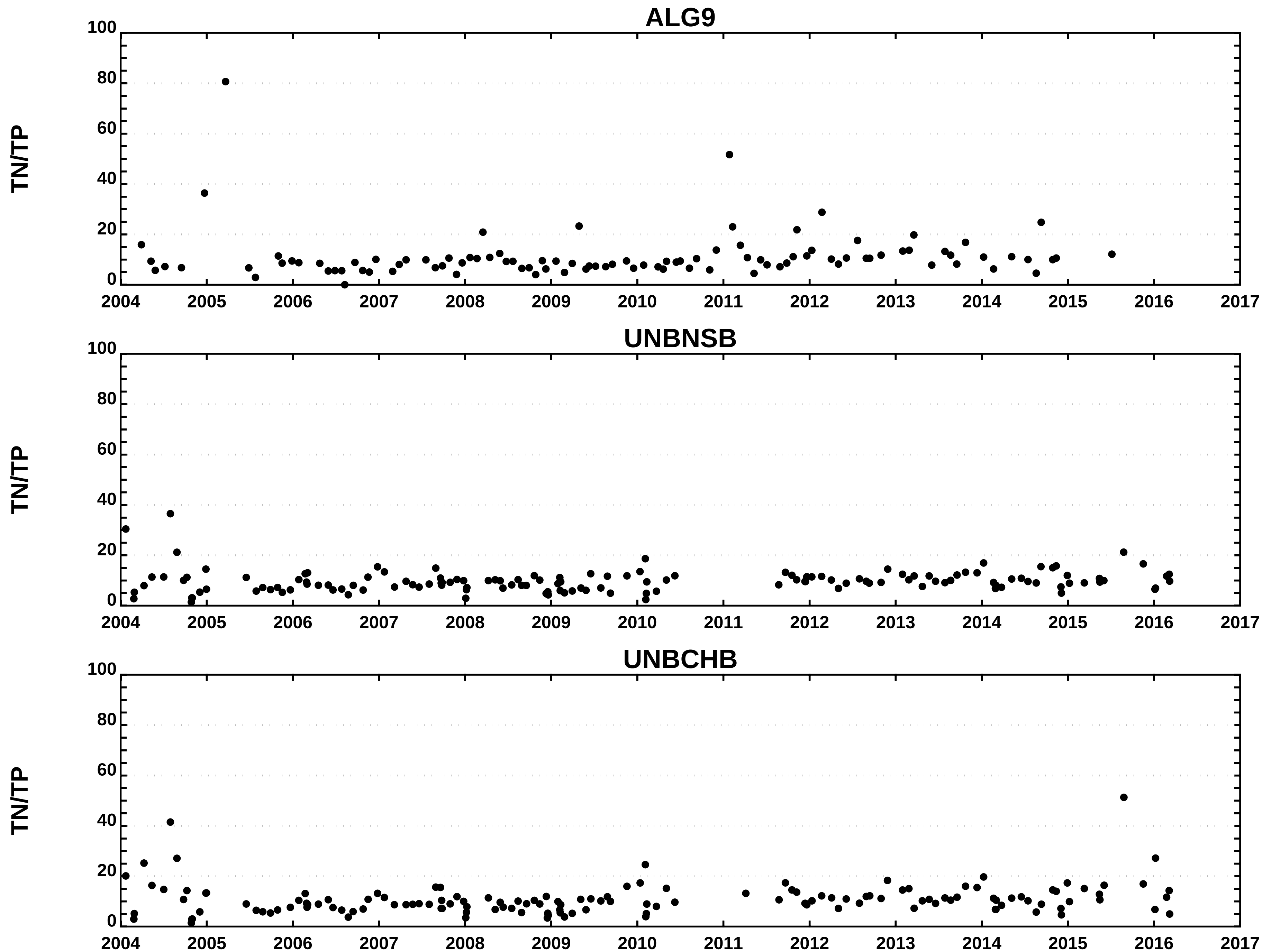


Figure A10. Newport Bay TN Data

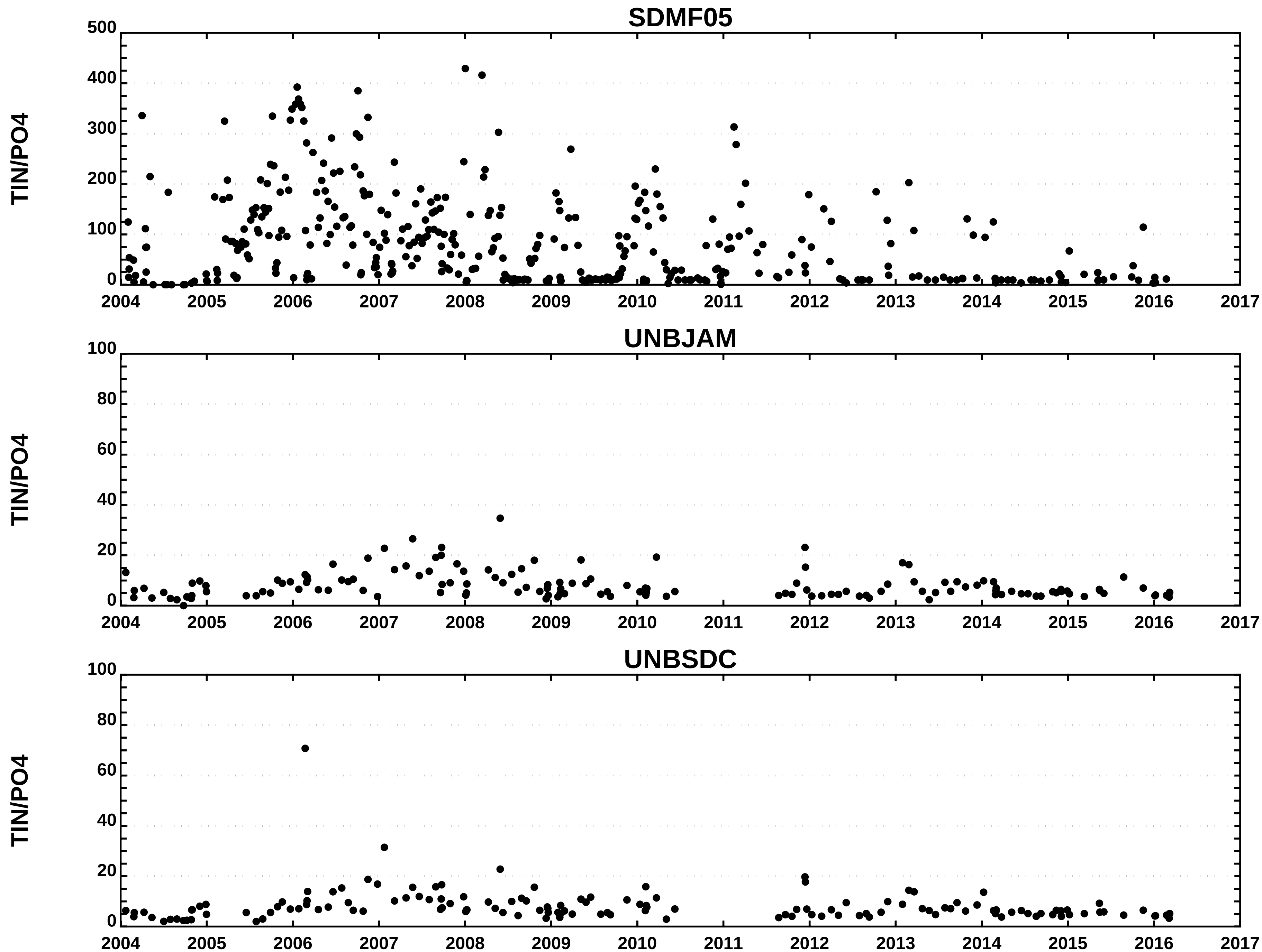


Figure A11. Newport Bay TN Data

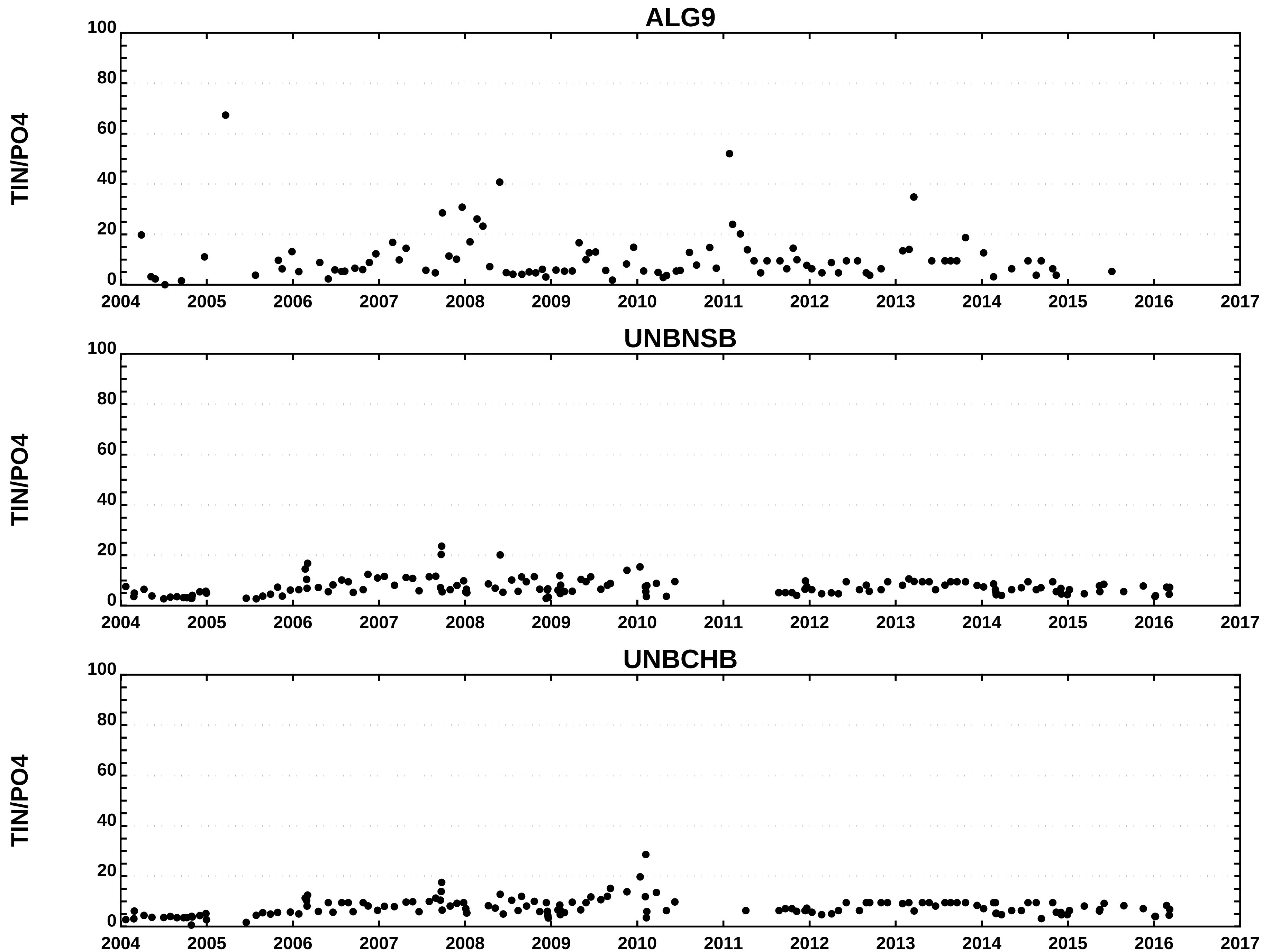
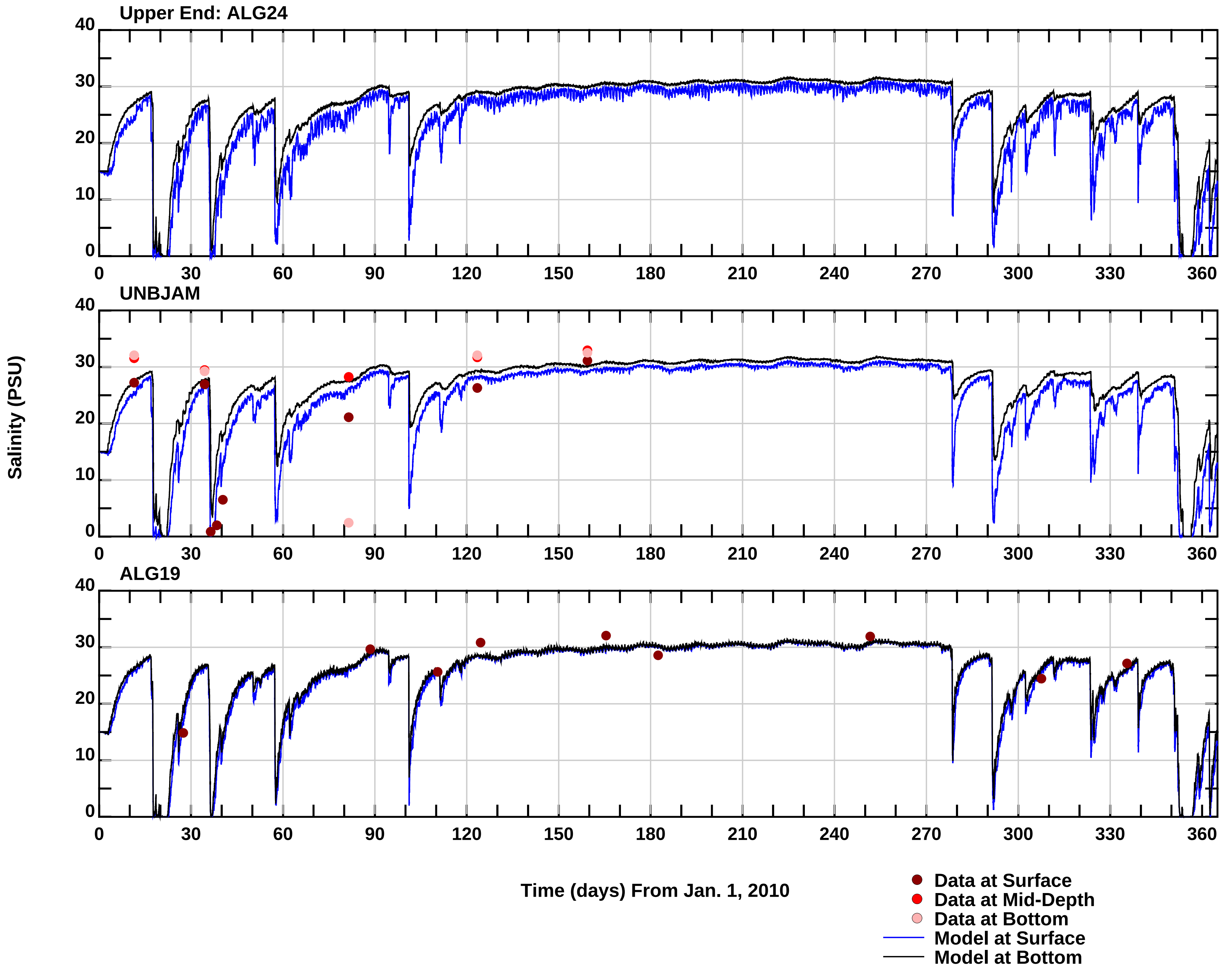
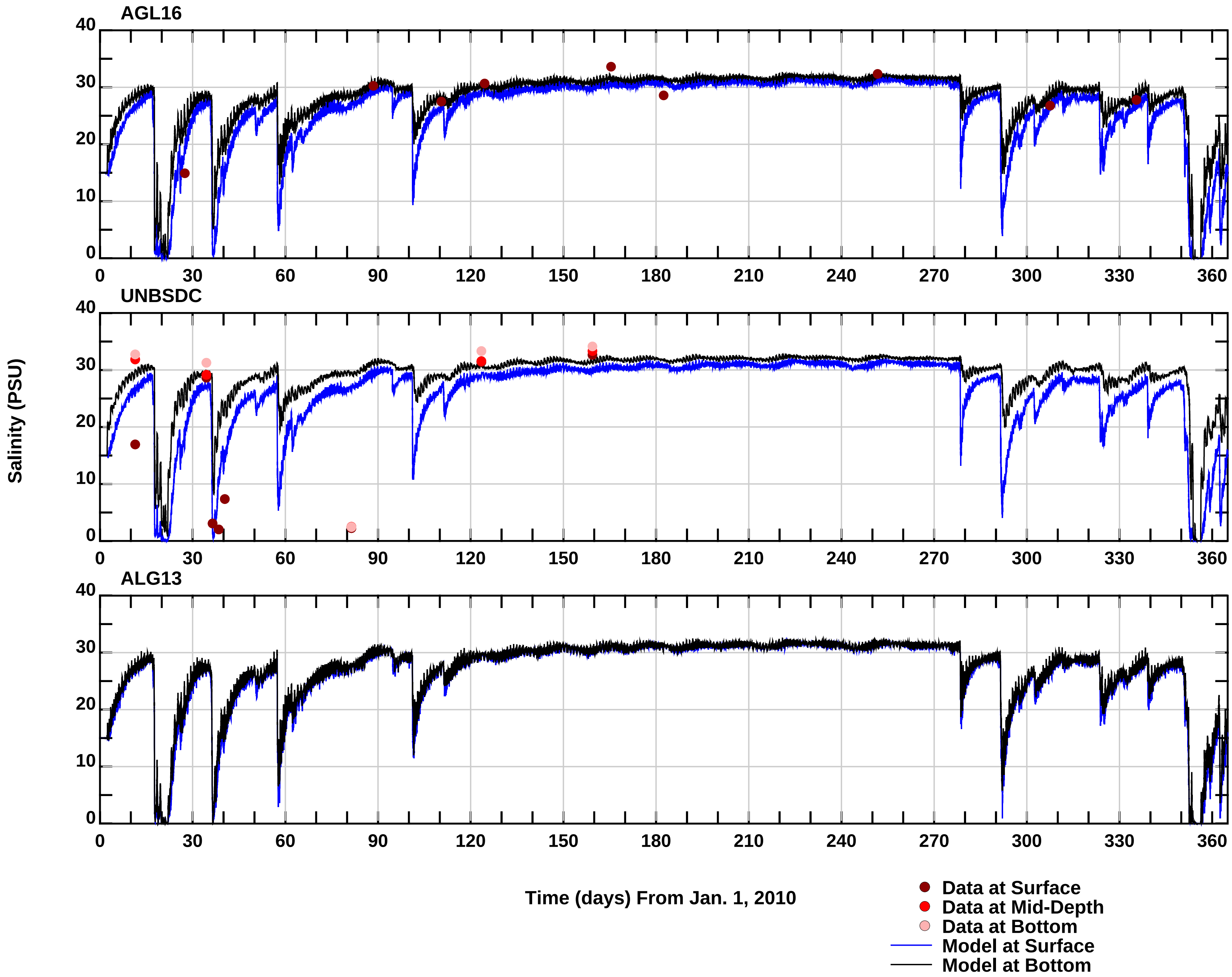


Figure A12. Newport Bay TN Data

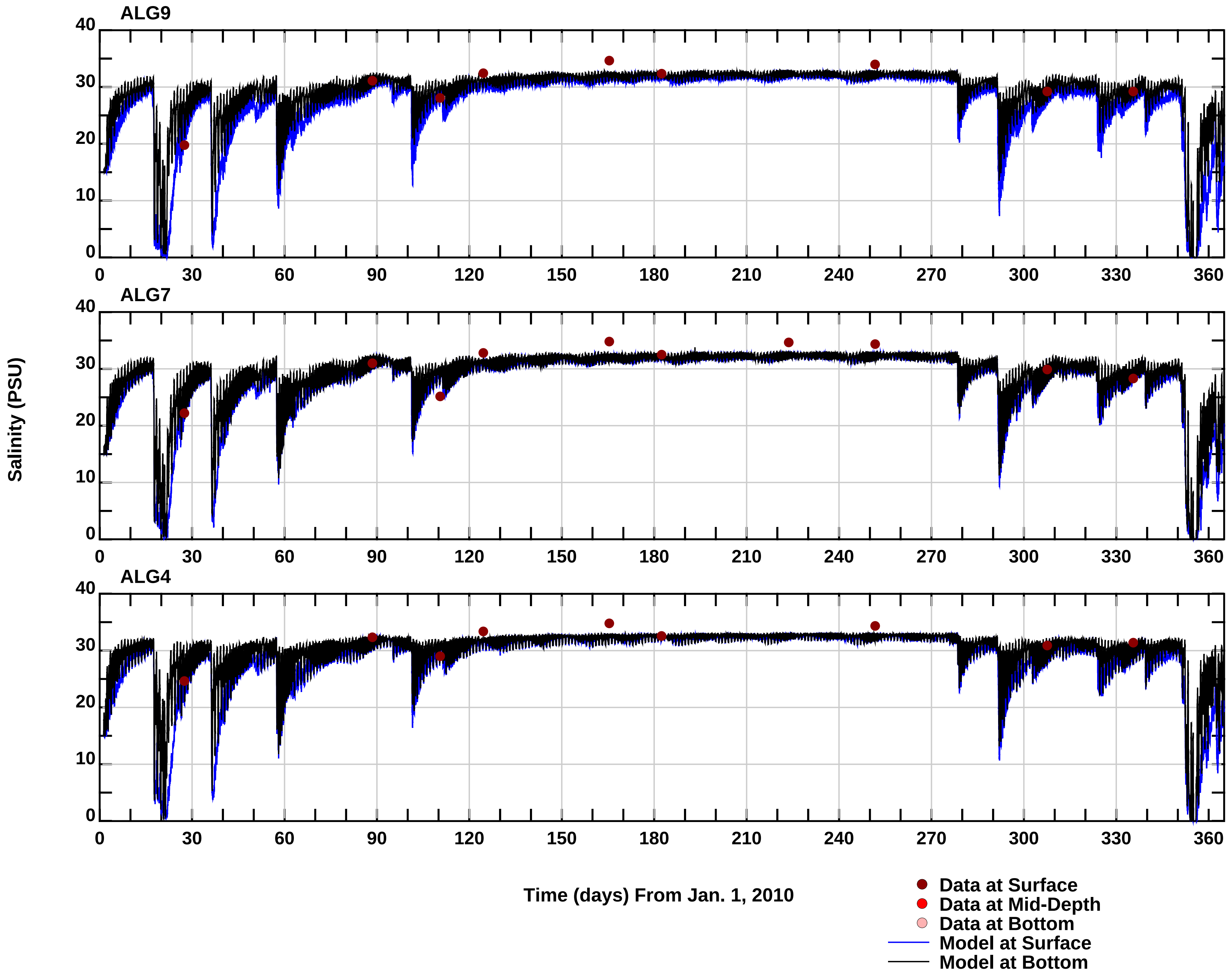
Attachment B. Model Salinity and Temperature Calibration Figures



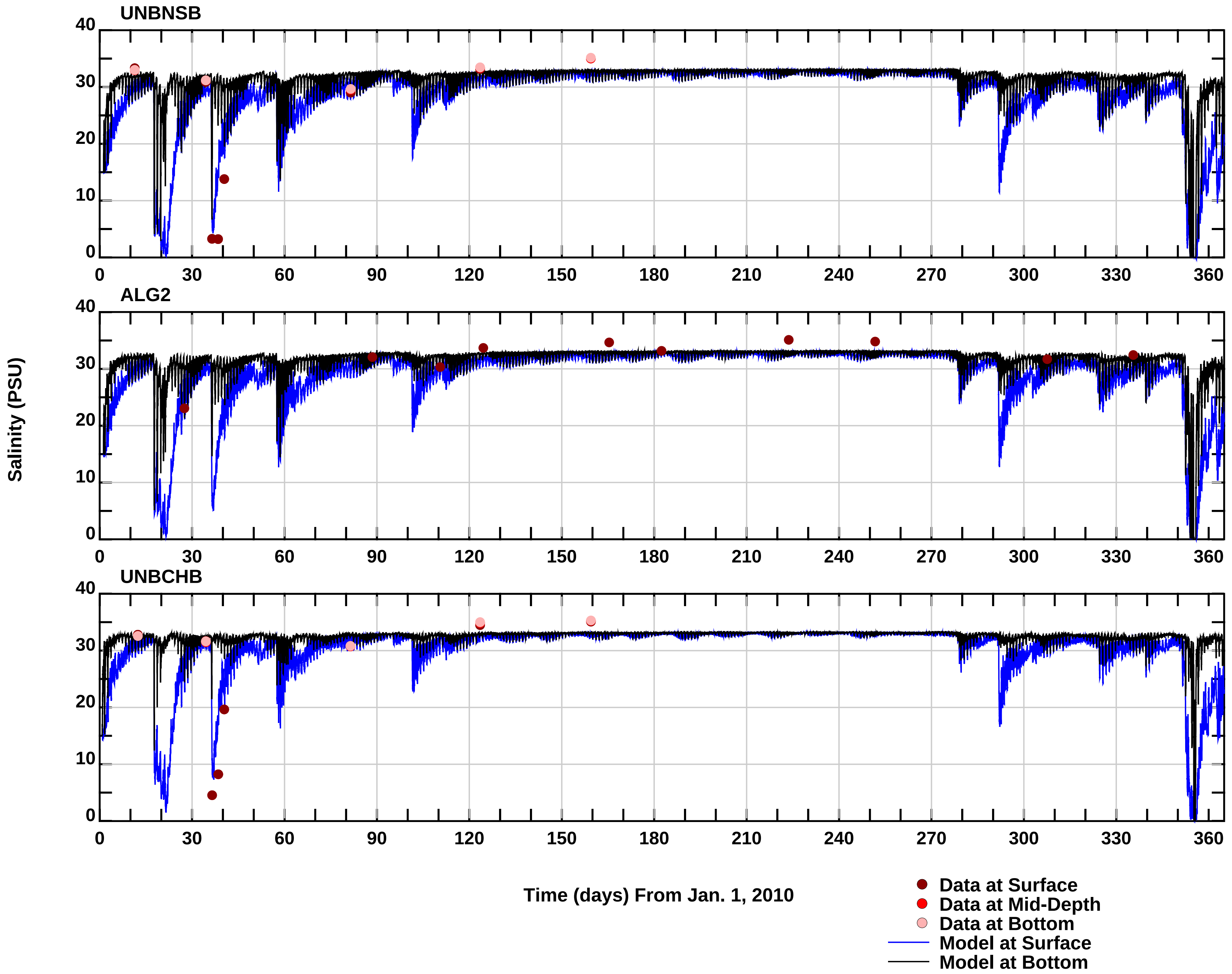
Upper End: ALG24
UNBJAM
ALG19
Salinity (PSU)
0
10
20
30
40
0
30
60
90
120
150
180
210
240
270
300
330
360
Time (days) From Jan. 1, 2010
Data at Surface
Data at Mid-Depth
Data at Bottom
Model at Surface
Model at Bottom

