West Point Treatment Plant

Ongoing Marine Water Quality Monitoring

King County
Department of
Natural Resources and Parks
Water and Land Resources Division

Water Quality Report –Update May 26th, 2017

OVERVIEW

As part of a long-term program, King County monitors water quality at 12 offshore and 20 beach locations (see Figure 1) to provide an understanding of water quality within the Puget Sound Central Basin, including at all treatment plant outfalls. The West Point Treatment Plant main outfall is the site labeled KSSK02 on the map, located 3,600 ft. offshore at approximately 230-ft deep. The county maintains a long-term dataset, over 50 years at some locations, which provides insight into natural variation. This monitoring program and dataset form the basis from which water quality conditions can be assessed that may be affected by the West Point wastewater discharge during its period of reduced treatment.

As of April 27th, 2017 all of the wastewater coming into West Point Treatment Plant each day is going through full secondary treatment. On May 10th, treated wastewater leaving the plant and being discharged to Puget Sound (effluent) was meeting all state permit requirements.

At the offshore sampling stations, dissolved oxygen, temperature, salinity, density (calculated), chlorophyll, and light intensity and transmission are measured throughout the entire water column from surface to bottom every two weeks. Additionally, nutrients, fecal indicator bacteria (FIB), suspended solids, and chlorophyll are measured at specific depths at each site, and phytoplankton composition and abundance are assessed at a subset of sites. Beach locations are monitored monthly for nutrients, FIB, temperature, and salinity.

Additional Monitoring: During the time treatment was reduced at the West Point plant and up until now, the sampling frequency at a subset of four offshore long-term monitoring stations has been increased to weekly. A new site was added at the emergency bypass outfall and is also sampled weekly. This frequency and variety of biological, chemical, and physical conditions can capture some impacts on ecosystem functions. As of April 10th, bacteria concentrations at a subset of six beach sampling stations are being monitored weekly. Also as of April 11th, a Submersible Ultraviolet Nitrate Analyzer (SUNA) sensor loaned to King County from the Washington State Dept. of Ecology has been used to support the monitoring efforts. The SUNA sensor adds rapid measurements of nitrate, and provides more information on variability from the surface to bottom.

Overall, the County's monitoring is sufficient to evaluate the most relevant water quality conditions that have the potential to result in any acute adverse effects to Puget Sound aquatic life.

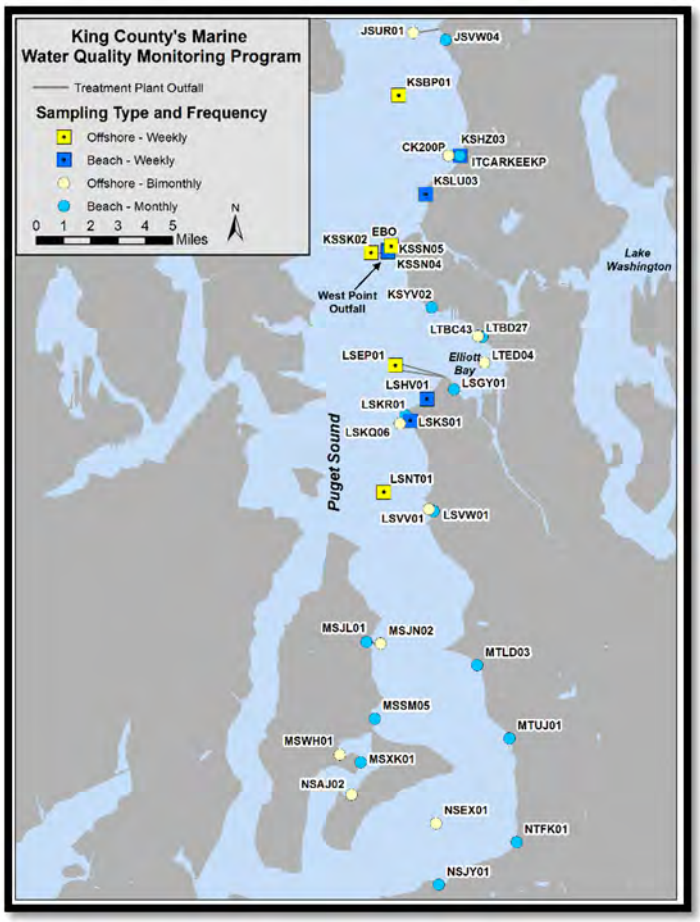

Figure 1. Map of King County's marine water quality monitoring stations.