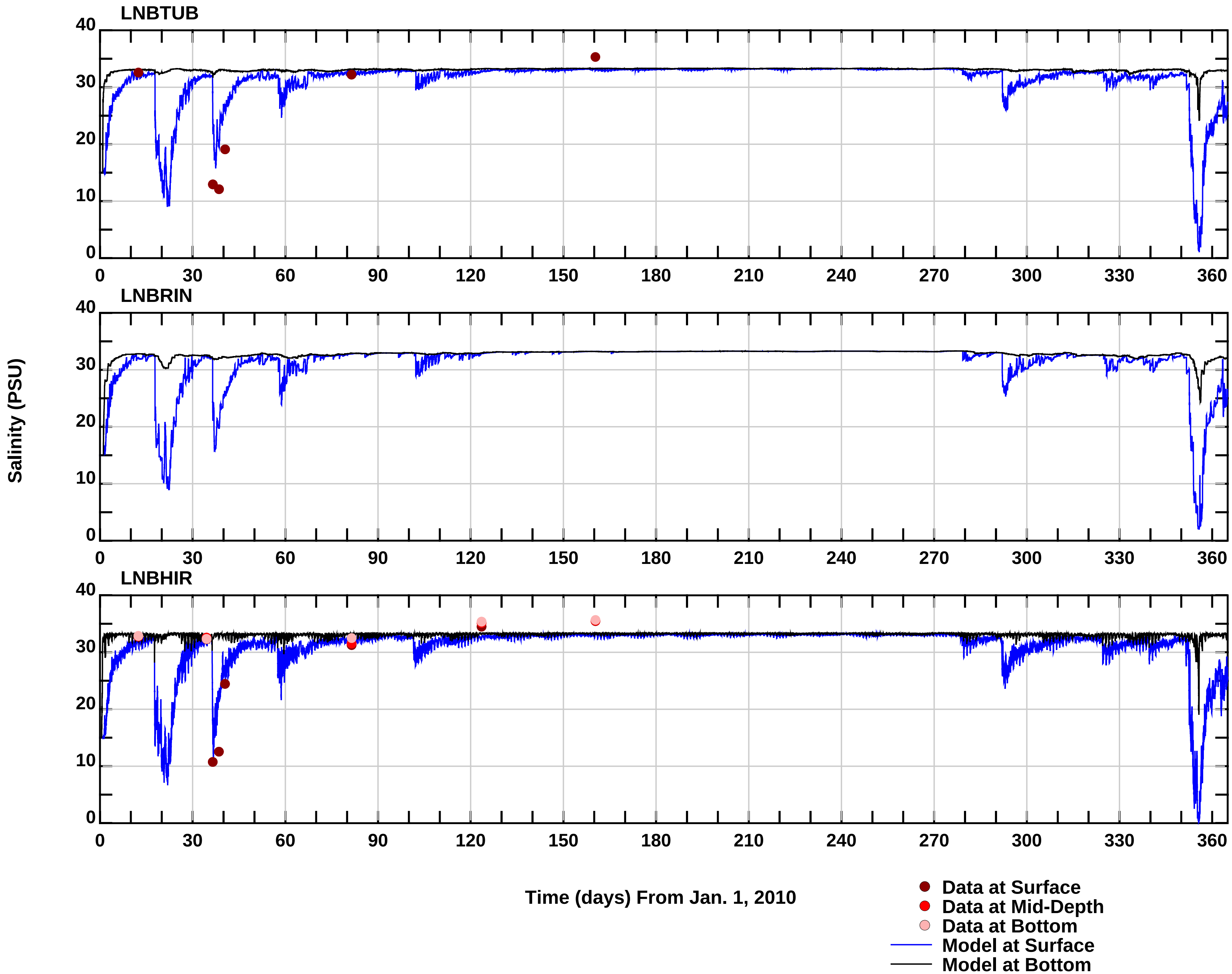


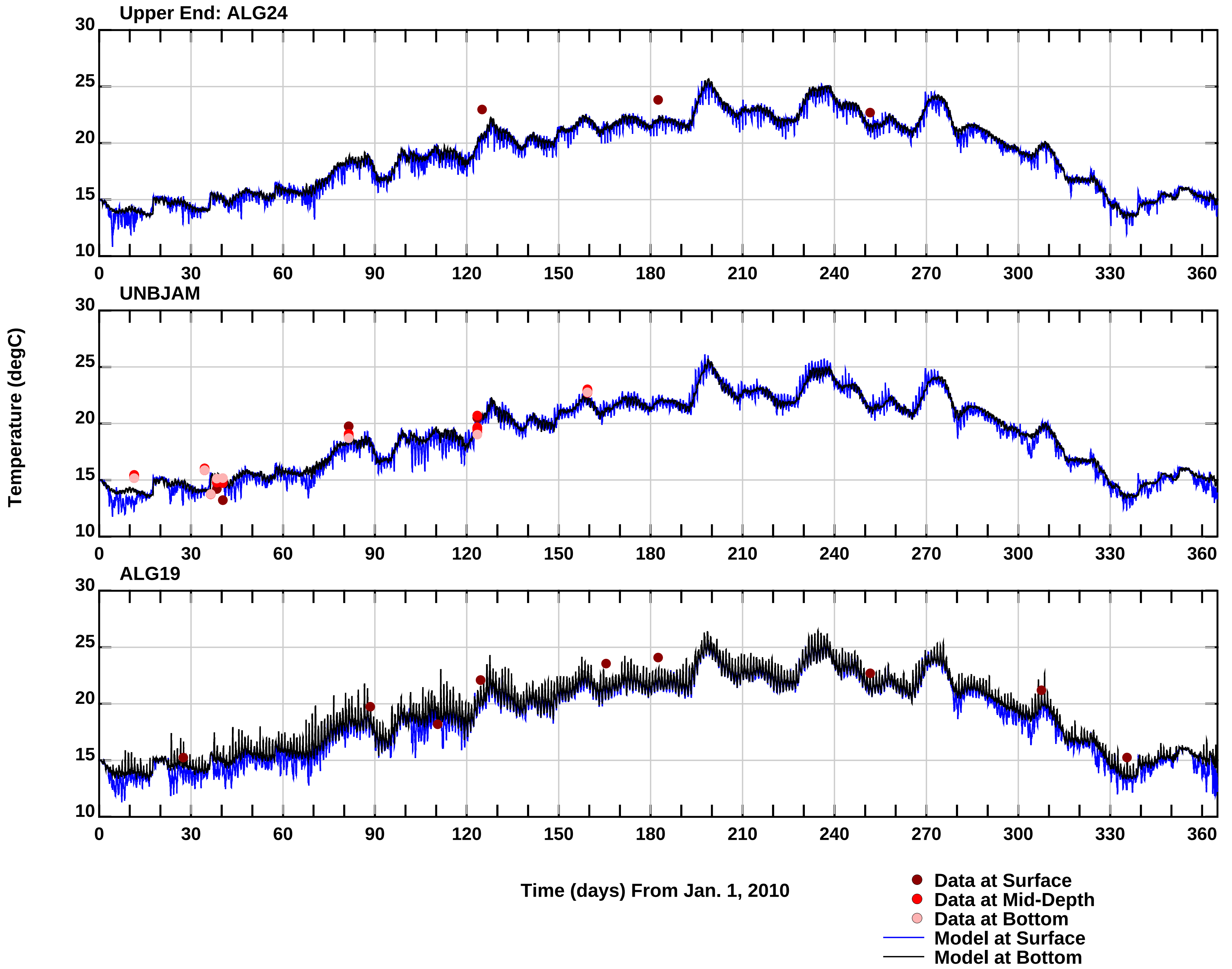
AGL16
UNBSDC
ALG13
Salinity (PSU)
Time (days) From Jan. 1, 2010
Data at Surface
Data at Mid-Depth
Data at Bottom
Model at Surface
Model at Bottom



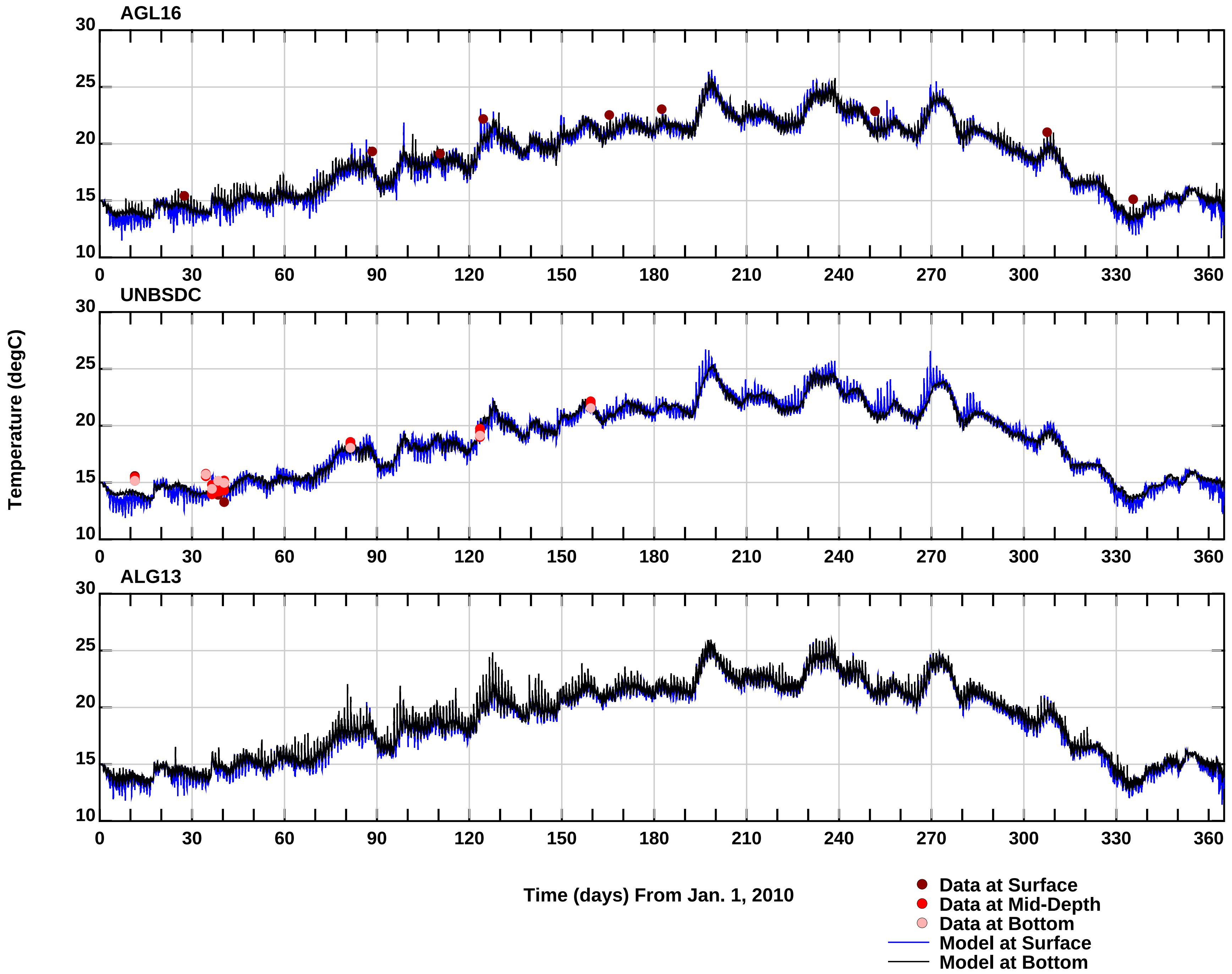
ALG9
ALG7
ALG4
Salinity (PSU)
40
30
20
10
0
0
30
60
90
120
150
180
210
240
270
300
330
360
Time (days) From Jan. 1, 2010
Data at Surface
Data at Mid-Depth
Data at Bottom
Model at Surface
Model at Bottom

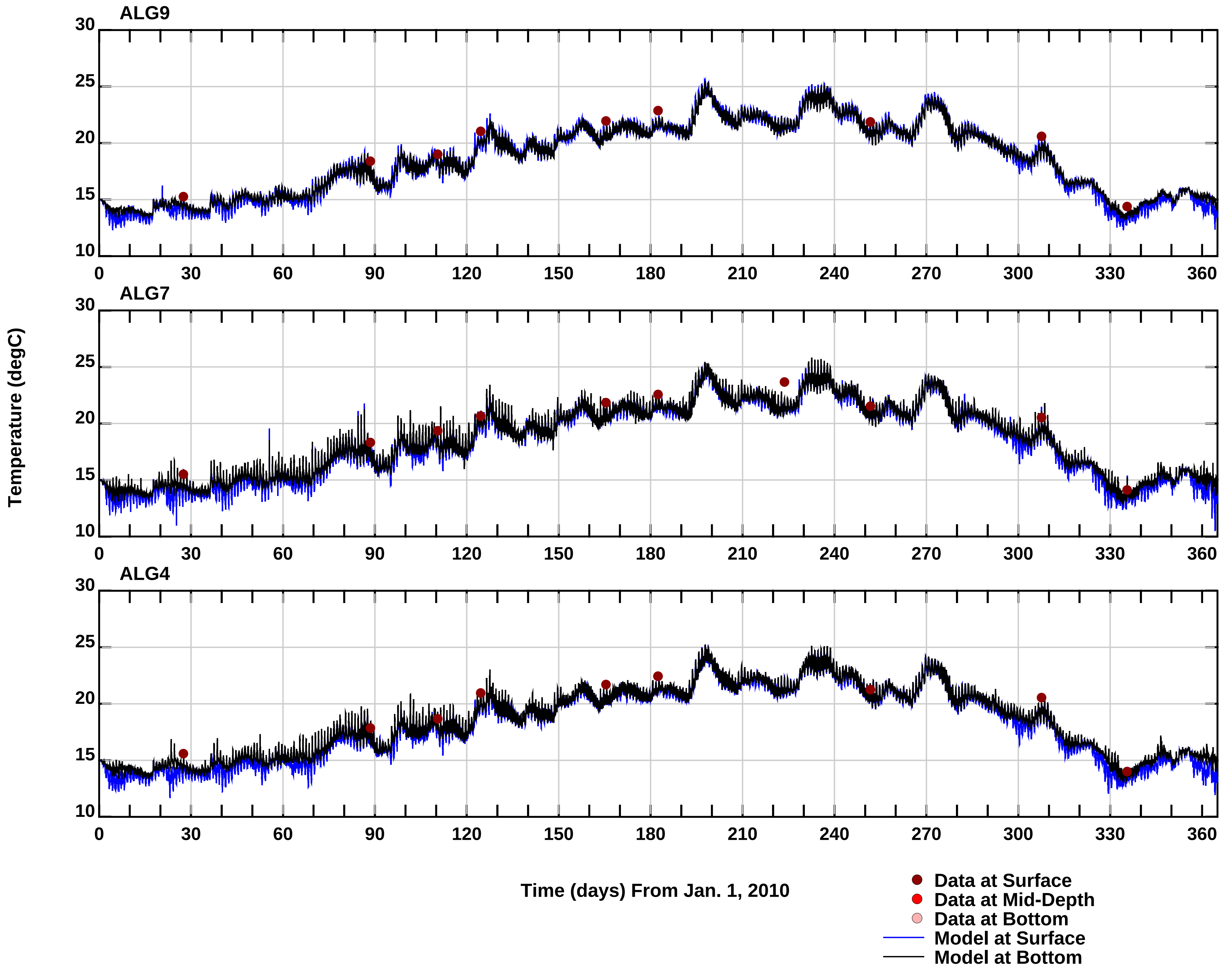

UNBNSB
ALG2
UNBCHB
Salinity (PSU)
Time (days) From Jan. 1, 2010
Data at Surface
Data at Mid-Depth
Data at Bottom
Model at Surface
Model at Bottom


LNBTUB
LNBRIN
LNBHIR
Salinity (PSU)
40
30
20
10
0
0
30
60
90
120
150
180
210
240
270
300
330
360
Time (days) From Jan. 1, 2010
Data at Surface
Data at Mid-Depth
Data at Bottom
Model at Surface
Model at Bottom

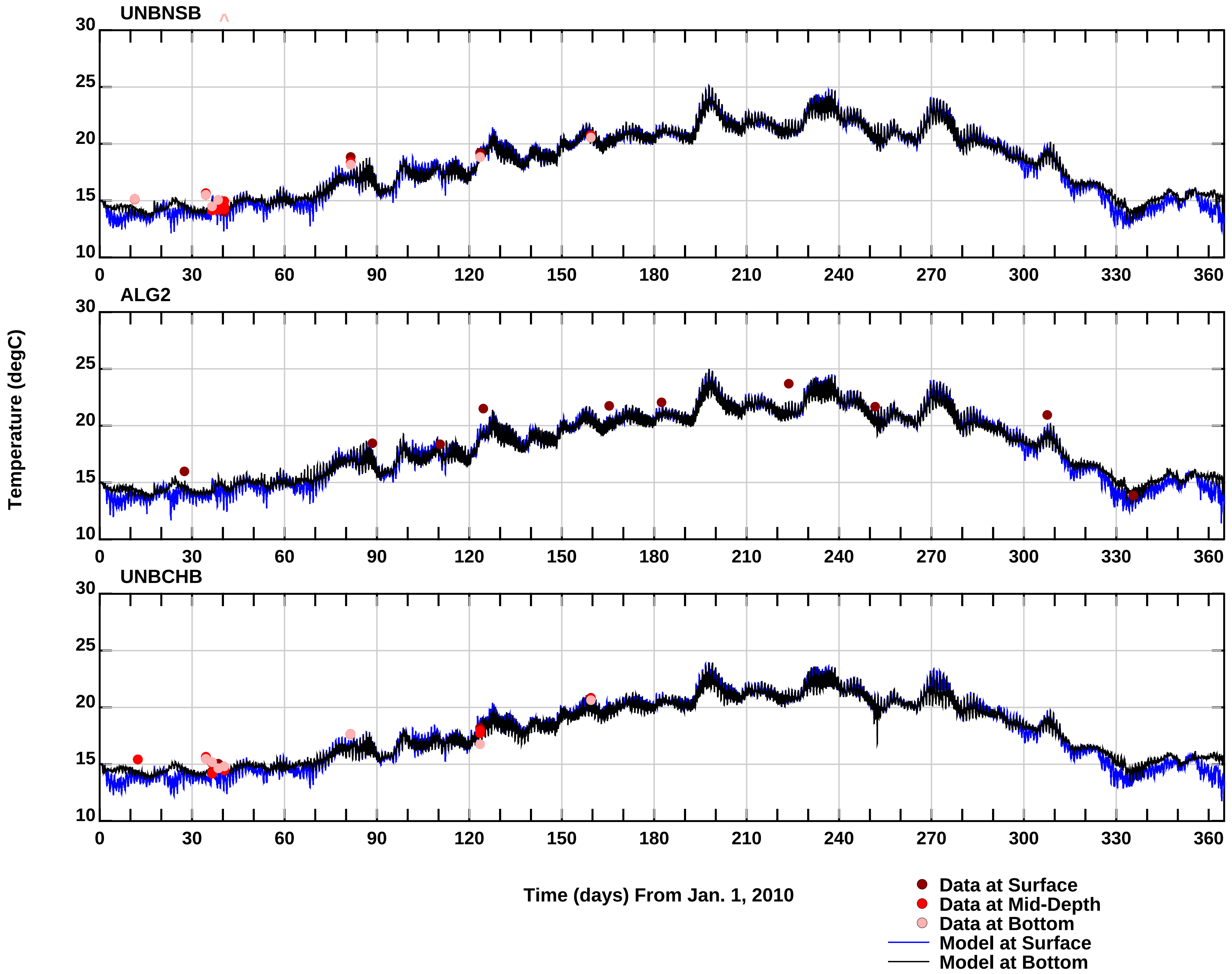


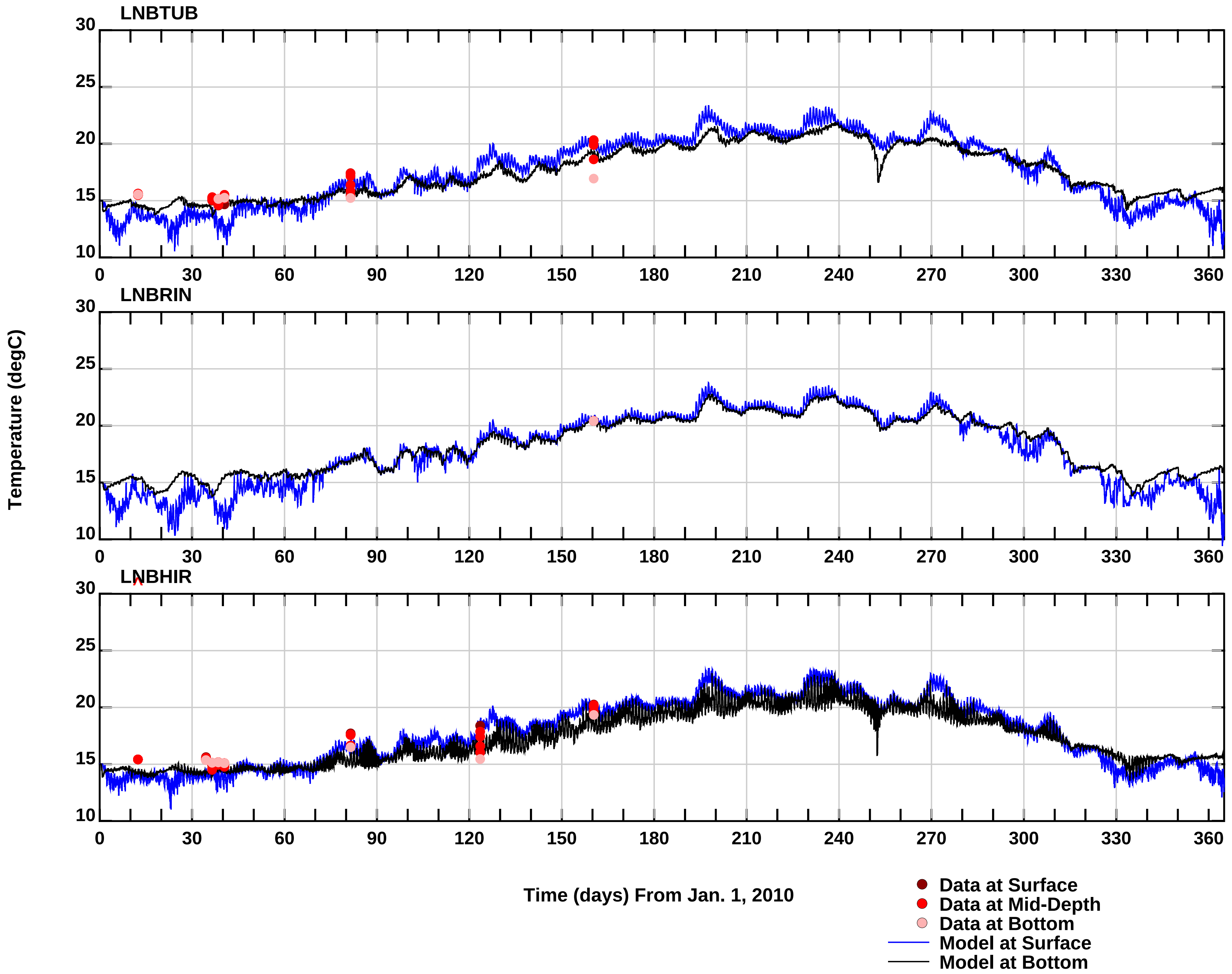
Upper End: ALG24
UNBJAM
ALG19
Temperature (degC)
30
25
20
15
10
0
30
60
90
120
150
180
210
240
270
300
330
360
Time (days) From Jan. 1, 2010
Data at Surface
Data at Mid-Depth
Data at Bottom
Model at Surface
Model at Bottom


AGL16
UNBSDC
ALG13
Temperature (degC)
30
25
20
15
10
0
30
60
90
120
150
180
210
240
270
300
330
360
Time (days) From Jan. 1, 2010
Data at Surface
Data at Mid-Depth
Data at Bottom
Model at Surface
Model at Bottom

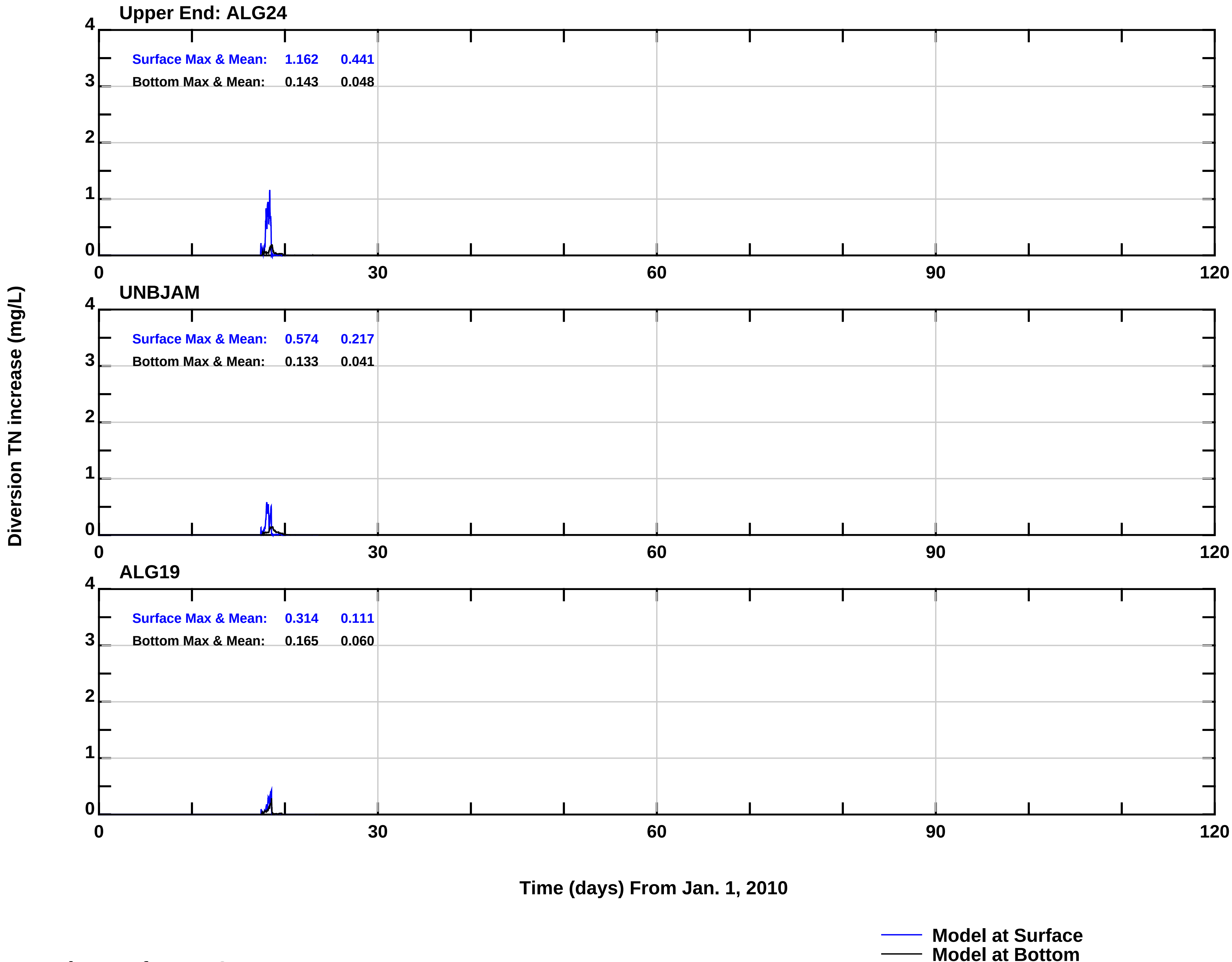


ALG9
ALG7
ALG4
Temperature (degC)
30
25
20
15
10
0
30
60
90
120
150
180
210
240
270
300
330
360
Time (days) From Jan. 1, 2010
Data at Surface
Data at Mid-Depth
Data at Bottom
Model at Surface
Model at Bottom


UNBNSB
ALG2
UNBCHB
Temperature (degC)
10
15
20
25
30
0
30
60
90
120
150
180
210
240
270
300
330
360
Time (days) From Jan. 1, 2010
Data at Surface
Data at Mid-Depth
Data at Bottom
Model at Surface
Model at Bottom


LNBTUB
LNBRIN
LNBHIR
Temperature (degC)
10
15
20
25
30
0
30
60
90
120
150
180
210
240
270
300
330
360
Time (days) From Jan. 1, 2010
Data at Surface
Data at Mid-Depth
Data at Bottom
Model at Surface
Model at Bottom

Attachment C. Calculated TN Increases due to IWRD Diversions



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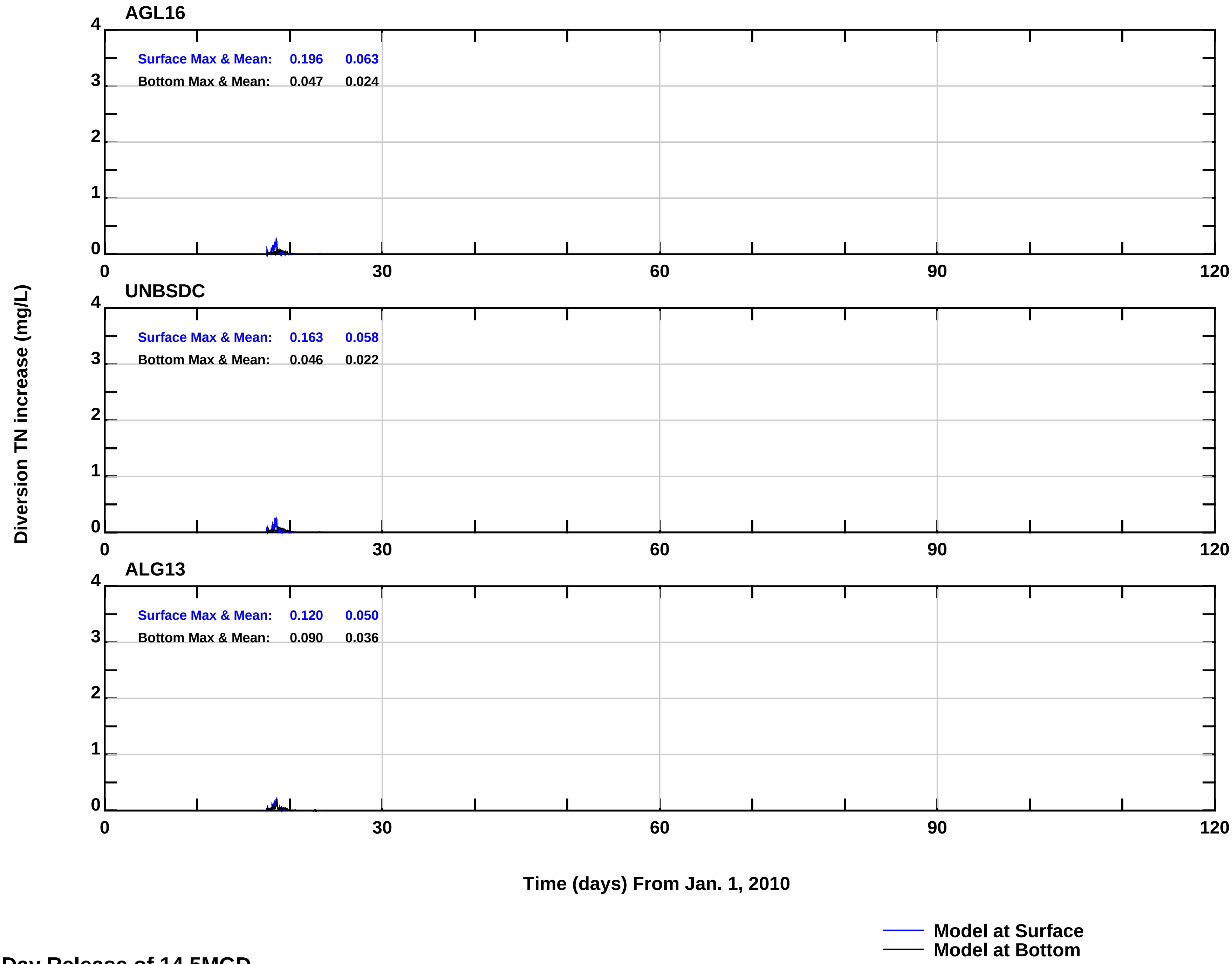

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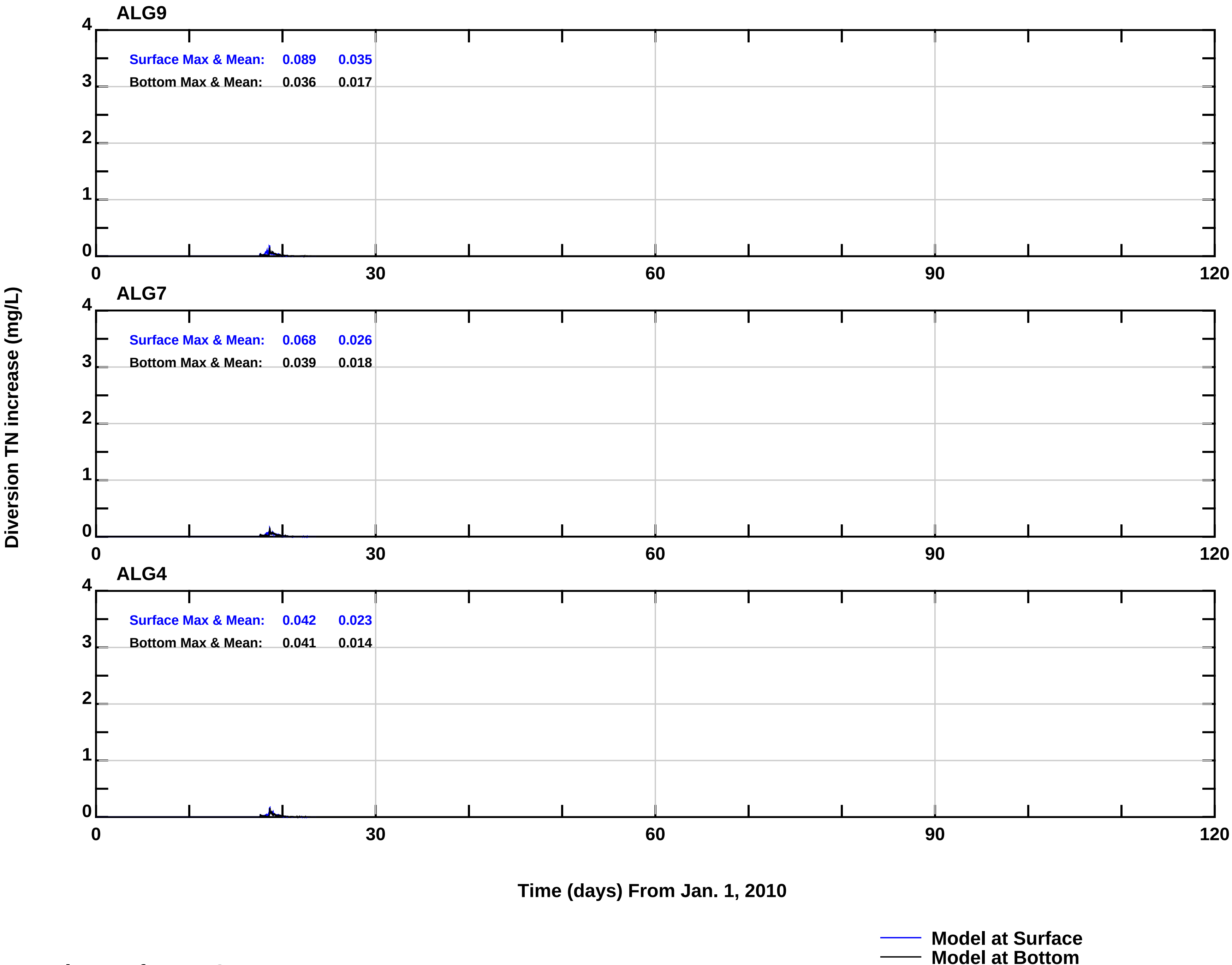

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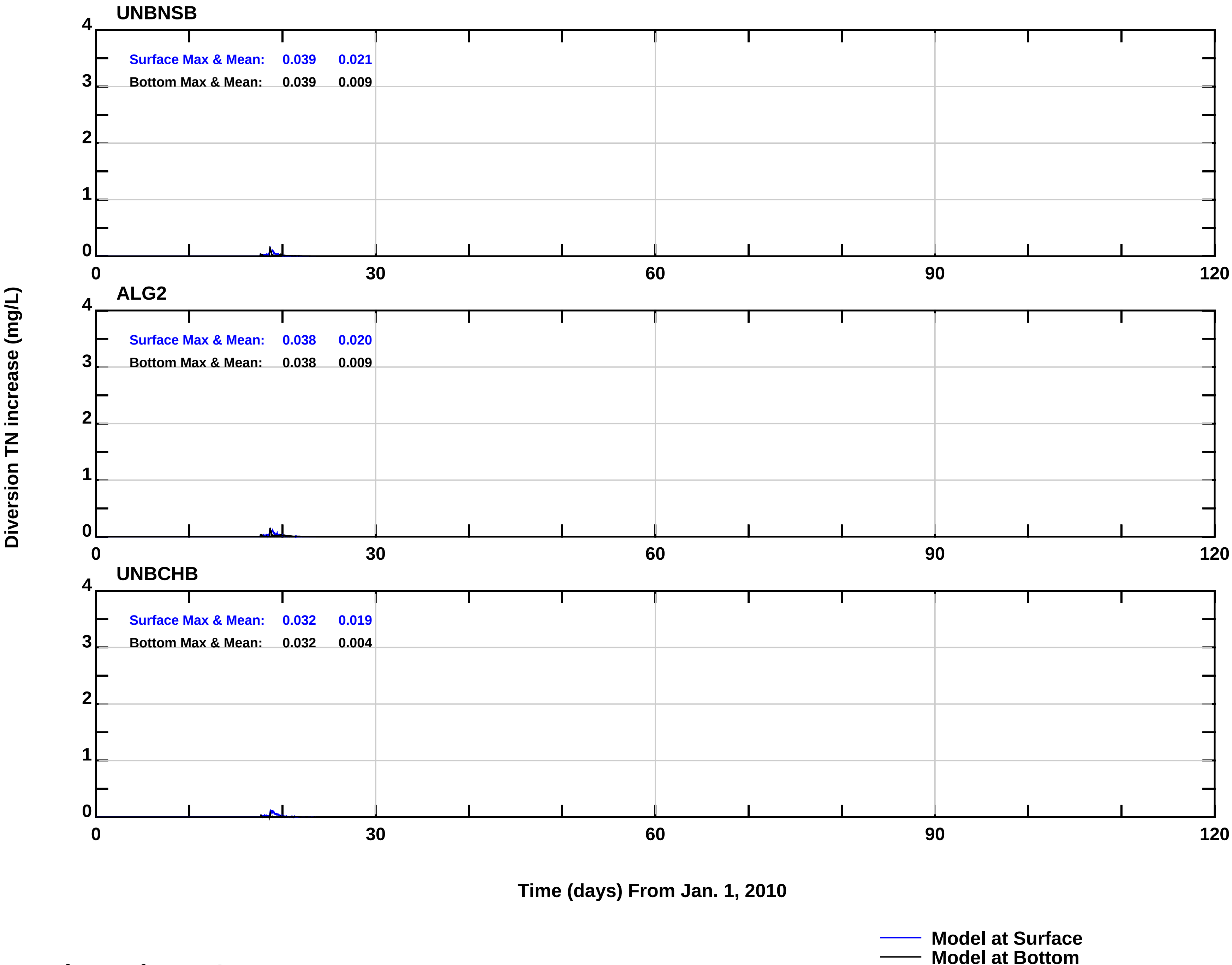

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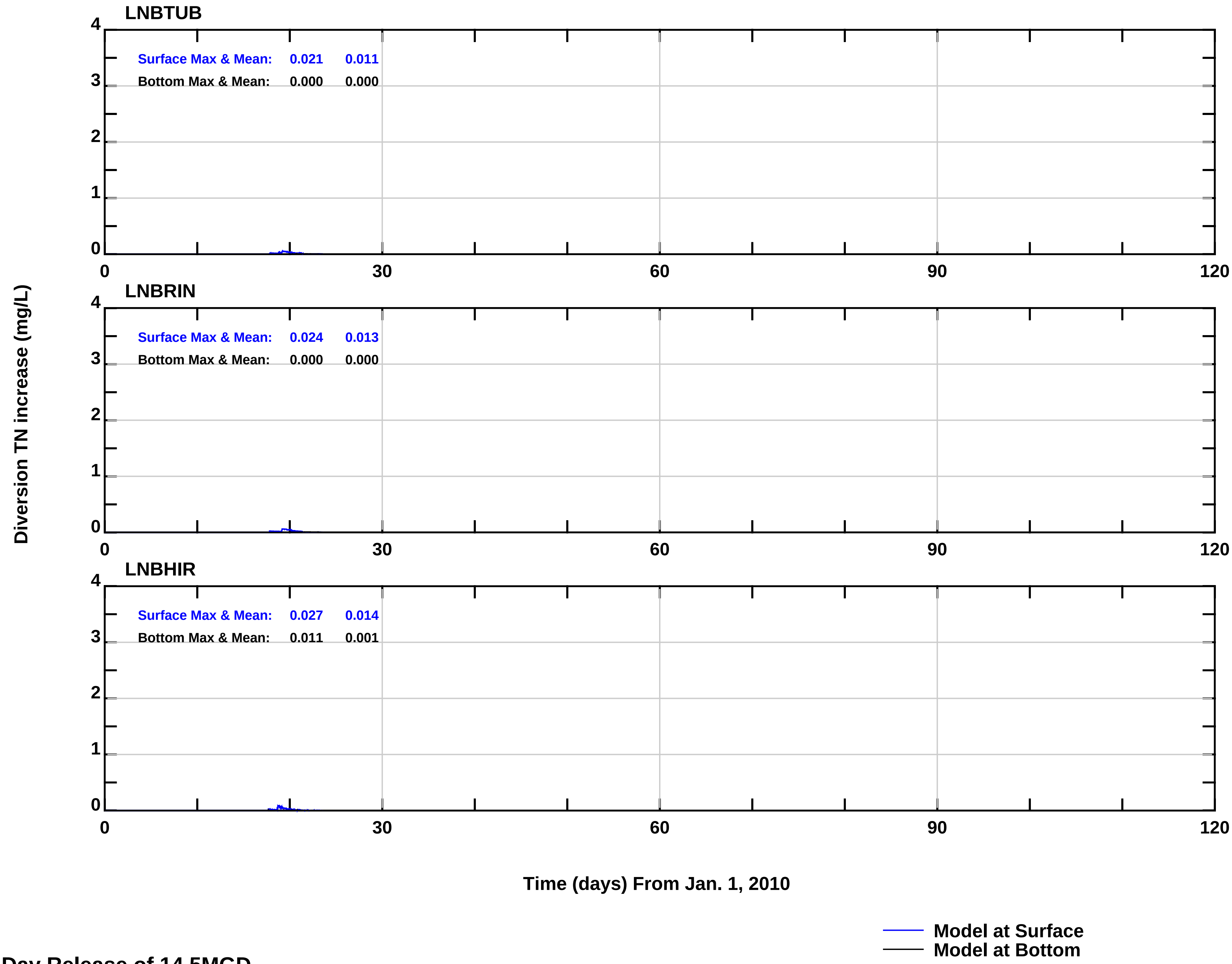

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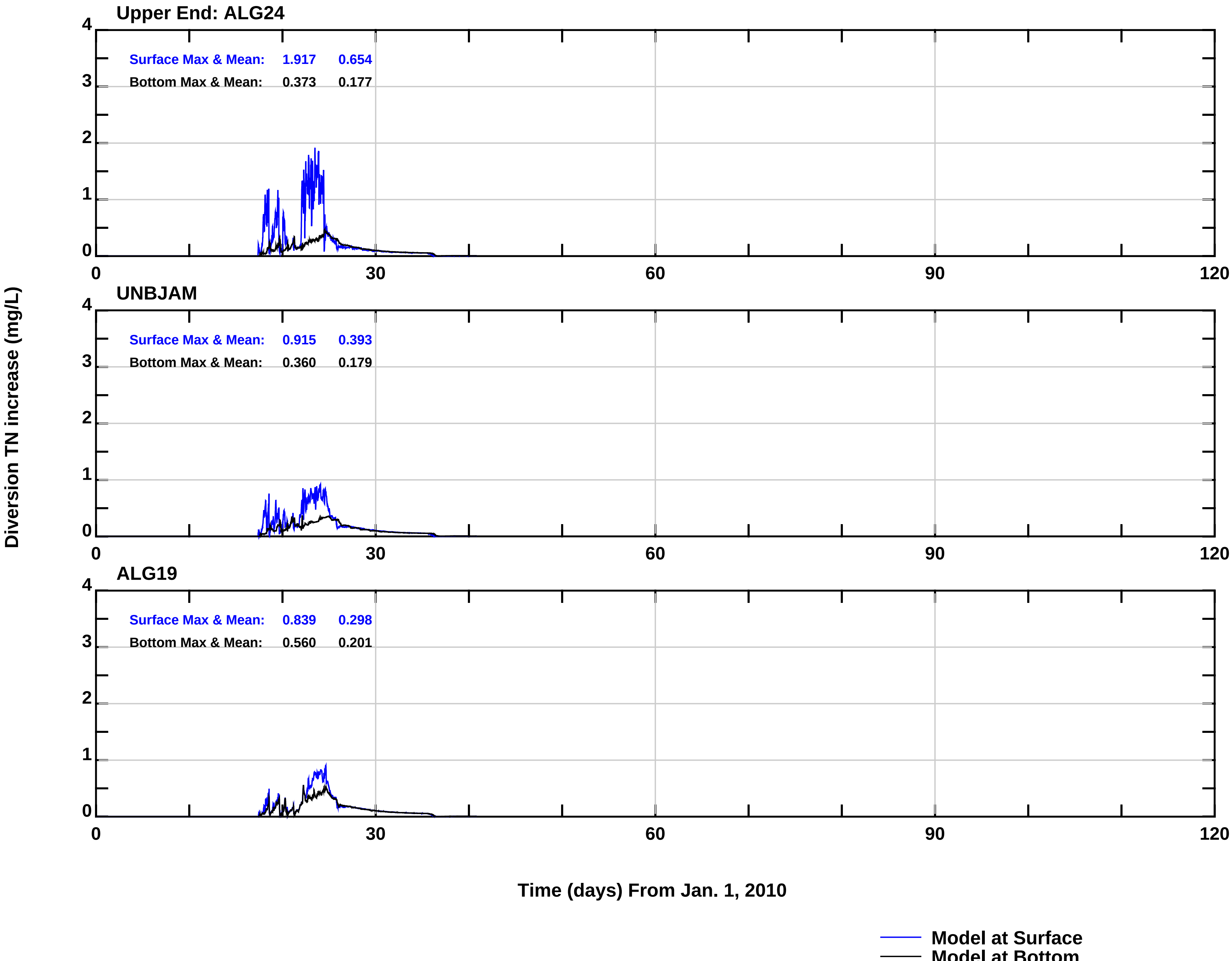