The most recent data results available from the May 1st and 2nd (all offshore and beach bacteria) and May 8th and 10th (offshore subset and beach bacteria) sampling events are

summarized for three key water quality indicators below. More data results are available in the appendix.

BACTERIA

Fecal coliforms, along with *Enterococcus*, are types of indicator bacteria that King County routinely monitor at freshwater and marine beaches, as well as offshore. These bacteria are found in the intestinal tracts and feces of humans and other warm-blooded animals, and can make their way into our waterways through various pathways. Although these bacteria are typically not pathogenic, they are important to monitor as an indicator that pathogens that make people sick may be present.

The State of Washington has a two part standard to protect human primary contact recreation and shellfish consumption in marine waters. The standard includes a 14 colony forming unit (CFU)/100 mL geometric mean average and a 43 CFU/100 mL peak concentration (the peak concentration is not to be exceeded in greater than 10% of samples). These standards are used for comparing data from multiple samples at a station rather than a single sample.

Comparing recent individual samples to the bacteria standards indicates that concentrations of fecal coliforms from surface waters at all offshore stations, including KSSK02 off of West Point, were low and all below the geometric mean standard and the peak standard during both sampling events in early May (Figure 2). Sub-surface bacteria concentrations were all low and below state water quality criteria as well. Despite low fecal coliform concentrations, no untreated West Point discharges, and no substantial rainfall events occurring, *Enterococcus* concentrations near West Point's shallow Emergency Bypass Outfall (EBO) were unusually high (Figure 3). While the source of these bacteria is unknown, fecal pollution from humans or wildlife can be a source of *Enterococcus* in seawater. In addition, this type of bacteria can occur naturally in high densities and can survive longer than fecal coliforms in the marine environment. For data on subsurface and *Enterococcus* bacteria concentrations, see Appendix Table A-2.

Concentrations of bacteria at the subset of six beach stations sampled weekly, which includes beaches near West Point, were all below the state's peak water quality standard. However, stations KSLU03 (Golden Gardens) and LSHV01 (Alki Beach) exceeded the geometric mean criteria on May 1st and May 8th, respectively (Appendix Figure A-8). Bacteria concentrations at both of those stations were slightly elevated, while all others were within the historical range for May (Appendix Table A-2).

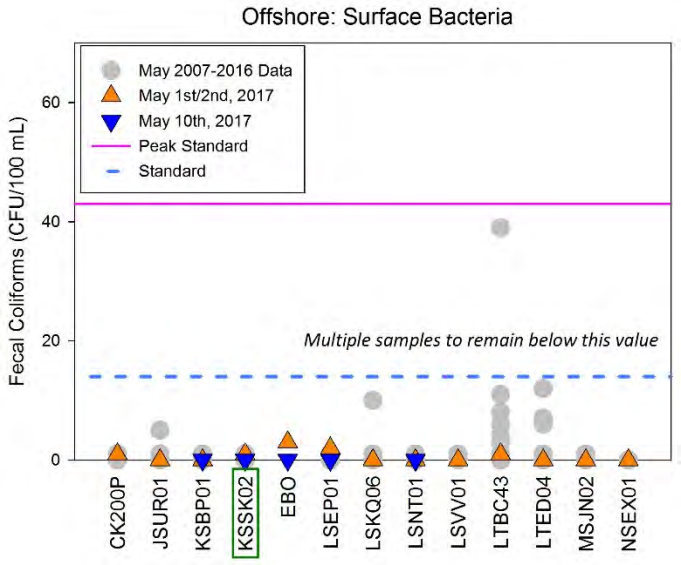

Figure 2. Bacteria (fecal coliforms) levels of single samples collected near surface (1 meter) at offshore stations in Central Puget Sound during the early May 2017 sampling events are illustrated with historical bacteria levels. Note: station KSSK02, West Point outfall, highlighted.