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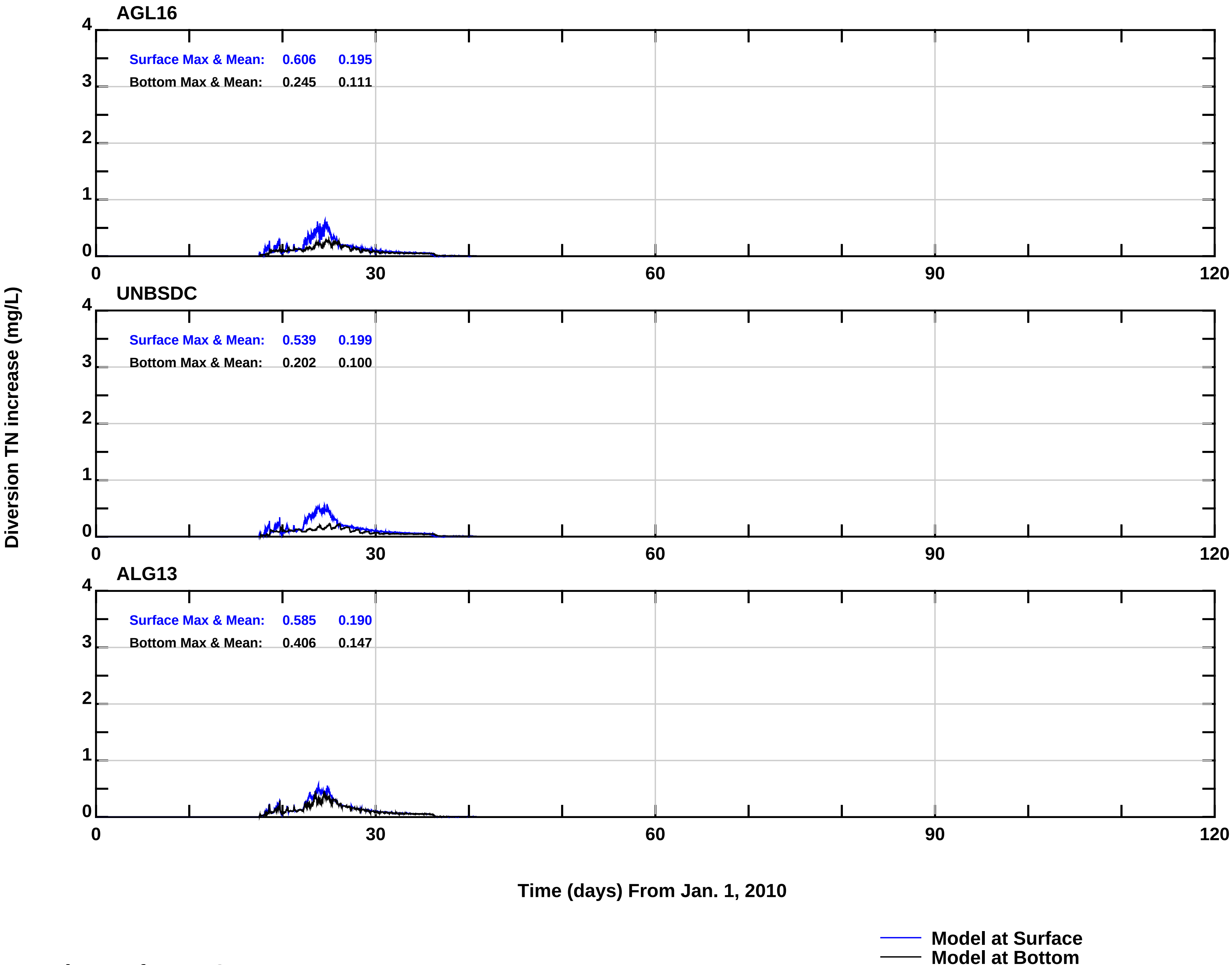

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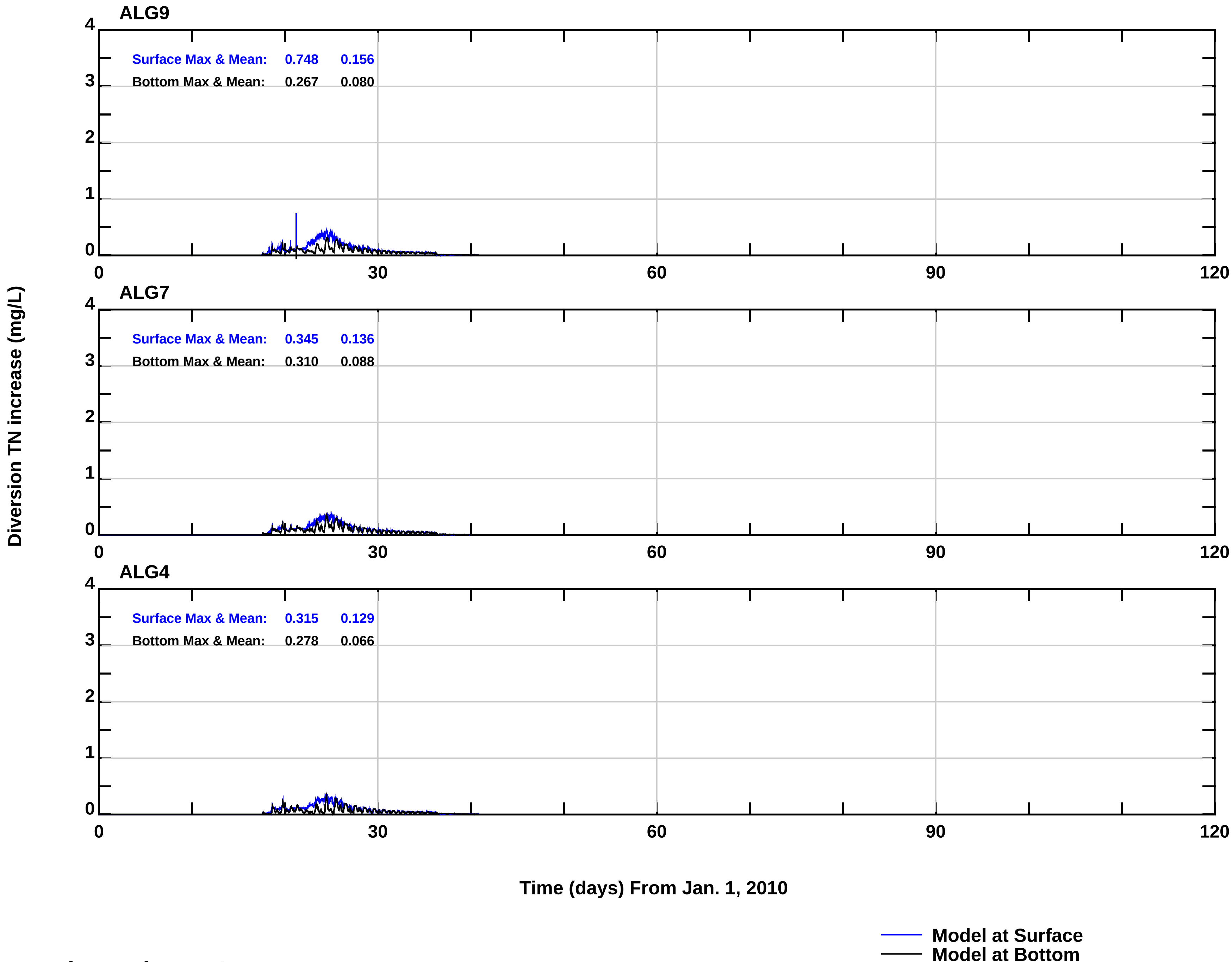

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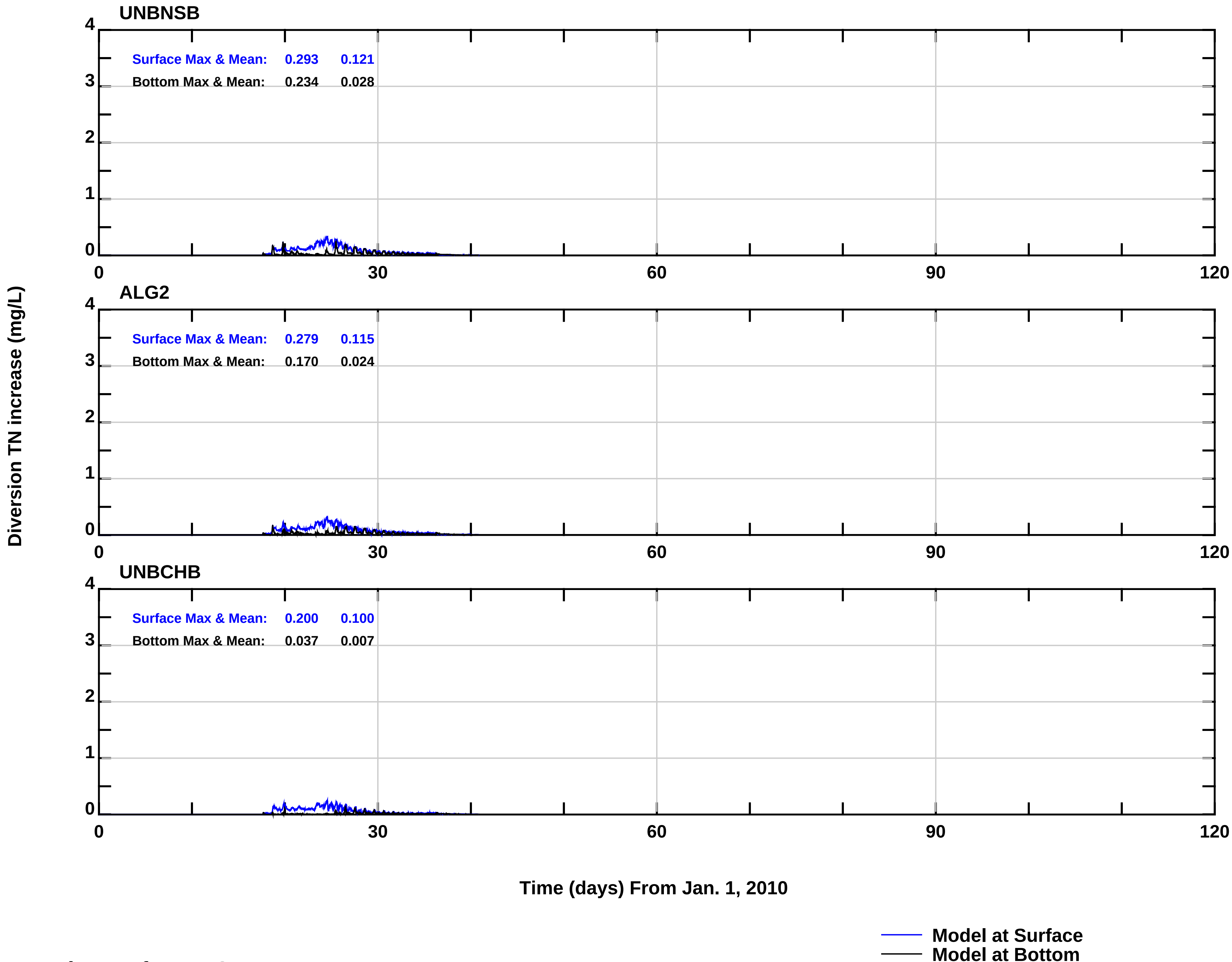

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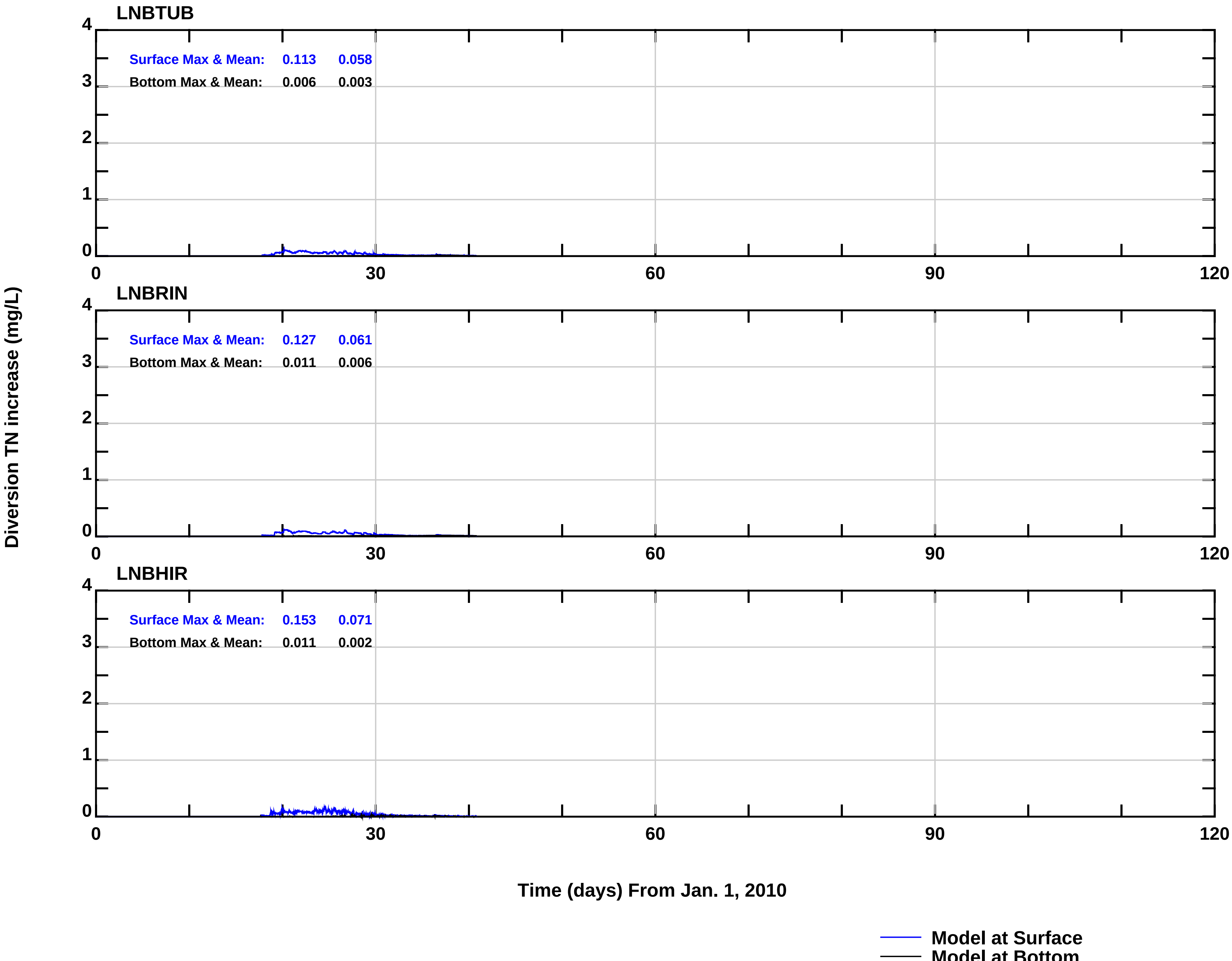

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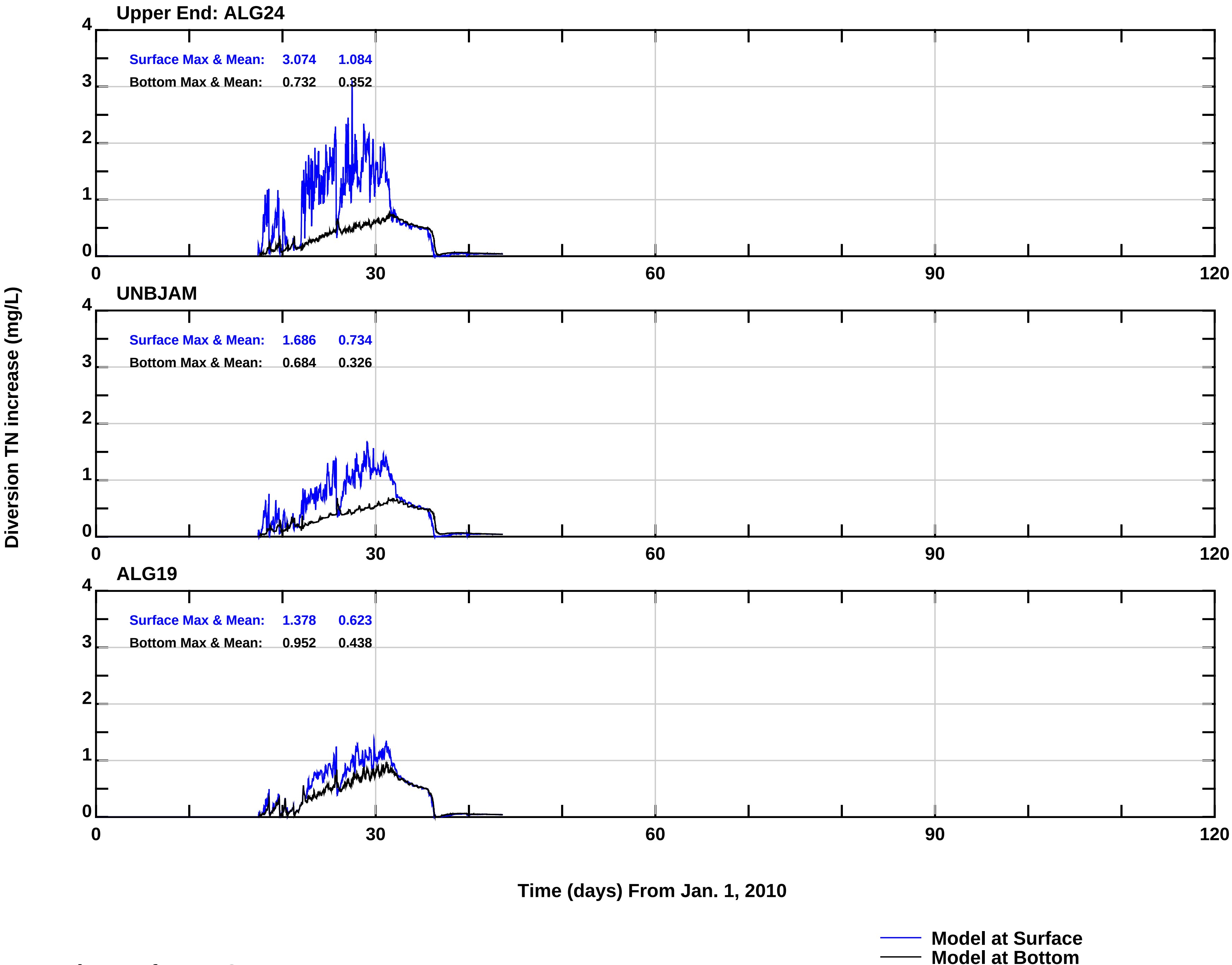

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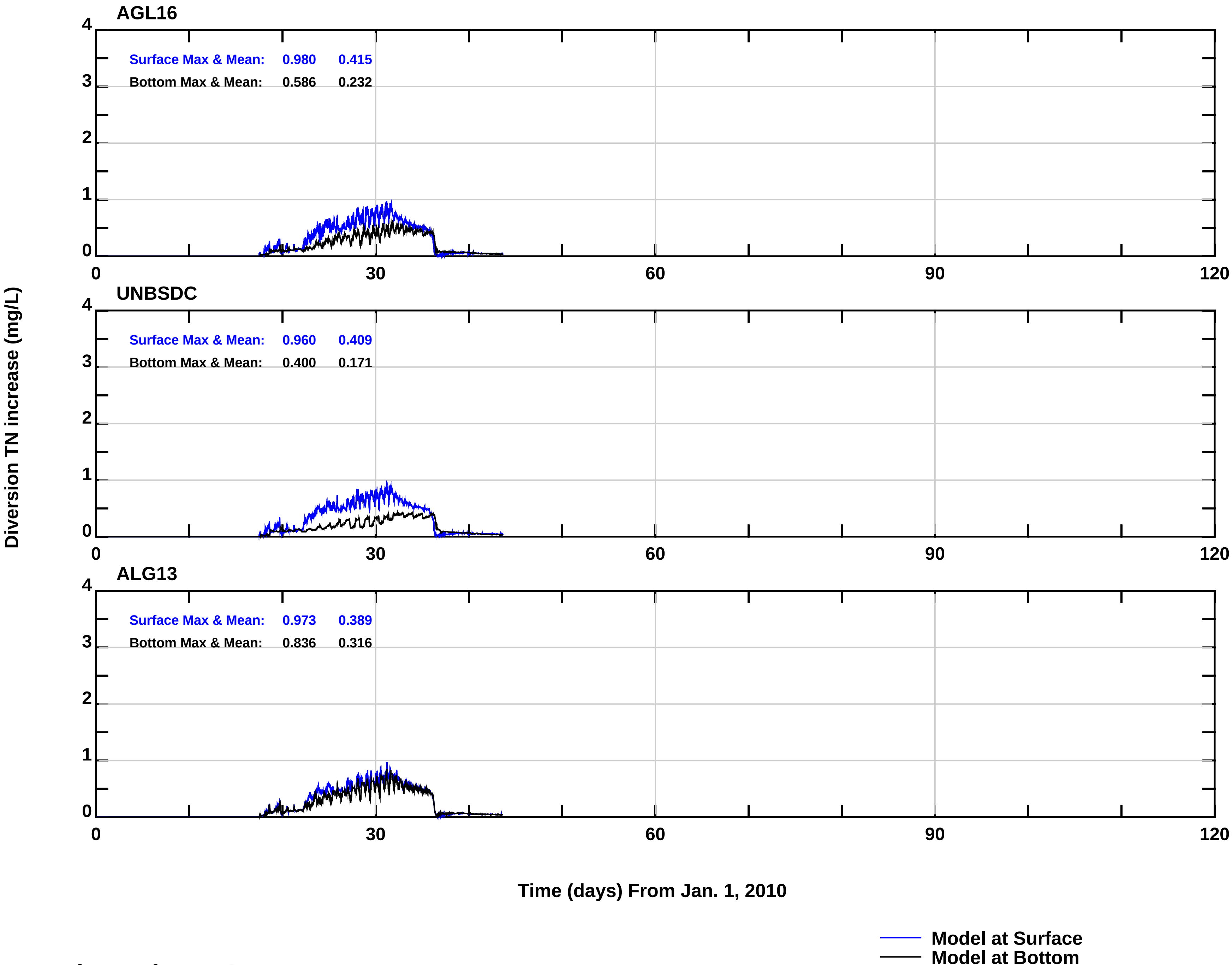

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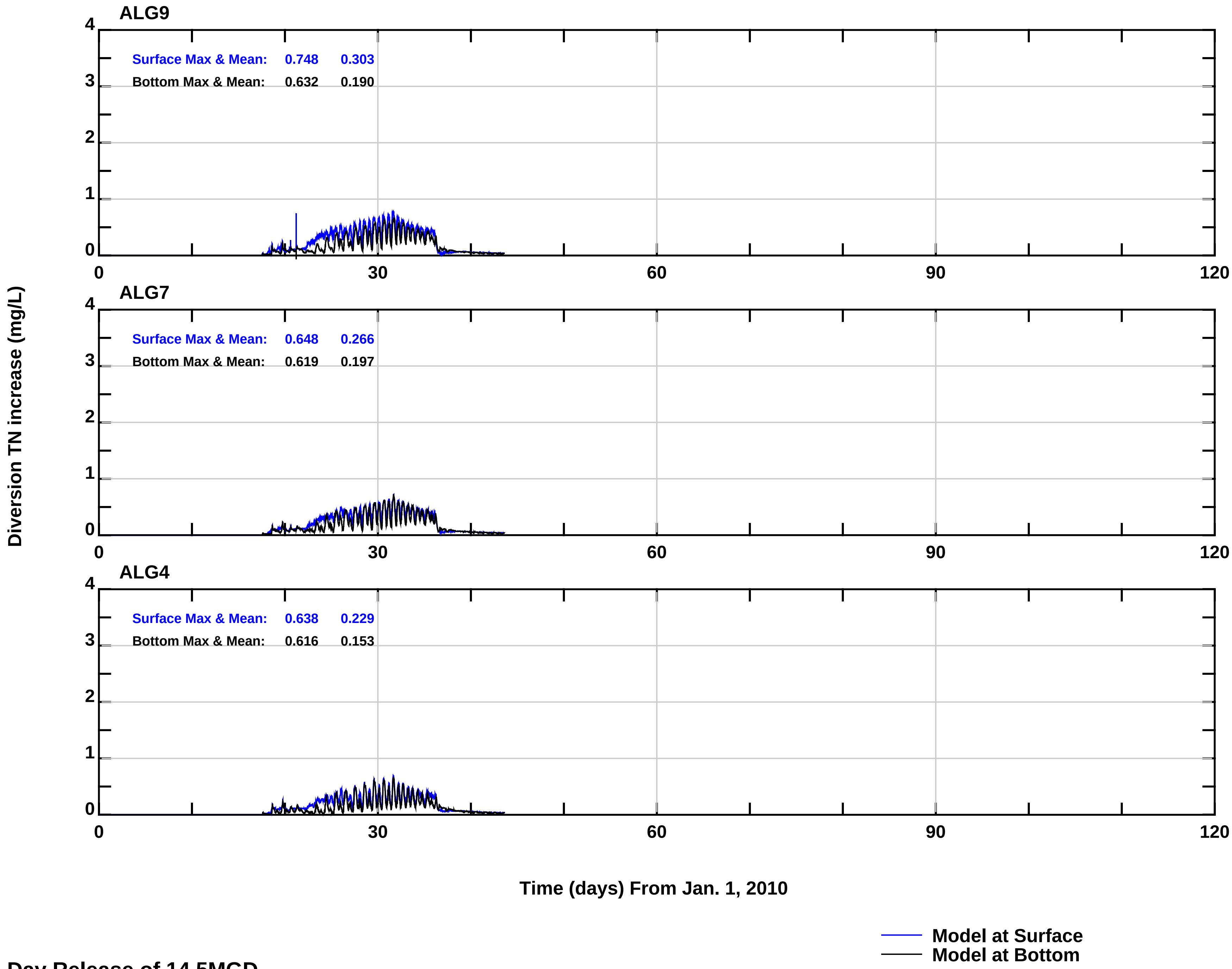