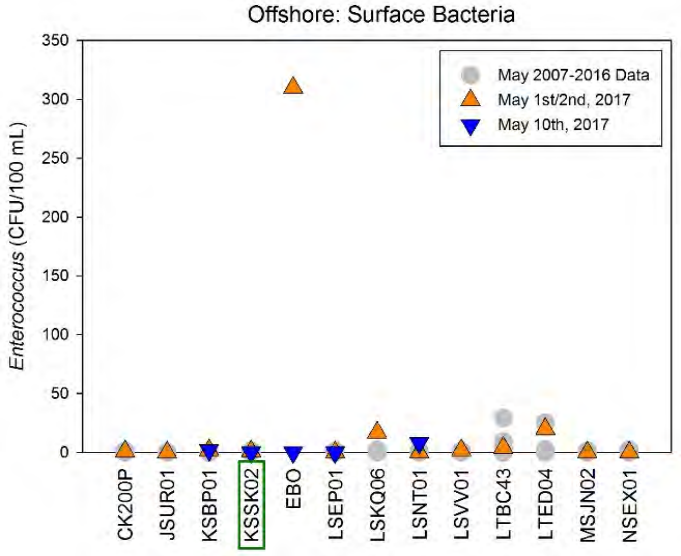

Figure 3. Bacteria (*Enterococcus*) levels of single samples collected near surface (1 meter) at offshore stations in Central Puget Sound during the early May 2017 sampling events are illustrated with historical bacteria levels. Note: station KSSK02, West Point outfall, highlighted.

NUTRIENTS

Nutrients, such as nitrogen compounds (ammonia and nitrate) and orthophosphate, are essential elements for aquatic plants and algae. Silica is a micronutrient needed by some algae and other organisms for skeletal growth. However, excess nutrients can cause a sudden increase in aquatic plants that can lead to unfavorable conditions. High ammonia concentrations can be toxic to aquatic organisms, including fish.

All ammonia values in offshore waters in early May were well below the lowest (chronic) water quality criterion, which is based upon temperature, salinity, and pH factors (anticipated to be about 2.2 mg/L for May conditions). Ammonia values at the deepest depth at the South Plant outfall station (LSEP01) were within normal ranges (Figure 4), unlike on April 18th when a high value was observed. Surface ammonia levels, including at the West Point and South Plant outfalls, were low (Appendix, Figure A-7).

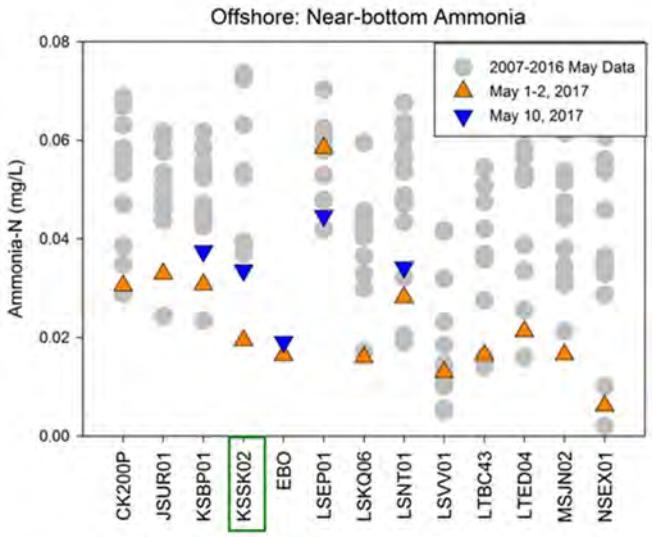

Figure 4. Ammonia levels collected at the deepest depth at offshore stations during the early May sampling events are shown with historical levels. Note: station KSSK02, the West Point outfall, is highlighted. The Emergency Bypass Station (EBO) was not routinely sampled prior to this event, so recent data cannot be compared to prior years.

Nitrate + nitrite, orthophosphate, and silica at offshore stations for all depths except the surface were within normal seasonal ranges for all sites. However, nitrate/nitrite and silica surface water values were either lower than normal or near the low range for historical values due to the regularly-occurring spring phytoplankton bloom that began in mid-late April. Phytoplankton (microalgae) take up nutrients for growth, such as nitrate and silica, which lowers levels in the water when the bloom is large. The bloom was more pronounced in the southern portion of the Central Basin during early May as indicated by high chlorophyll-*a* values. Chlorophyll-*a* values were also high at all five of the stations sampled on May 10th (see Appendix, Figure A-6). The results of the SUNA sensor (shown in the Appendix) also show low nitrate at the surface particularly on May 10th, and better capture the extent of low levels with depth. Most sites show higher nitrate particularly at near-bottom depths, which can be a typical seasonal pattern.