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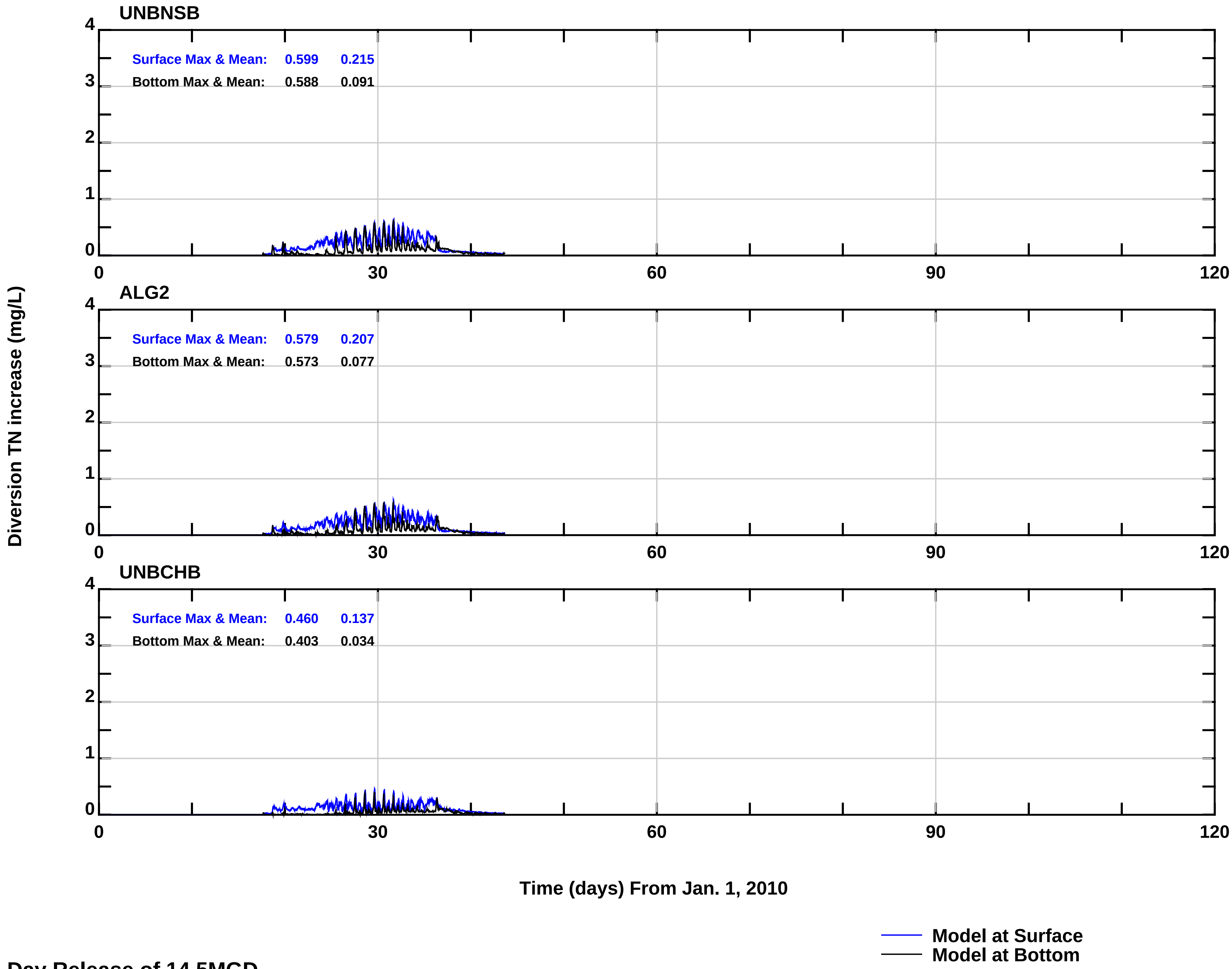

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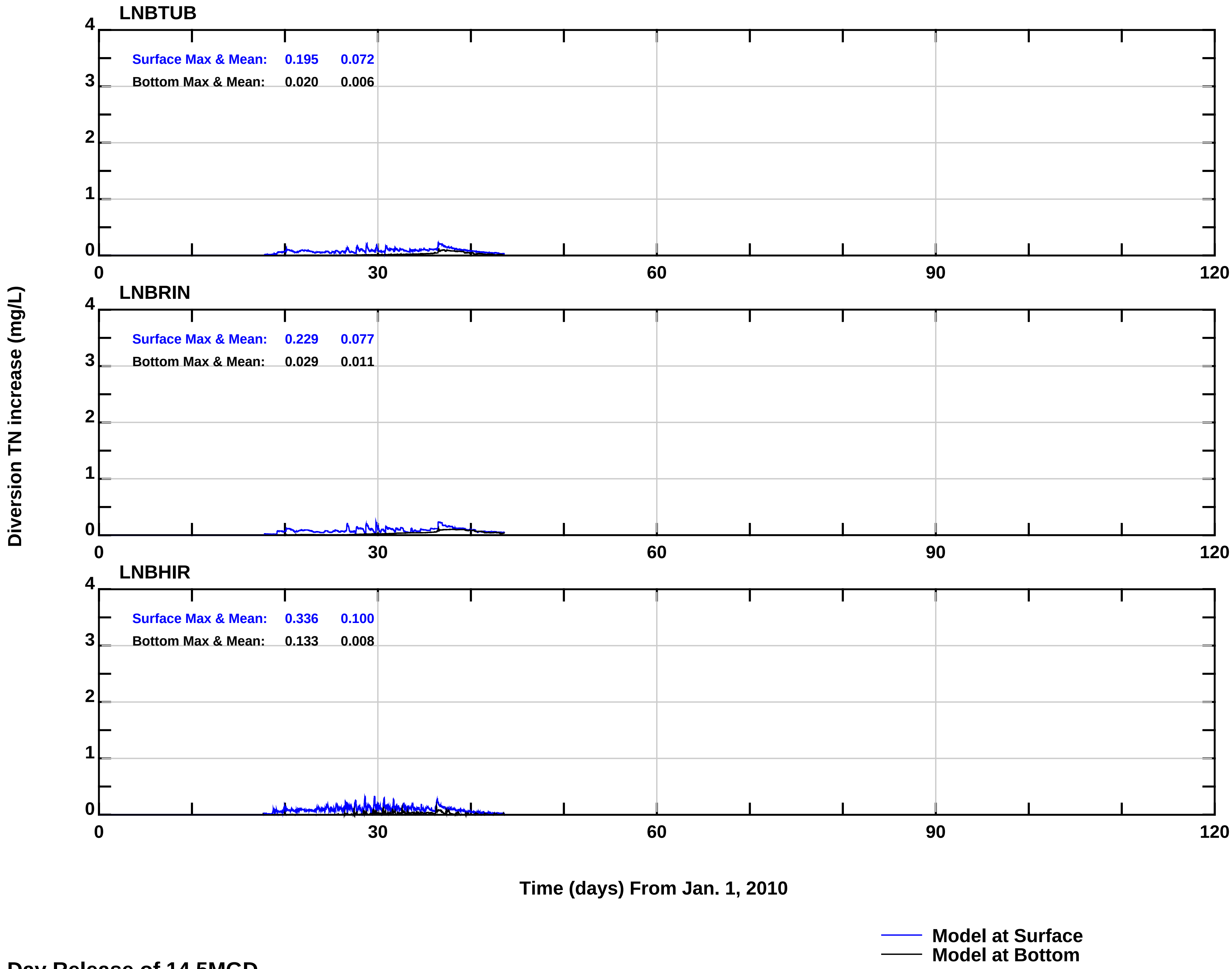

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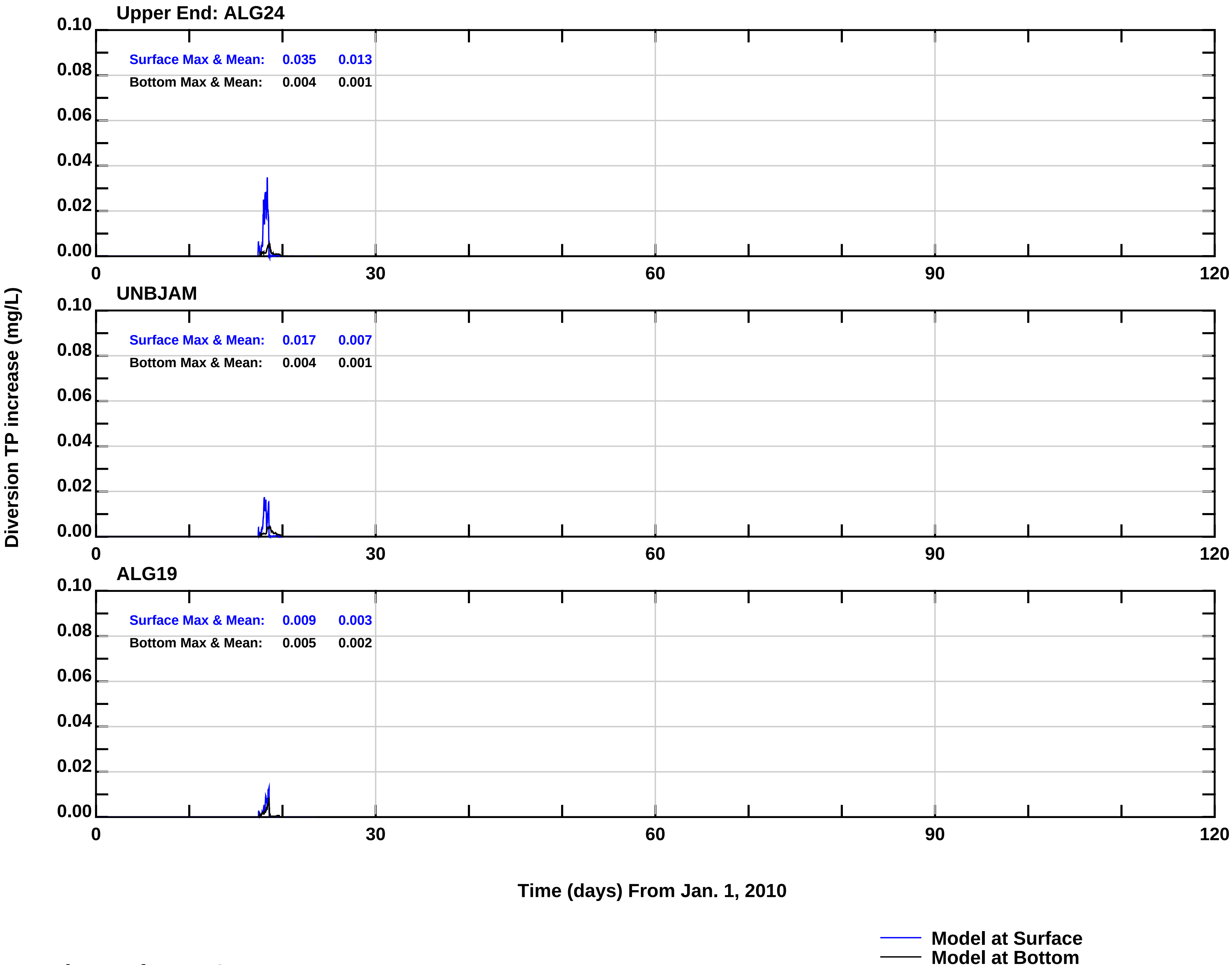
Attachment D. Calculated TP Increases due to IWRD Diversions



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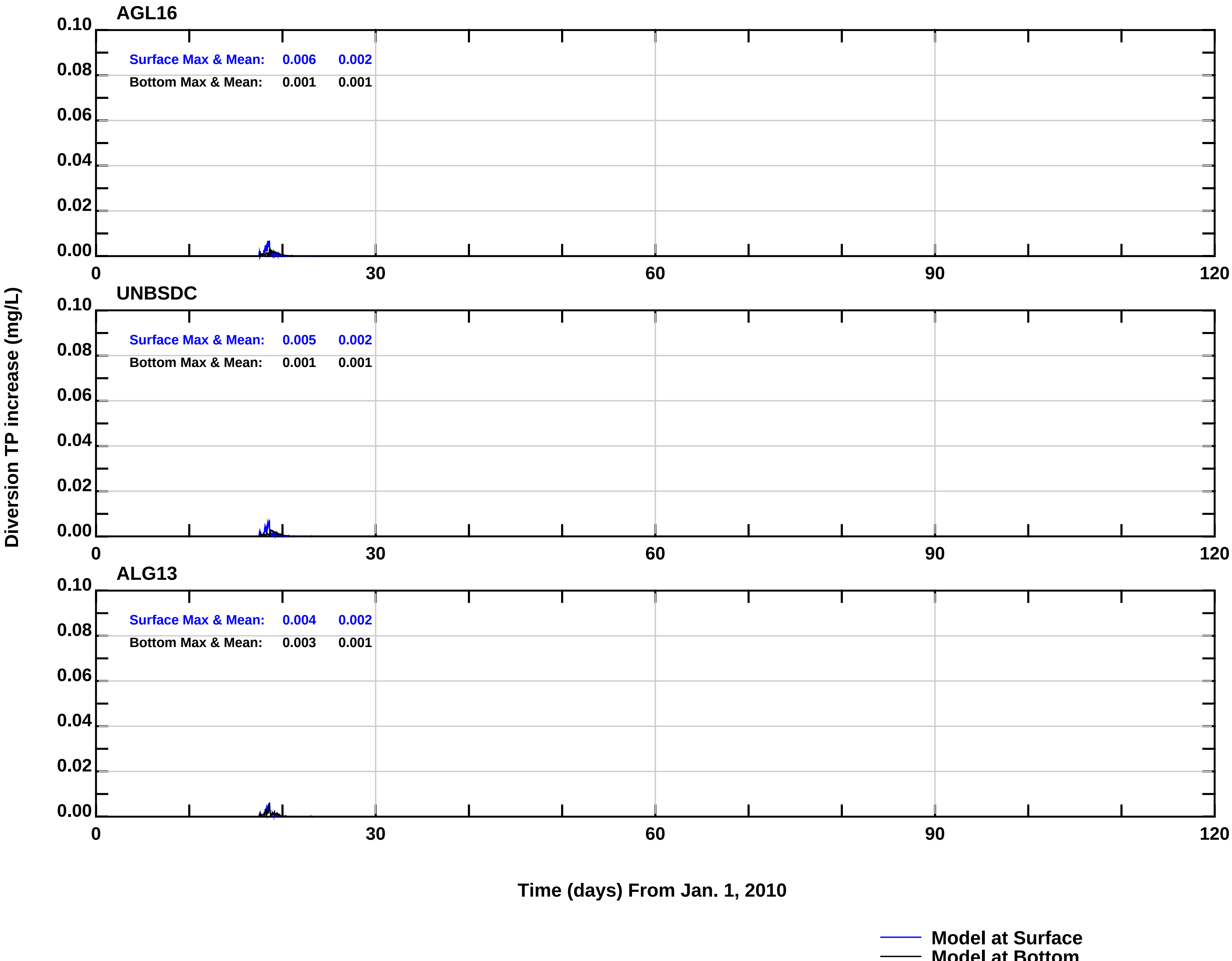

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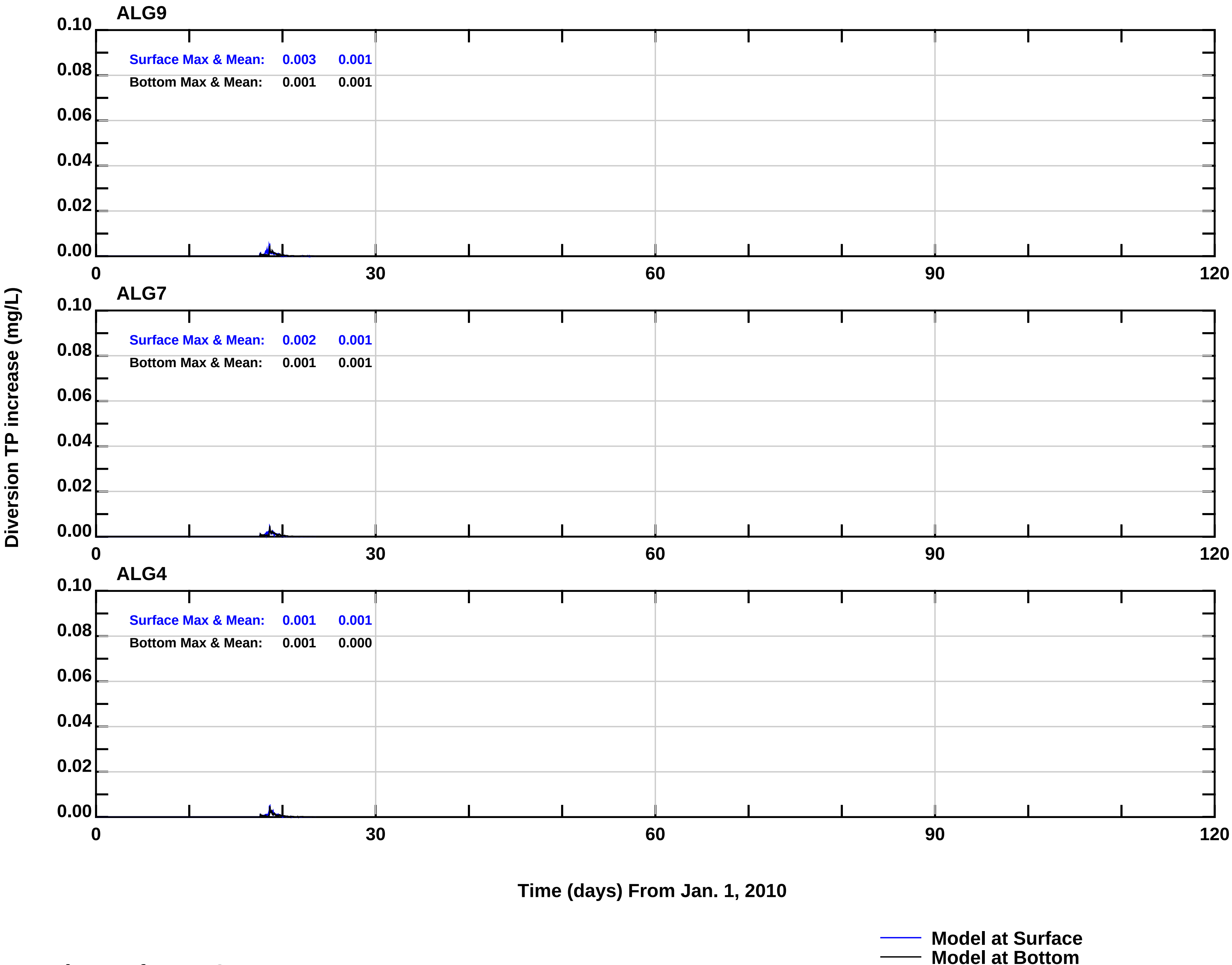

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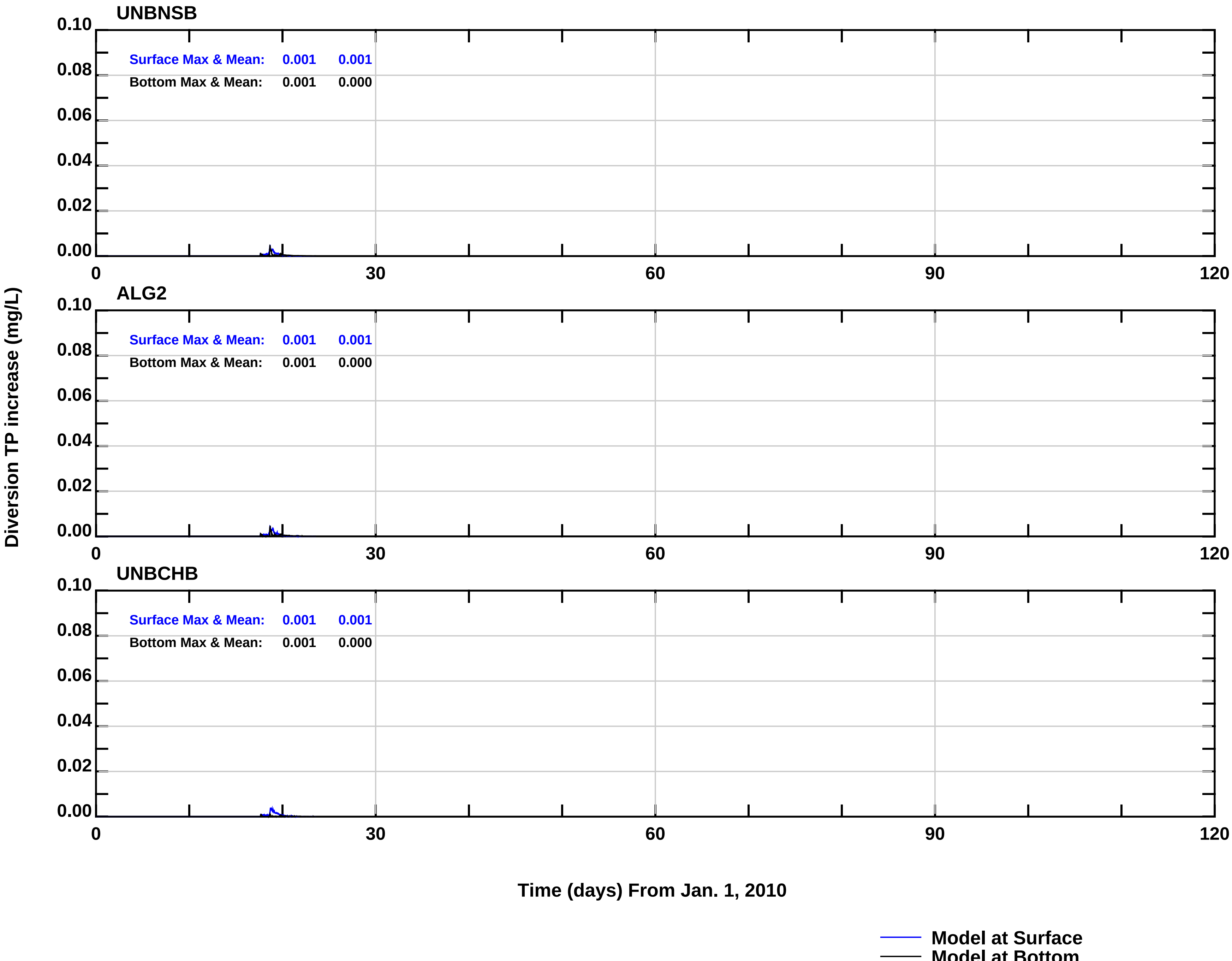

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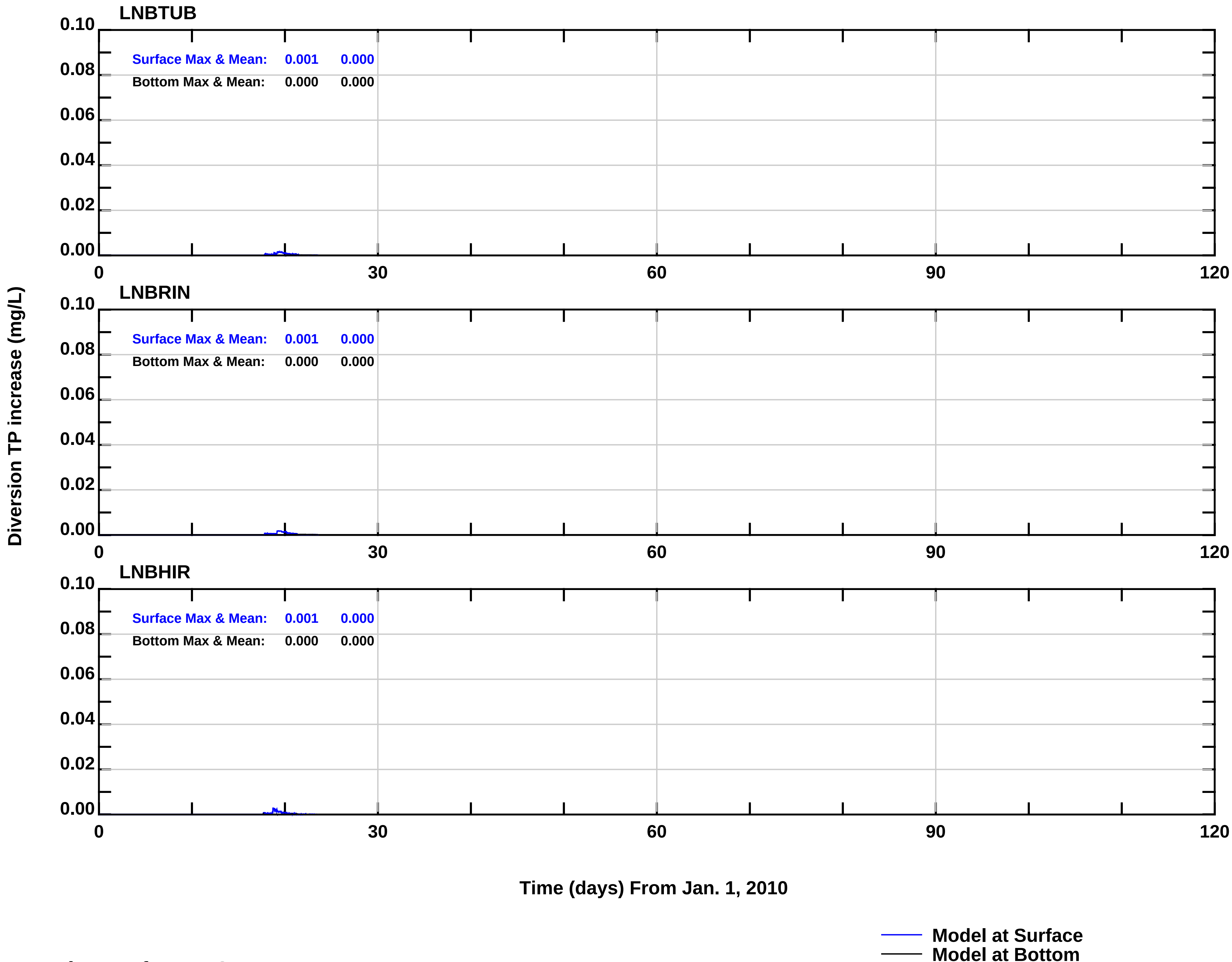

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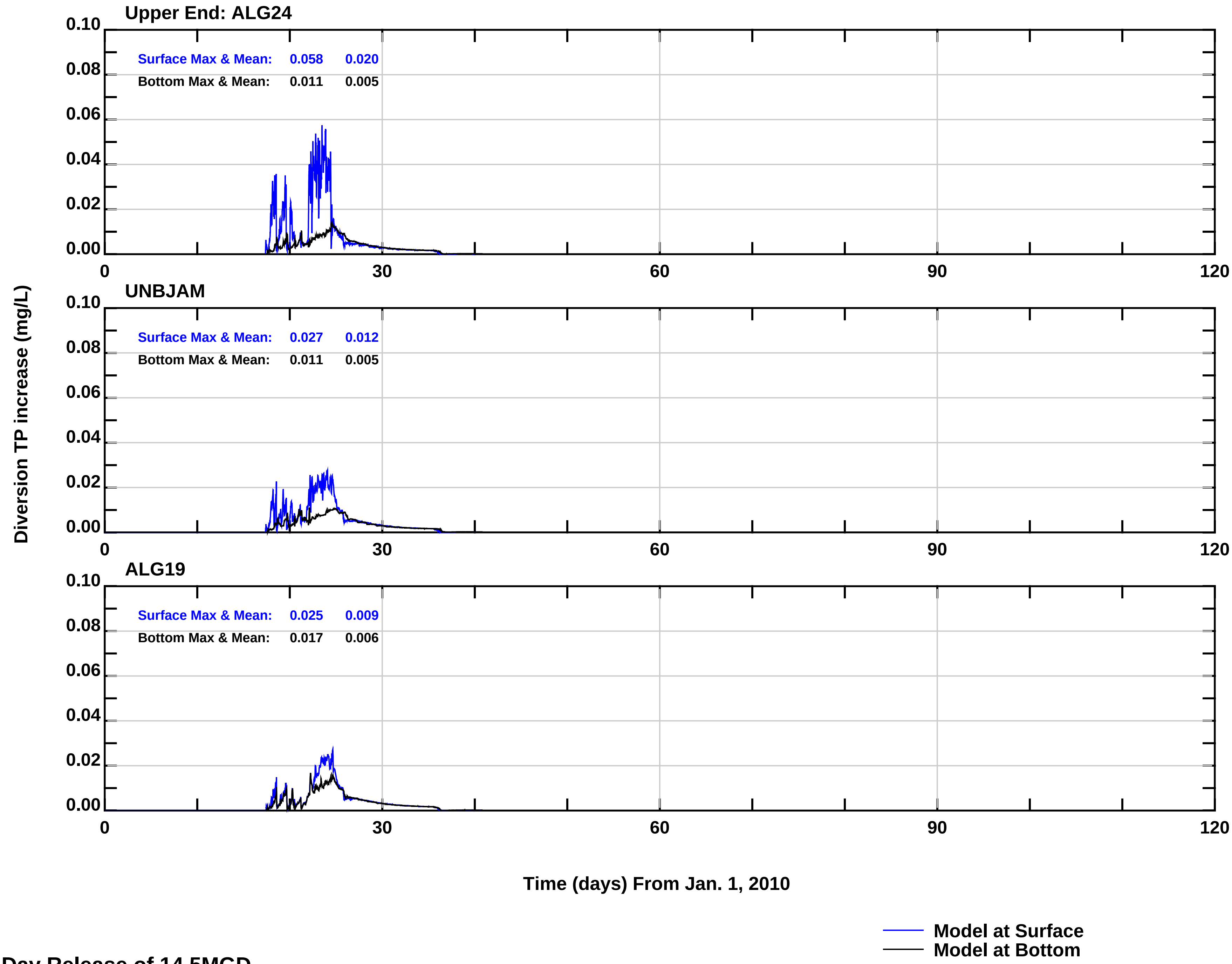

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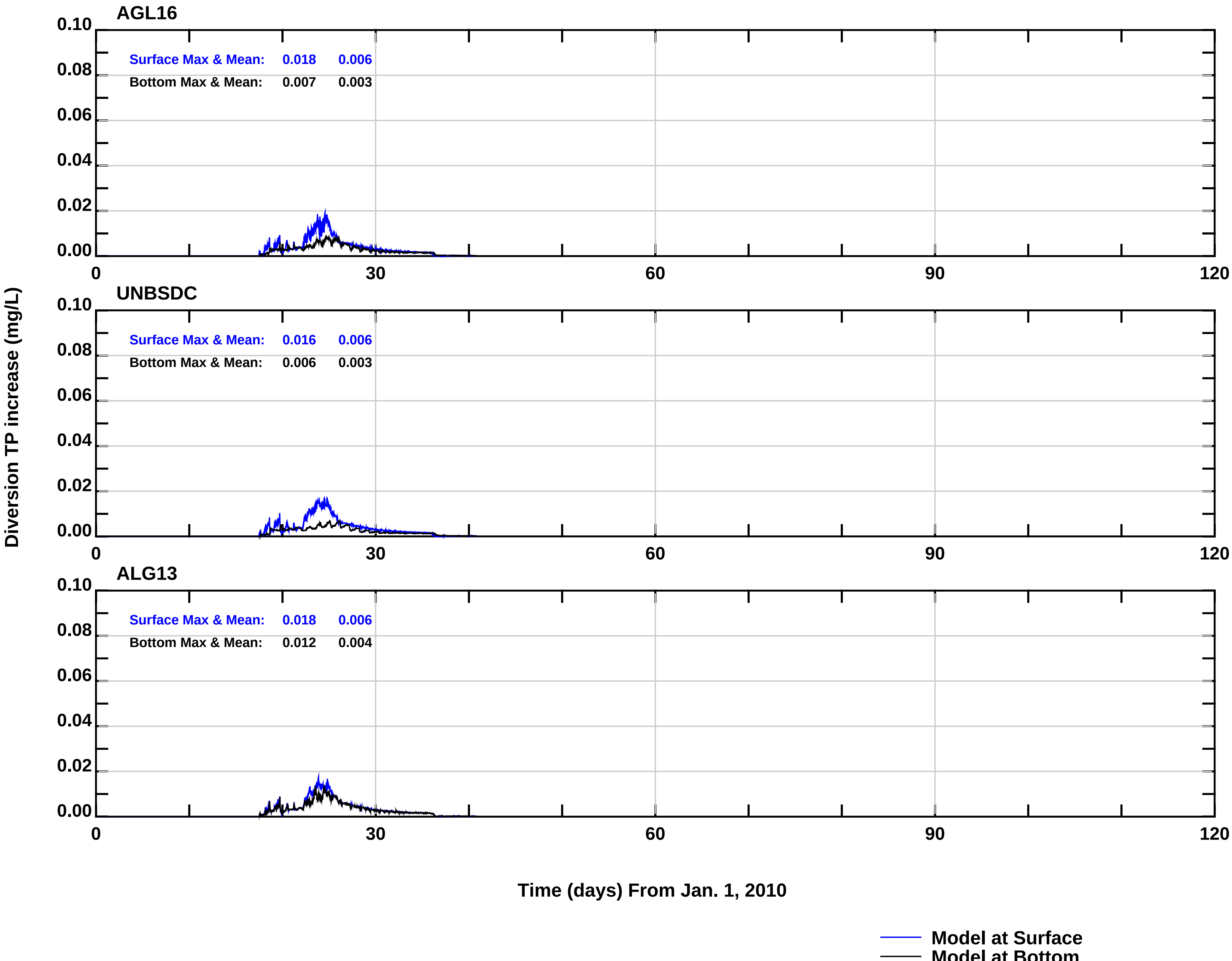

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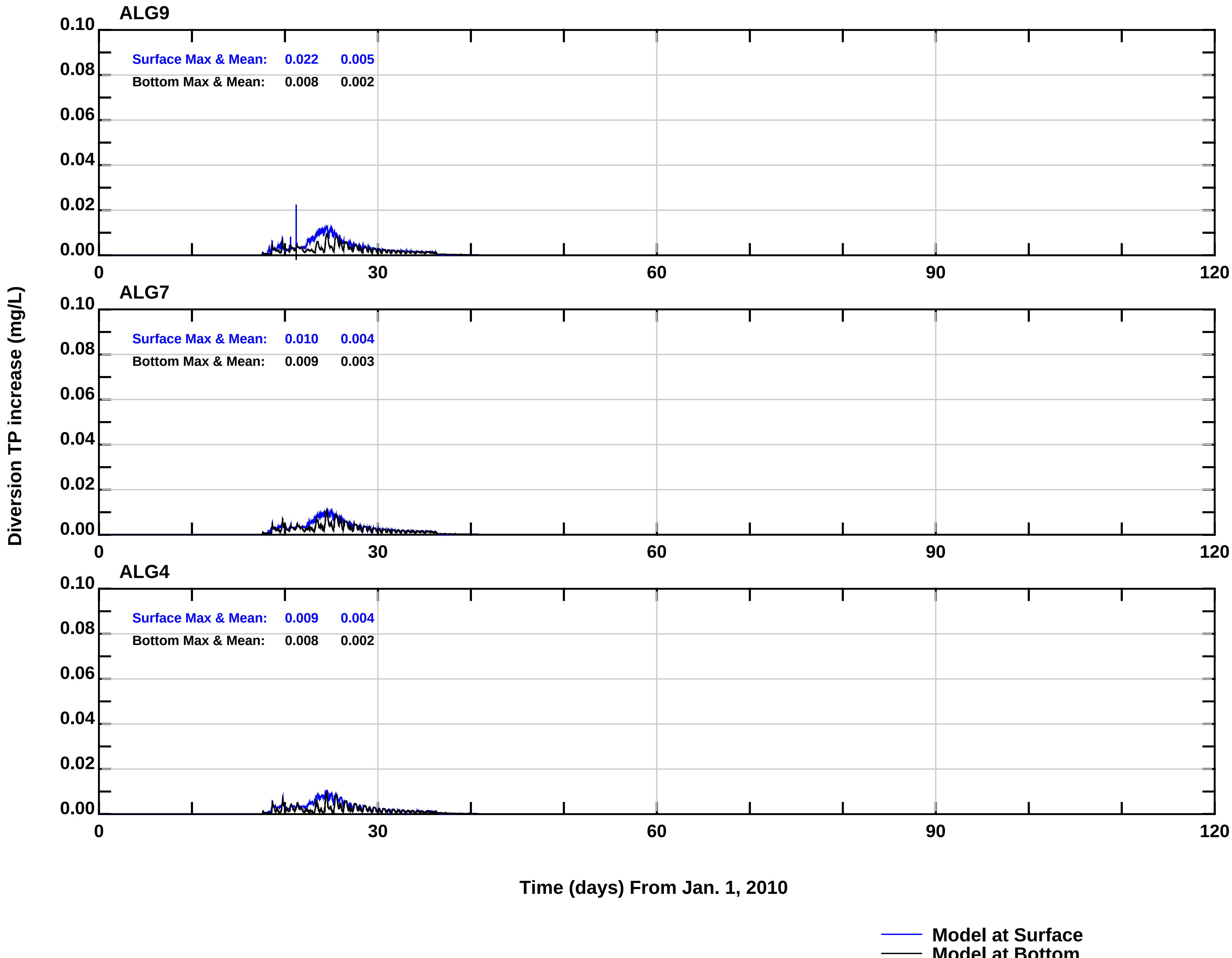

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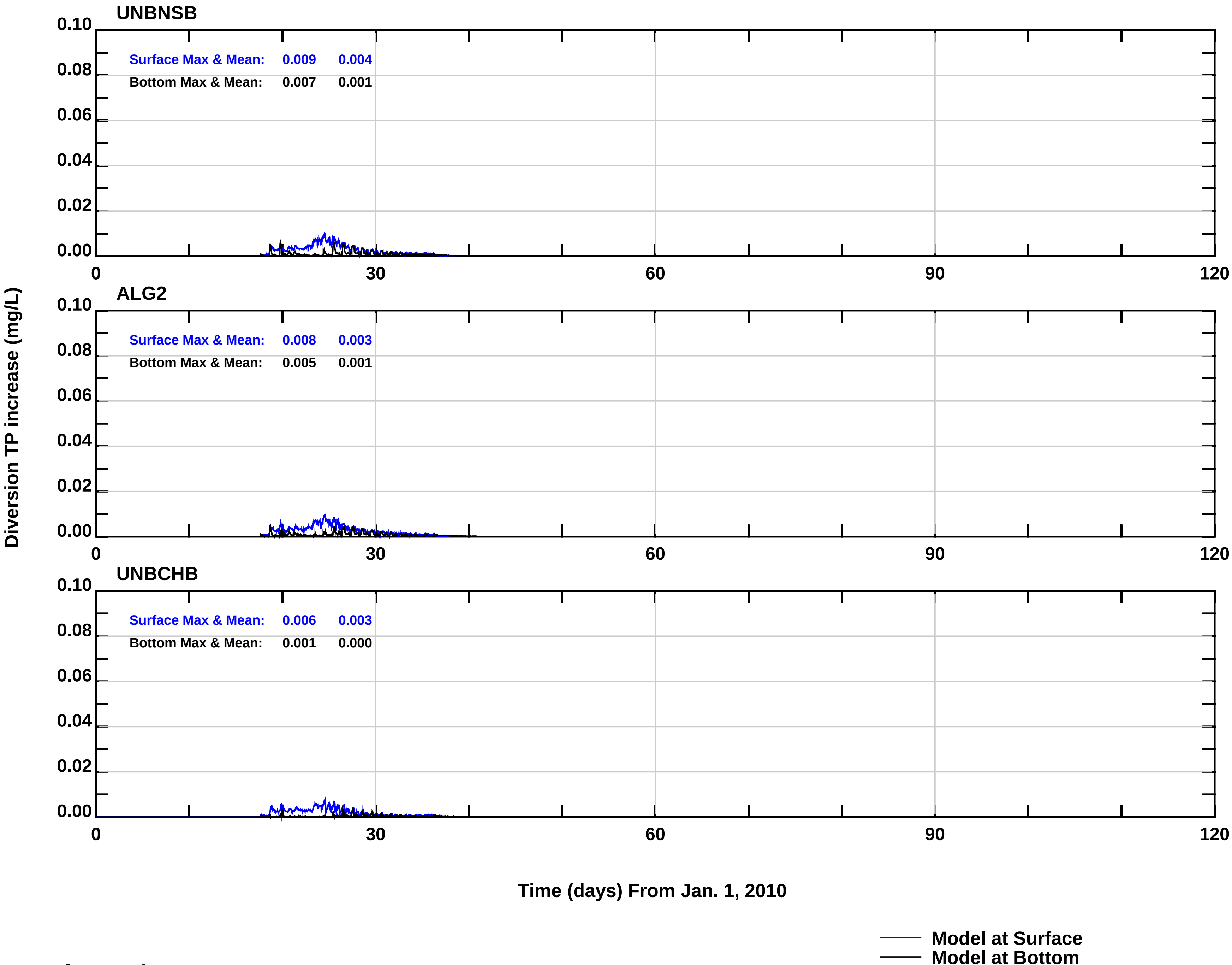

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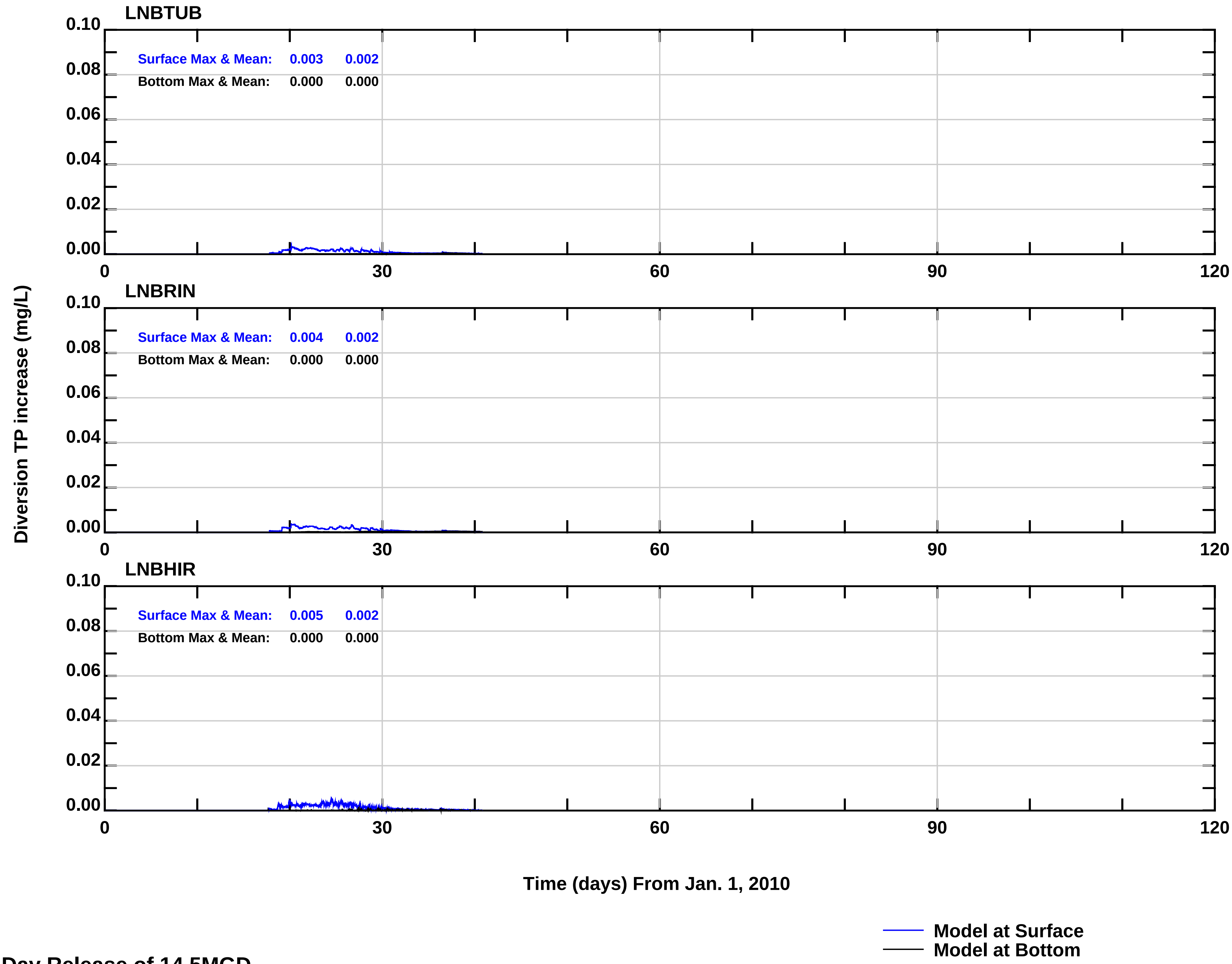

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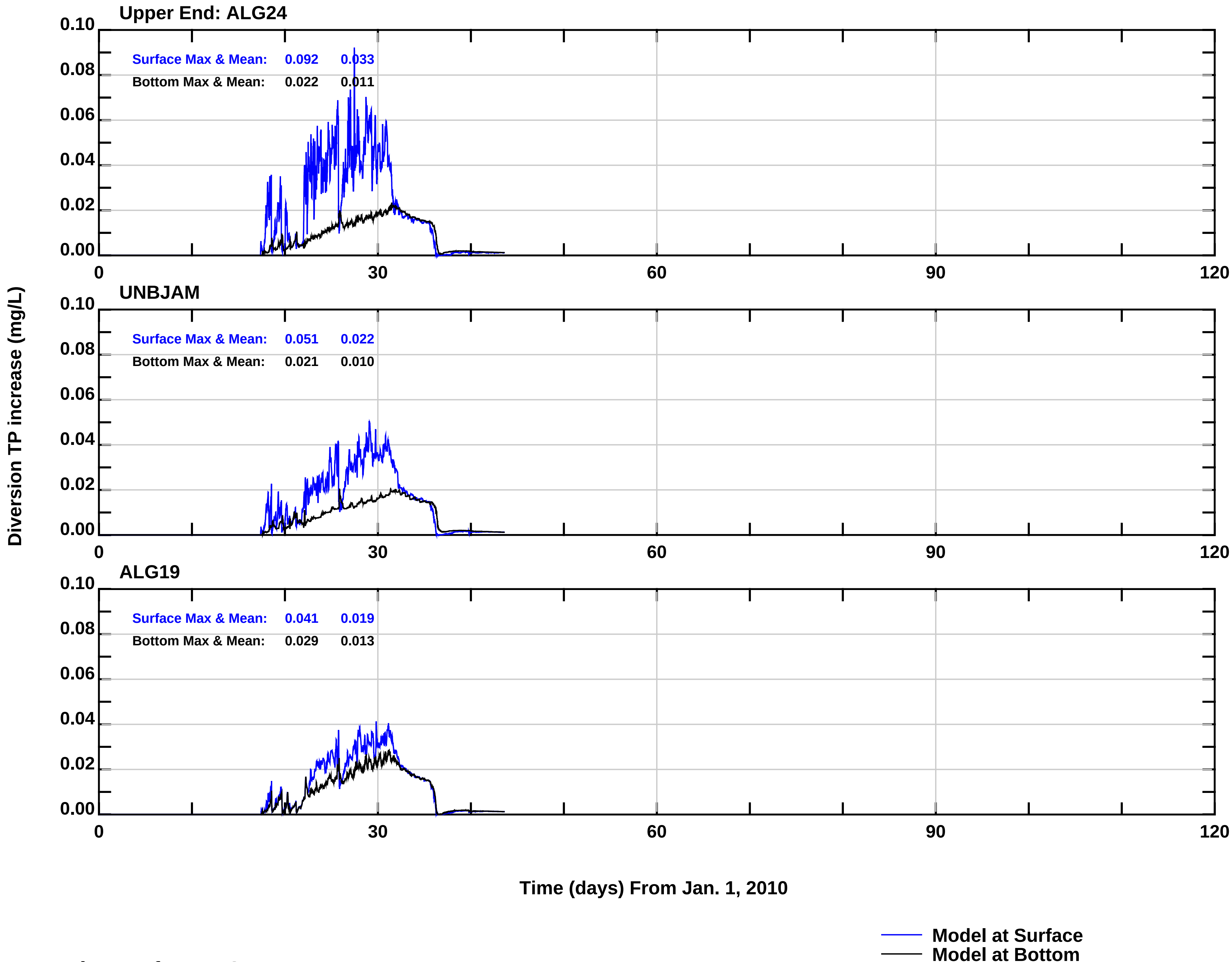

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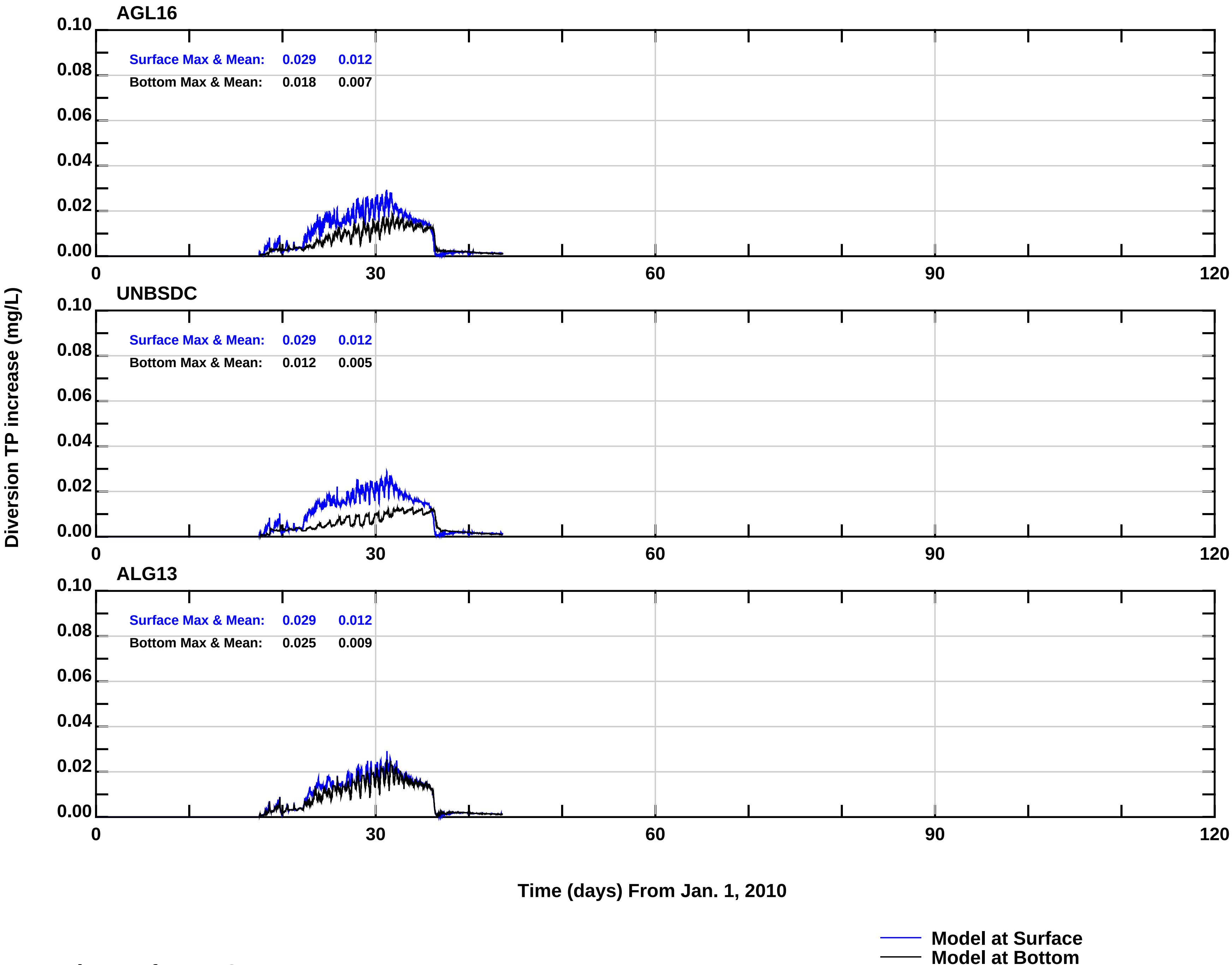

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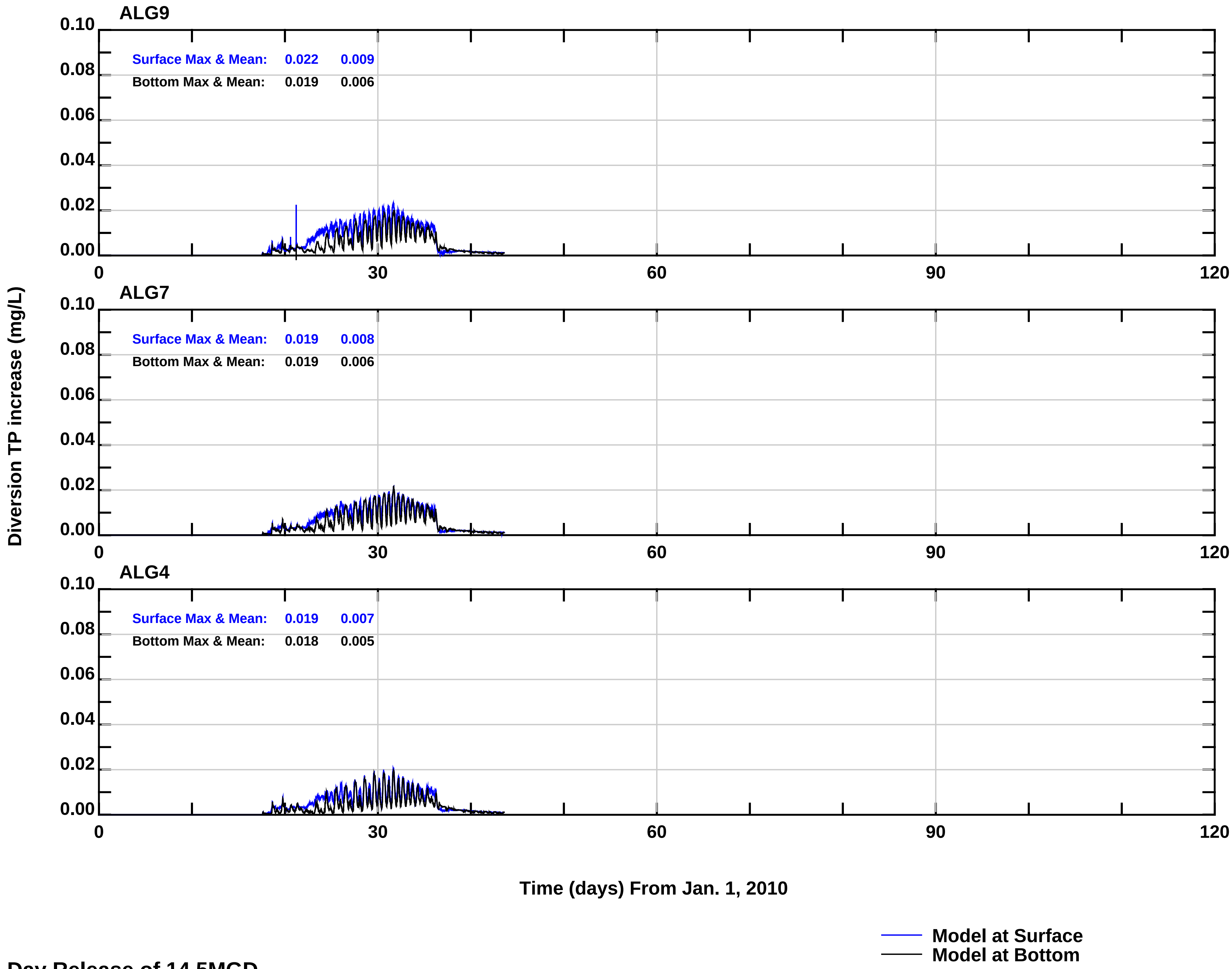

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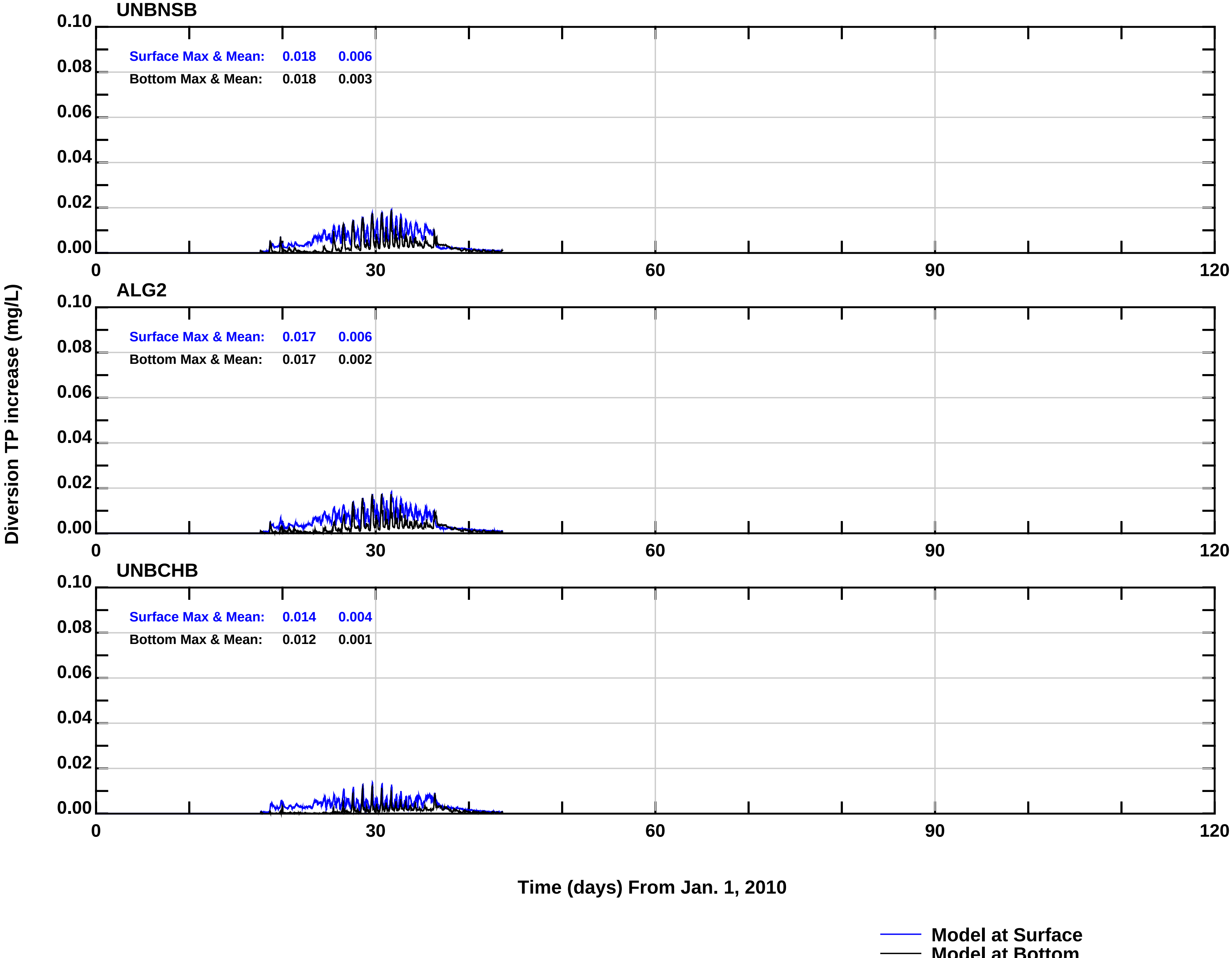

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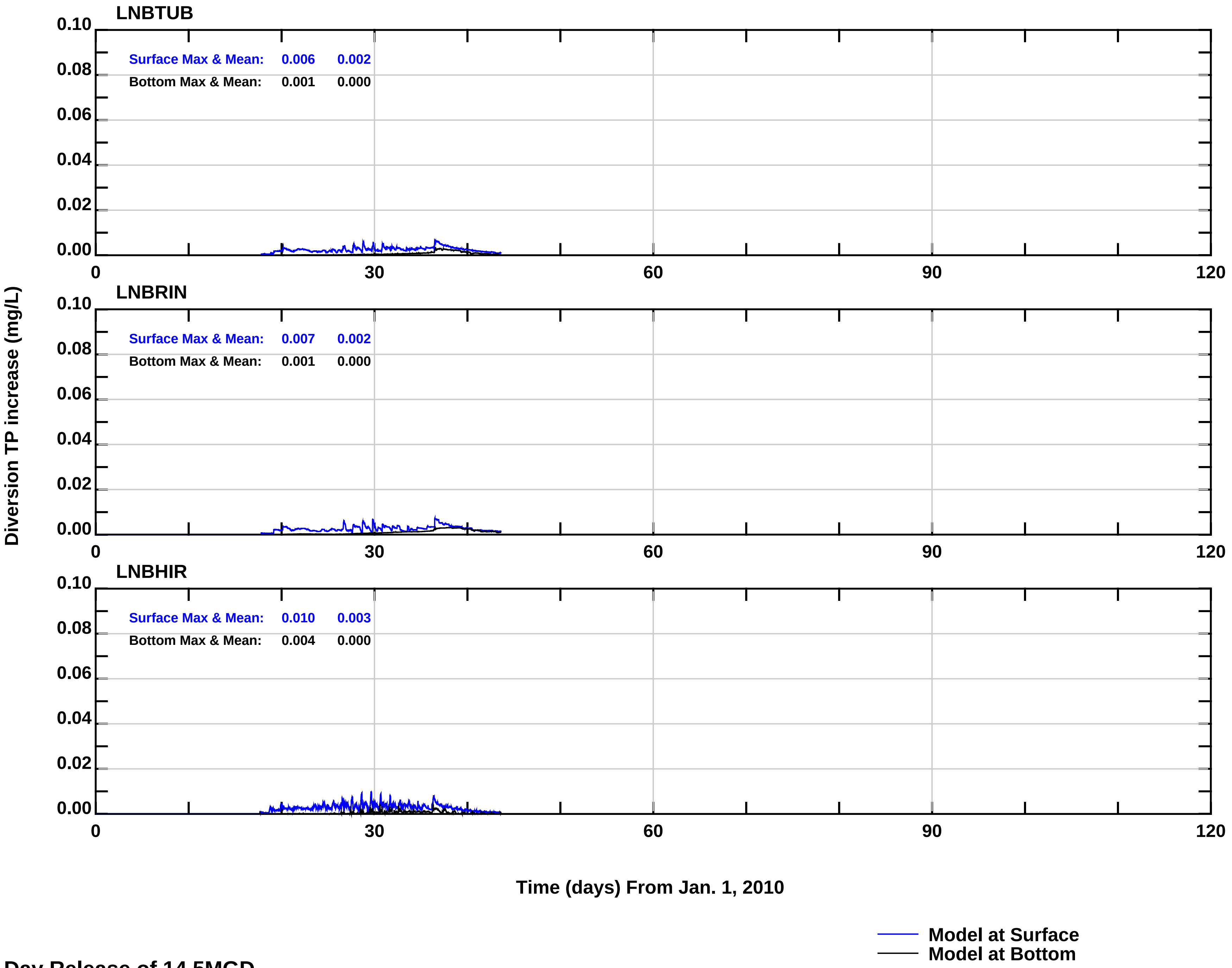

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Addendum #1

Water Quality Evaluation

Michelson Water Recycling Plant Proposed Diversions to San Diego Creek and Newport Bay

Irvine Ranch Water District

March 14, 2018

Contents

Figures

Tables

Introduction

This Addendum to the *Water Quality Evaluation – Michelson Water Recycling Plant Proposed Diversions to San Diego Creek and Newport Bay* Report (dated January 5, 2018) presents additional evaluation results for a proposed 33 MGD diversion along with a new approach for quantifying potential water quality impacts in Newport Bay. Much of the background information presented in the January 5, 2018 report will not be repeated here but rather the focus will be on the updates completed.

IRWD Diversion Evaluation (33 MGD)

The calibrated hydrodynamic model presented in the January 5, 2018 report was again used to estimate nutrient impacts in Newport Bay for a final build-out condition IRWD diversion flow to San Diego creek of 33 MGD over three time periods: 1-day release; 7-day release; and 14-day release. The proposed effluent quality used to characterize MWRP recycled water is 10 mgN/L total nitrogen (TN) and 0.3 mgP/L total phosphorus (TP). These diversion model runs were all started on January 18, 2010 at 1000 hours, which was the start of the January winter storm as completed previously. TN and TP were modeled as a conservative tracer in the hydrodynamic model (i.e., no nutrient processing) with only mixing and dilution associated with creek flow and tidal mixing. This approach provides the calculated increase in TN and TP due to the proposed diversion over existing (background) levels that are present in the bay.

Table 1 presents the calculated TN and TP increases during the diversion periods for the two IRWD diversion flows (i.e., 14.5 MGD and 33 MGD). It should be noted that these calculated increases are for the 1-day, 7-day and 14-day diversion periods and may not reflect appropriate averaging time periods for evaluating impacts on bay macroalgae growth because of their short duration.

In order to address an averaging time period that better reflects the potential impact on macroalgae growth in the bay, Table 2 presents calculated TN and TP increases for averaging periods of 30, 60 and 90 days that may be more relevant to addressing nutrient impacts on macroalgae biomass. This table presents the calculated range in increases for the three locations used in Table 1 for the 30, 60 and 90 day averaging periods that are more biologically relevant.

It is anticipated that the calculated TN and TP increases due to the proposed IRWD diversions will not affect macroalgae levels in upper Newport Bay for the following reasons.

- Diversions are proposed during high flow periods when creek flow dilution of the diversion and short flushing times in the bay will reduce any potential impacts.
- The winter period diversions (October-April) will occur when bay water temperatures are low and not supportive of macroalgae growth (i.e., July-August).
- Diversion effluent TN and TP concentrations are primarily in the dissolved form (>80 percent) and will not significantly contribute to particulate nitrogen and phosphorus that may settle to the sediments and return as dissolved nutrients during warmer summer months (July-August) due to sediment diagenesis or decay
- An assessment as to the potential impacts in Newport Bay using the updated nutrient assessment approach is presented below for both diversion flows.

Table 1. TN & TP Bay Increases Due to Diversions (Short Term)

Diversion Period	Location	14.5 MGD Diversion Flow		33 MGD Diversion Flow	
		TN Increase (mgN/L)	TP Increase (mgP/L)	TN Increase (mgN/L)	TP Increase (mgP/L)
1-day	Jamboree Road	0.22	0.007	0.56	0.017
	Santa Ana-Delhi Channel	0.06	0.002	0.14	0.004
	Northstar Beach	0.02	0.001	0.05	0.001
7-days	Jamboree Road	0.39	0.012	0.91	0.027
	Santa Ana-Delhi Channel	0.20	0.006	0.45	0.013
	Northstar Beach	0.12	0.004	0.27	0.008
14-days	Jamboree Road	0.73	0.022	1.52	0.046
	Santa Ana-Delhi Channel	0.41	0.012	0.89	0.027
	Northstar Beach	0.21	0.006	0.49	0.015

Table 2. TN and TP Bay Increases Due to Diversions (Long Term)

Diversion Period	Averaging Period	14.5 MGD Diversion Flow		33 MGD Diversion Flow	
		TN Increase (mgN/L)	TP Increase (mgP/L)	TN Increase (mgN/L)	TP Increase (mgP/L)
1-day	30 days	≤0.01	<0.001	0.01-0.03	<0.001
	60 days	<0.01	<0.001	≤0.01	<0.001
	90 days	<0.01	<0.001	<0.01	<0.001
7-days	30 days	0.07-0.15	0.002-0.005	0.15-0.34	0.005-0.010
	60 days	0.03-0.08	0.001-0.002	0.08-0.17	0.002-0.005
	90 days	0.02-0.05	0.001-0.002	0.05-0.11	0.002-0.003
14-days	30 days	0.17-0.45	0.005-0.014	0.38-0.94	0.011-0.028
	60 days	0.09-0.23	0.003-0.007	0.20-0.48	0.006-0.014
	90 days	0.06-0.15	0.002-0.005	0.13-0.32	0.004-0.010

Flushing Time Analysis (33 MGD)

The calibrated hydrodynamic model was used to calculate flushing times of upper Newport Bay for a range of constant creek flows with a final build-out condition IRWD diversion flow of 33 MGD starting at both neap tide (low tidal range) and spring tide (high tidal range) conditions. For this analysis, the spatial area of the upper bay was defined as from the Coast Highway Bridge to the mouth of San Diego Creek. The creek flows assigned were 5, 15, 50, 500 and 1,000 cfs. Flushing times were calculated by starting the model simulation with an initial tracer concentration of 100 mg/L in all model grid cells in the upper bay; and then running the model and tracking the decrease in tracer mass over time due to creek flow and tidal mixing. The flushing time was calculated when the initial tracer mass was reduced by 63 percent, or to 37 percent of the initial tracer mass (i.e., 1 e-folding time or 1/e). This definition of flushing time (i.e., 1 e-folding time) is routinely used to define flushing times in tidal systems.

Table 3 presents the calculated flushing times for each of the assumed creek flows in the analysis at both diversion flows. Low flow (i.e., 5 to 50 cfs) flushing times ranged from 5 to 9 days; and high flow (500 to 1,000 cfs) flushing times range from 1 to 2 days. The 33 MGD diversion flow reduced the flushing time by about 1 to 2 days as compared to the 14.5 MGD diversion flow at the low creek flows; and did not affect the flushing time at the high creek flows.

In completing the flushing time calculations for the 33 MGD diversion flow, the 14.5 MGD results were also updated as the prior results did not include the diversion flow (i.e., the prior flushing time results only included the effect of the creek flow). This correction slightly reduced the flushing times at low creek flows and had little impact at high creek flows.

Given that these upper bay flushing times are of short duration (particularly at the high creek flows when diversions may occur), any potential water quality impacts in the bay due to the proposed IRWD diversions will be minimized. That is, the increased TN and TP concentrations due to the proposed IRWD diversions will typically occur during time periods when flushing times are short (i.e., less than 1 week).

Table 3. Upper Bay Flushing Time Results

Creek Flow (cfs)	14.5 MGD Diversion Flow		33 MGD Diversion Flow	
	Flushing Time (days)		Flushing Time (days)	
	Neap Tide	Spring Tide	Neap Tide	Spring Tide
5	9.1	8.6	7.1	6.5
15	8.1	7.7	6.1	5.6
50	6.1	5.6	5.0	4.9
500	2.0	2.0	2.0	2.0
1,000	1.2	1.3	1.2	1.3

Updated Nutrient Assessment Analysis

Macroalgal biomass in Newport Bay over the past 20 years has shown a declining trend. Average dry biomass has remained low and steady from 2007 to 2012; and biomass has been non-detectable at all monitoring stations since 2013[1] (see p. 7). Bay macroalgal data indicate that when present, measureable biomass levels are typically reported in the summer/fall months of May through October. The TMDL Annual Data Report[1] also indicates that bay monitoring is conducted "during July through September (the peak season for macroalgal growth)" and that the "months of July through August are used as the index period for evaluating long-term trends in algal biomass for Upper Newport Bay".

This summer time period (i.e., July-September or July-August) is typically when water temperatures are warmer and more favorable for peak macroalgal growth. In general, the proposed IRWD diversions during the winter, high flow "off-peak" time period (i.e., October through April) will minimize potential water quality impacts in Newport Bay. In addition, the proposed IRWD diversion of TN and TP are primarily in the dissolved form. This diversion of dissolved nutrients during the "off-peak" season will not contribute to sediment bound nutrients in the bay that may return during the summer peak macroalgal growing season through sediment nutrient release.

Therefore, the following approach is proposed to provide a more quantitative method to assess the impact of proposed IRWD diversions on Newport Bay nitrogen and phosphorus levels.

- TN and TP data for the period from 2007 through 2017 were analyzed to determine concentrations that reflect the low to non-detectable macroalgal biomass in the bay. That is, TN and TP concentrations were developed that reflect concentrations to measure potential changes against due to the proposed IRWD diversions.
- Seasonal average TN and TP concentrations were developed by year for monitoring station groups in the bay. The seasonal period was set as October through April ("off-peak") to reflect a period when proposed IRWD diversions may occur. Completing the analyses by year provides a measure of natural variability in bay nutrient concentrations due to factors such as hydrology.
- Overall TN and TP averages were developed from the yearly seasonal averages and an upper bound concentration was set as the overall average plus one standard deviation. In addition, a maximum average concentration was also developed for evaluating short-term perturbations in the bay. Figure 1 presents an analysis of the bay TN and TP data by station group for the 2007-2017 time period. Table 4 presents a summary of the data analyses; and Figure 2 presents a map of the bay monitoring stations used and monitoring groups.
- Model calculated TN and TP increases due to the proposed IRWD diversions were added to the overall averages; and then model results were compared to the upper bound and maximum average concentrations for assessing potential water quality impacts in Newport Bay.
- Using the upper bound and maximum average concentrations as points of measure, allow the natural variability in the bay to be included in the impact assessment. The other factors

[1] Newport Bay Nutrient TMDL – 2017 Annual Data Report. Prepared by County of Orange, OC Public Works, OC Environmental Resources, Water Quality Compliance. December 15, 2017.

related to infrequent proposed IRWD diversions during high flow, winter ("off-peak") periods and the short-term diversion periods will continue to provide additional protection against potential adverse water quality impacts in the bay.

The infrequent need for the proposed IRWD diversions (i.e., expected once every 3-5 years) during high, storm driven, creek flow periods suggests that considering a frequency component in developing the nutrient comparison concentrations in addition to the magnitude and duration components is important to consider. These three components are typically incorporated into modern water quality criteria. For example, Florida DEP used an acceptable one in three year exceedance frequency in developing their estuary numeric nutrient criteria (NNC). That is, one exceedance over a three year period shows compliance with the NNC. Considering a frequency component in the assessment approach will also offset any exceedances of the bay nutrient comparison concentrations given the infrequent need for the proposed IRWD diversions.

A matrix of water quality impacts for the 30-day averaging period is presented in Tables 5 and 6 to allow consideration of the different IRWD diversion periods and different diversion flows. These matrices lump the Group 1-3 assessments together because macroalgal biomass is mainly observed at these stations. Tables 7 and 8 present the matrix of water quality impacts for the 90-day averaging period.

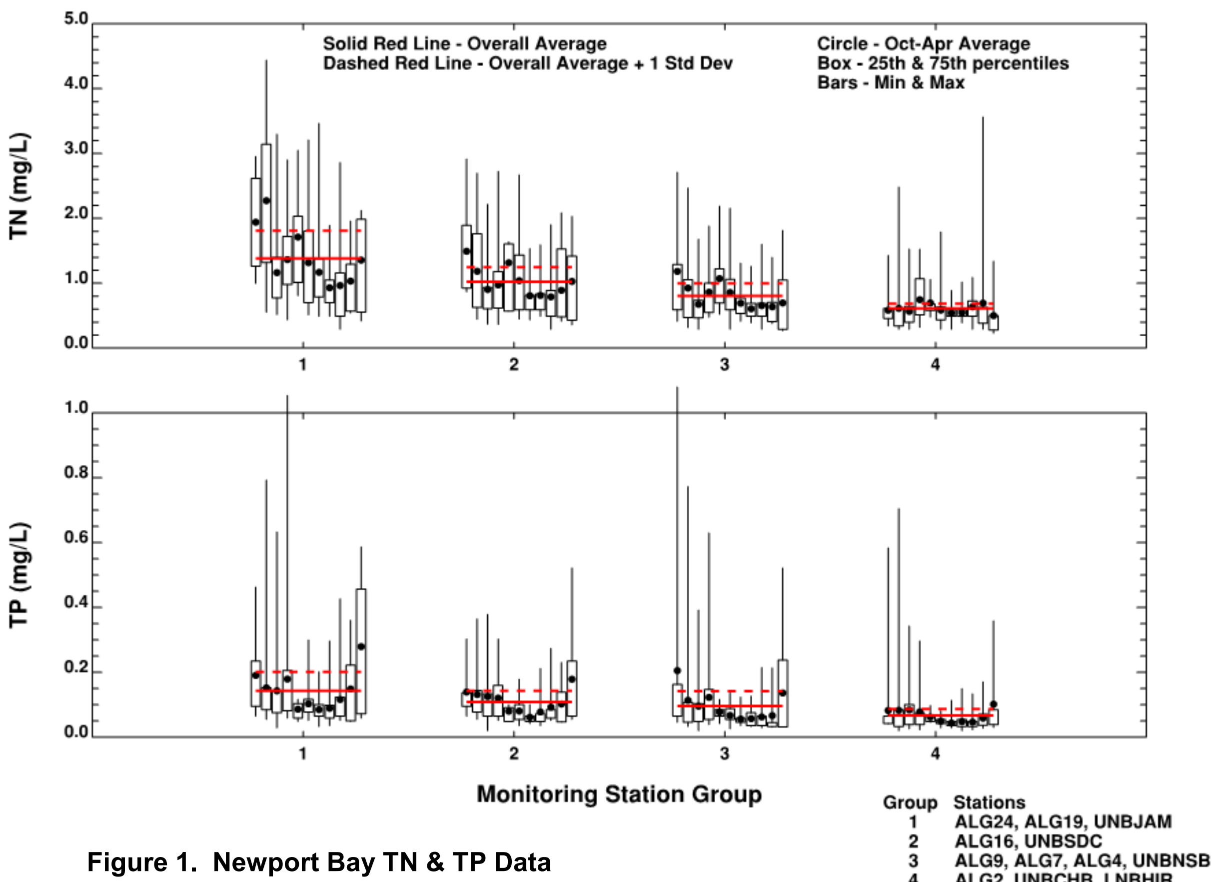


Figure 1. Newport Bay TN & TP Data
(Note: Each bar represents on year from 2007-2017

Figure 2. Newport Bay Monitoring Stations and Groups

Using this assessment method, bay impacts for all IRWD diversion flows and periods for TN using the 30-day averaging period are less than the upper bound and maximum average concentrations with the exception of the 33 MGD diversion flow at the 14-day diversion period. Bay impacts for TP are all less than the upper bound and maximum average concentrations. For TN and TP using the 90-day averaging period, bay impacts are all less than the upper bound and maximum average concentrations.

Figures 3 and 4 present the 30-day averaging period results graphically so that comparisons by individual group can be viewed. These figures show the calculated TN and TP increases along with the upper bound and maximum average concentrations for the three diversion periods and two diversion flows. Figures 5 and 6 present similar graphics for the 90-day averaging period.

Although the IRWD 33 MGD, 14-day diversion was greater than the TN upper bound and maximum average concentrations, the mitigating effects of the diversion during the winter, high flow “off peak” time period will minimize the potential for water quality impacts in Newport Bay. In addition, the infrequent need for the IRWD diversions (i.e., once every 3-5 years) and considering an acceptable exceedance frequency of 1 in 3 years suggests that this IRWD diversion would also be acceptable and not cause water quality problems in Newport Bay.

This proposed assessment method is still considered conservative in that it compares model calculated monthly average (or 90-day average) TN and TP increases to a seasonal (Oct-Apr) data average. Monthly data averages are expected to be more variable, provide higher upper bound concentrations and further support a conclusion that the 14-day, 33 MGD diversion is acceptable.

Currently, the existing dataset only consists of monthly grab samples at the monitoring stations in the bay and true monthly data averages cannot be developed from the data available at this time.

Table 4. Summary of Nutrient Comparison Concentrations

Group	TN (mg/L)			TP (mg/L)		
	Overall Average	Upper Bound	Maximum Average	Overall Average	Upper Bound	Maximum Average
1	1.38	1.97	2.27	0.143	0.198	0.280
2	1.02	1.33	1.49	0.108	0.143	0.179
3	0.81	1.08	1.18	0.097	0.142	0.206
4	0.61	0.70	0.75	0.067	0.086	0.102
Group 1 – ALG24, ALG19, UNBJAM (upper bay) Group 2 – ALG16, UNBSDC (upper middle bay) Group 3 – ALG9, ALG7, ALG4, UNBNSB (lower middle bay) Group 4 – ALG2, UNBCHB, LNBHIR (lower bay)						

Table 5. Potential Bay TN Levels (30-day Averaging Period)

Flow (MGD)	Diversion Period		
	1-day	7-day	14-day
14.5	0.81-1.40	0.87-1.54	0.98-1.84
33.0	0.82-1.41	0.96-1.73	1.19-2.32

Table 6. Potential Bay TP Levels (30-day Averaging Period)

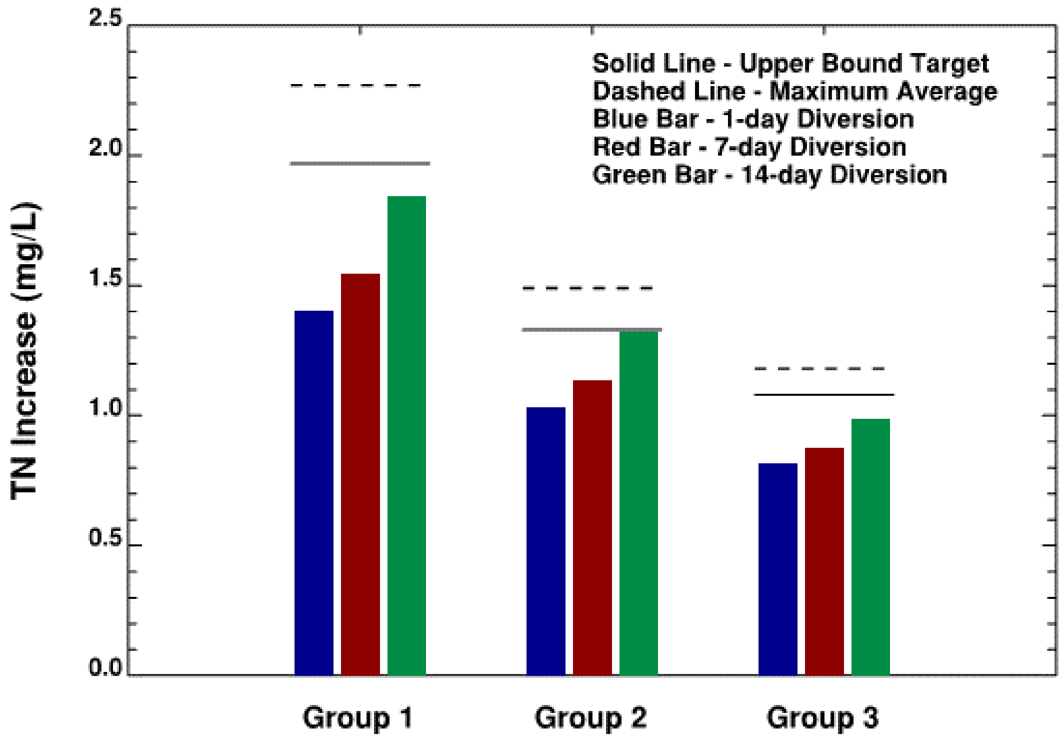
Flow (MGD)	Diversion Period		
	1-day	7-day	14-day
14.5	0.097-0.144	0.099-0.148	0.102-0.157
33.0	0.097-0.144	0.101-0.153	0.108-0.171

Table 7. Potential Bay TN Levels (90-day Averaging Period)

Flow (MGD)	Diversion Period		
	1-day	7-day	14-day
14.5	0.81-1.39	0.83-1.44	0.87-1.54
33.0	0.81-1.39	0.86-1.50	0.94-1.70

Table 8. Potential Bay TP Levels (90-day Averaging Period)

Flow (MGD)	Diversion Period		
	1-day	7-day	14-day
14.5	0.097-0.143	0.097-0.145	0.098-0.148
33.0	0.097-0.143	0.098-0.147	0.101-0.153



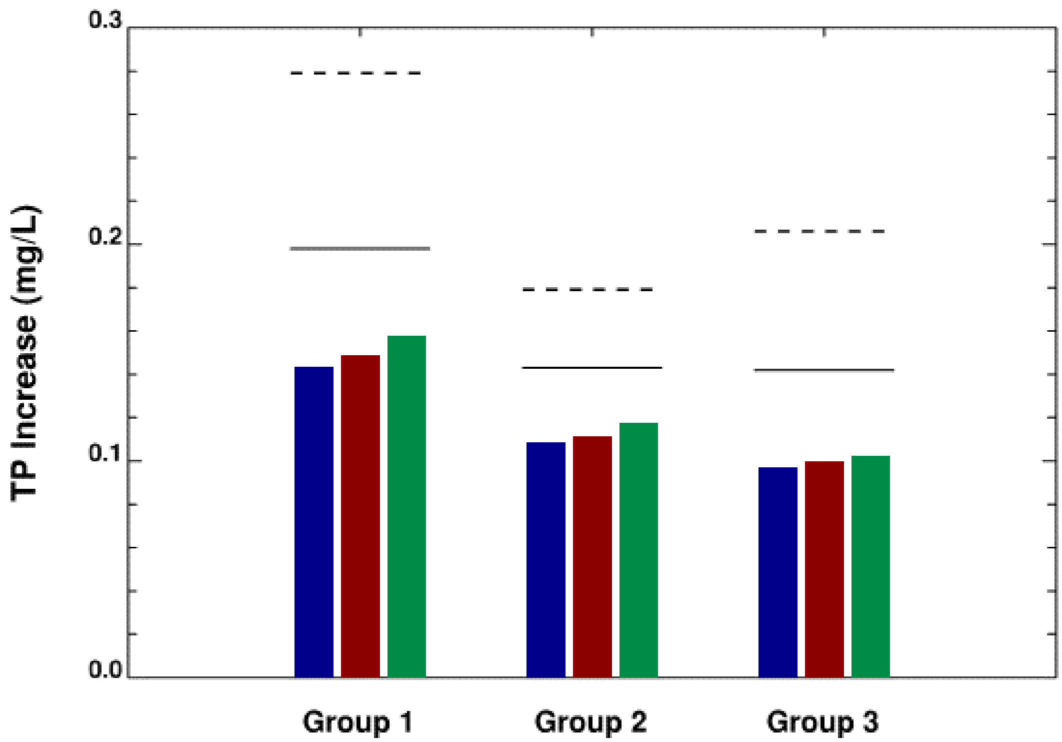


Figure 3. Calculated IRWD Diversion TN & TP Increases
14.5 MGD Diversion Flow, 30-day Averaging Period

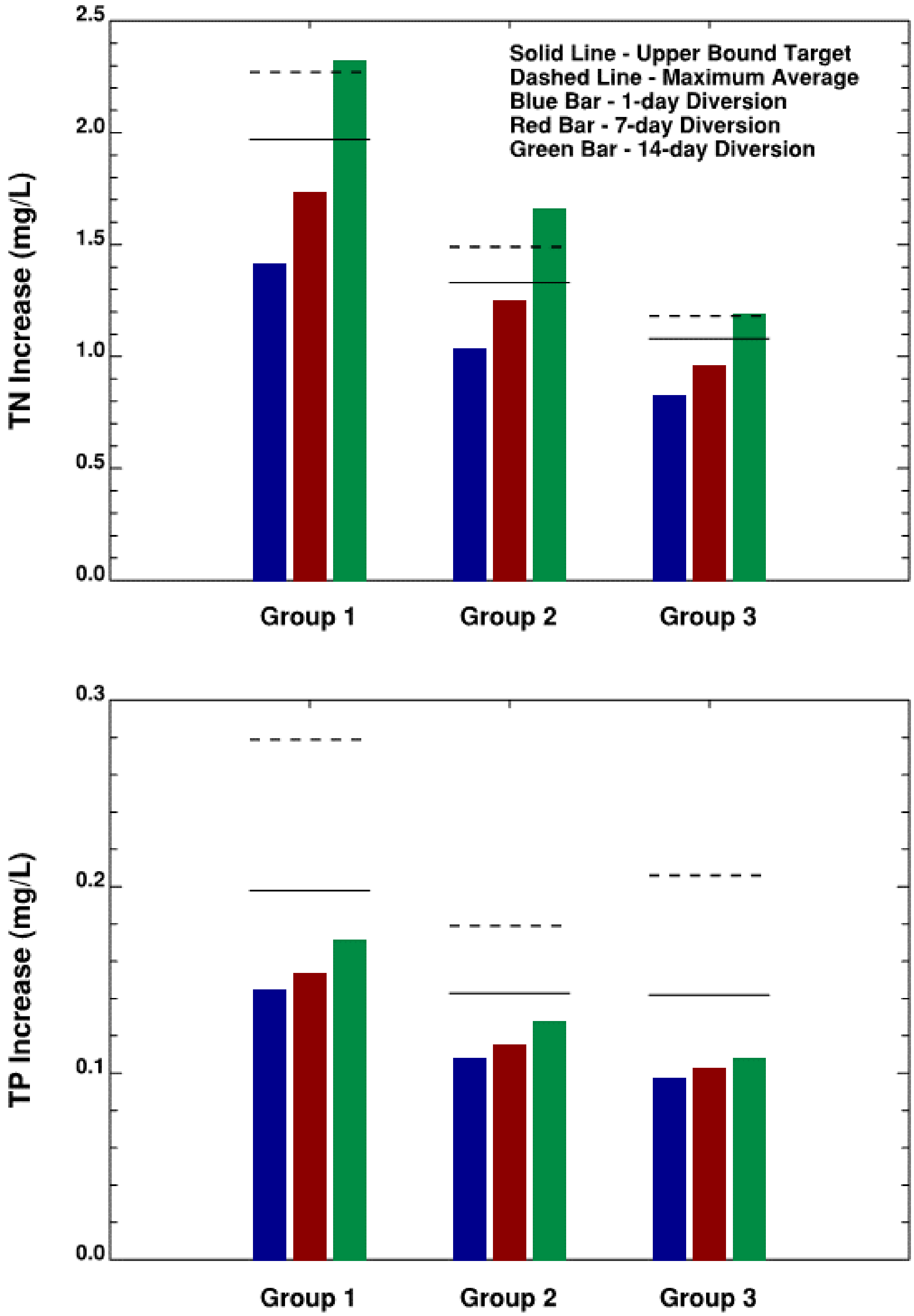


Figure 4. Calculated IRWD Diversion TN & TP Increases (33 MGD Diversion Flow, 30-day Averaging Period)

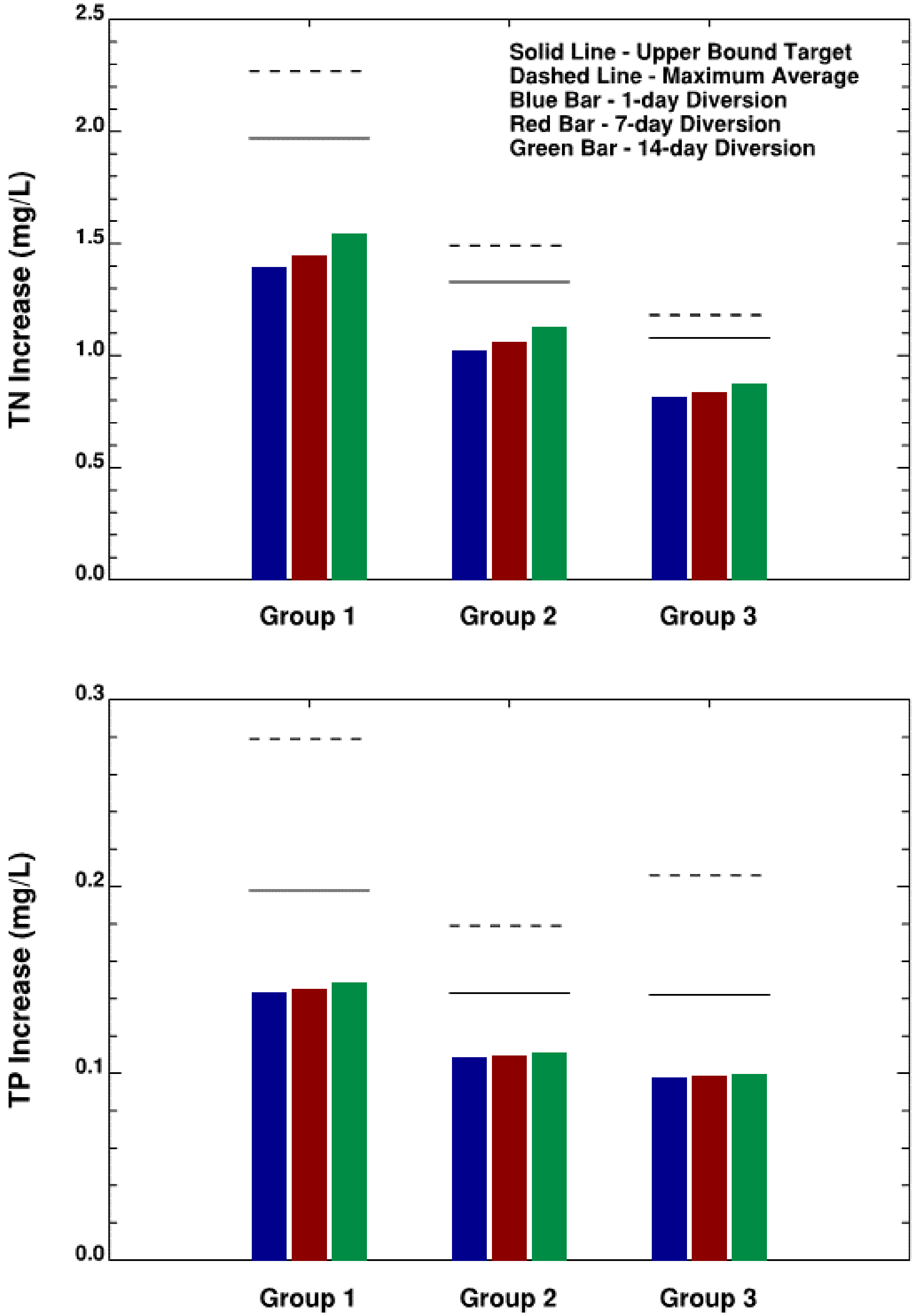


Figure 5. Calculated IRWD Diversion TN & TP Increases (14.5 MGD Diversion Flow, 90-day Averaging Period)

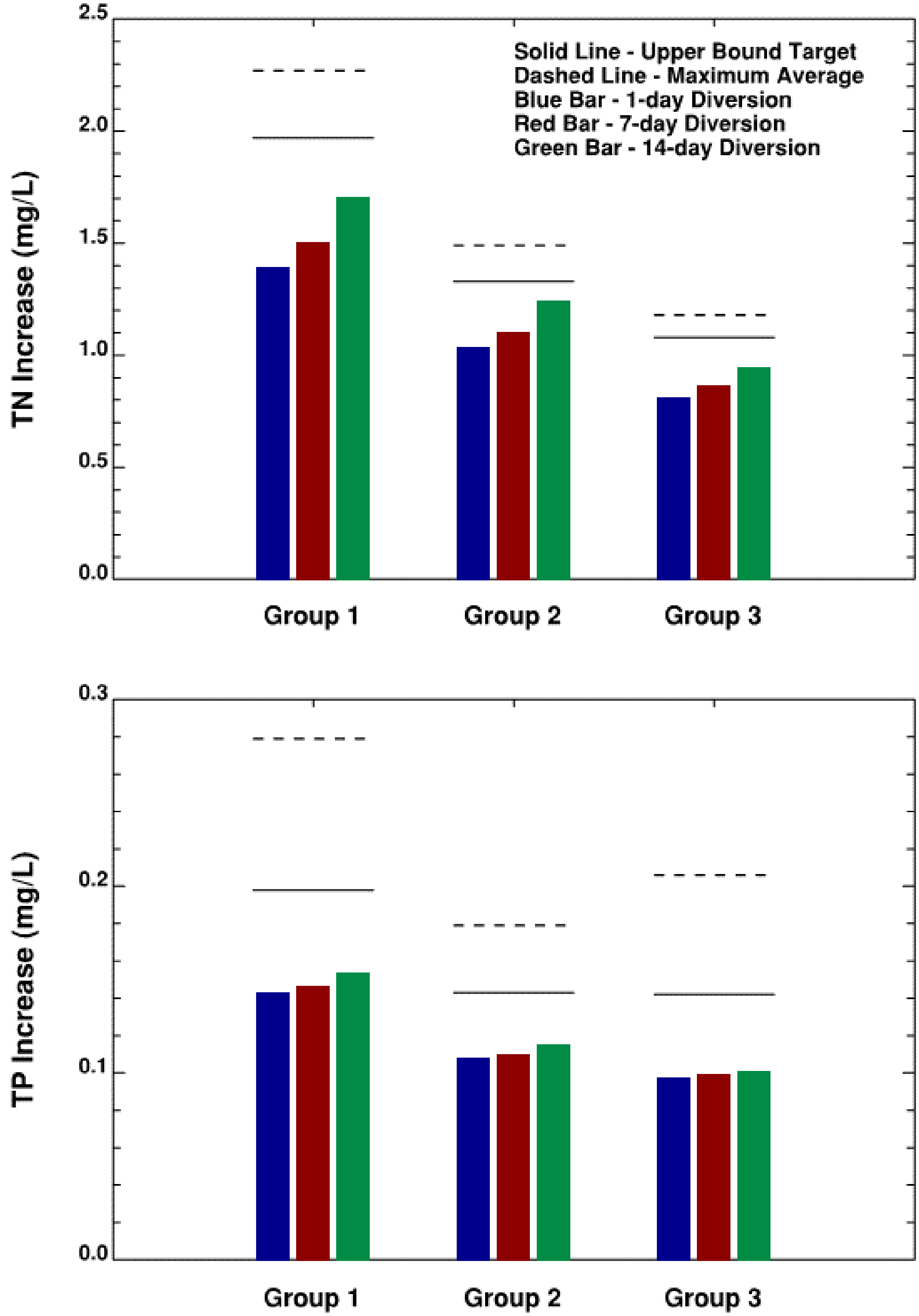


Figure 6. Calculated IRWD Diversion TN & TP Increases (33 MGD Diversion Flow, 90-day Averaging Period)

Conclusions

This Addendum to the *Water Quality Evaluation – Michelson Water Recycling Plant Proposed Diversions to San Diego Creek and Newport Bay* Report (dated January 5, 2018) presents additional evaluation results for a proposed 33 MGD diversion along with a new approach for quantifying potential water quality impacts in Newport Bay. The following updated conclusions from these further analyses are presented below.

- The proposed IRWD diversions would potentially be required during the winter (high flow) periods of the year and, therefore, will take advantage of higher creek flows for diluting the diversion and increasing flushing in Newport Bay. In addition, the proposed IRWD diversions may only occur once every 3 to 5 years.
- Macroalgae growth and biomass in upper Newport Bay typically is the greatest during the July through August index period when bay water temperatures are more favorable to growth. Therefore, the proposed IRWD diversions during high flow, cooler winter months, will mitigate potential water quality (macroalgae) impacts in the bay.
- The MWRP effluent to be diverted to San Diego Creek is primarily in the dissolved form of TN and TP. This will minimize the potential water quality impacts in Newport Bay since the diversion release will be transported out of the bay. In addition, the dissolved nutrients in the diversion will not significantly contribute to particulate nitrogen and phosphorus that may settle to the sediments and return to the water column as dissolved nutrients during warmer summer months of the year.
- The calibrated hydrodynamic model was used to calculate flushing times for upper Newport Bay for a range in creek flows at the two diversion flows. Low flow (i.e., 5 to 50 cfs) flushing times ranged from 5 to 9 days; and high flow (500 to 1,000 cfs) flushing times range from 1 to 2 days.
- Based on the updated nutrient assessment approach, bay impacts for all IRWD diversion flows and periods for TN using the 30-day averaging period are less than the upper bound and maximum average concentrations, with the exception of the 33 MGD diversion flow at the 14-day diversion period. Bay impacts for TP are all less than the upper bound and maximum average concentrations. For TN and TP using the 90-day averaging period, bay impacts are all less than the upper bound and maximum average concentrations.
- Although the IRWD 33 MGD, 14-day diversion was greater than the TN upper bound and maximum average concentrations, the mitigating effects of the diversion during the winter, high flow "off peak" time period will minimize the potential for water quality impacts in Newport Bay. In addition, the infrequent need for the IRWD diversions (i.e., once every 3 to 5 years) and considering an acceptable exceedance frequency of 1 in 3 years suggests that this IRWD diversion would also be acceptable and not cause water quality problems in Newport Bay.
- Given that upper bay flushing times are of short duration, any potential water quality impacts in the bay due to the proposed IRWD diversions will be minimized. That is, the increased TN and TP concentrations due to the proposed IRWD diversions will typically occur during time periods when flushing times are short (i.e., less than 1 week).