DISSOLVED OXYGEN

Dissolved oxygen is important for marine life, and can control the presence or absence of species. Aquatic life requires a certain amount of oxygen dissolved in the water to live, and different species have different tolerances. Waters with high dissolved oxygen are considered healthy for sustaining many species.

Plants and algae produce oxygen during the day. In deep waters, it can be too dark for plant growth and is separated from surface mixing with air, so processes like decomposition by bacteria can result in low dissolved oxygen. Human inputs of organic materials and decay of sinking algae at depth may decrease oxygen levels. Also, deep waters from the Pacific Ocean enter Puget Sound and can result in naturally occurring low oxygen levels.

The State of Washington dissolved oxygen standard to protect aquatic life depends on the designated waterbody use. For Central Puget Sound, the one-day minimum dissolved oxygen standard is 7 mg/L for waters of extraordinary quality. At the dissolved oxygen level of 5 mg/L, biological stress can be induced on marine life. If dissolved oxygen levels fall below 3 mg/L, then this can displace or potentially result in death of some marine species.

The most recent near-bottom data from early May show typical oxygen conditions for offshore sites across Central Puget Sound, with all oxygen levels above the state water quality standard (Figure 5).

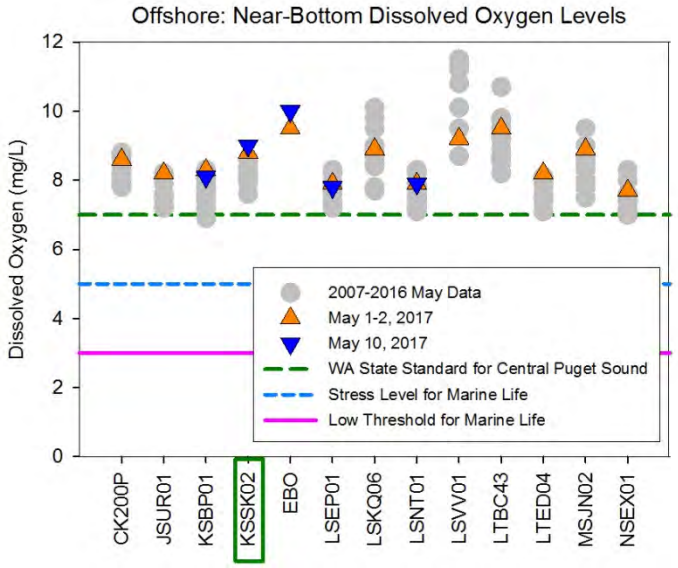

Figure 5. In Puget Sound, the lowest dissolved oxygen levels are typically found near the seafloor, so near-bottom oxygen levels are shown by site on top of historical oxygen conditions for the first half of May. Note: station KSSK02, West Point outfall, highlighted in green. The EBO site, Emergency Bypass Outfall, was added recently, so no historical data are available.

Similar to April, high oxygen conditions continue throughout the water column, with the highest levels near the surface. Rising spring growth of phytoplankton and other algae has resulted in increased oxygen levels, reflecting typical conditions for May.

SUMMARY

Water sample results collected between May 1st and 2nd and May 8th and 10th, 2017 are summarized below. Additional results are provided in the Appendix.

- Concentrations of fecal coliforms at offshore stations were below the geometric mean reference water quality standards as well as the peak standard in early May.
- *Enterococcus* concentrations at the shallow EBO station were much higher than other offshore stations despite no untreated discharges occurring during that time.
- Beach bacteria concentrations were typical at four of the six stations monitored weekly during the first two weeks of May. However, two stations (Golden Gardens and Alki Beach) had fecal coliform concentrations that were slightly elevated above normal and exceeded the geometric mean reference value, but not the peak water quality criterion.
- Ammonia levels were within normal ranges at all sites and depths.
- Nitrate/nitrite, orthophosphate, and silica results were within expected seasonal values for offshore waters at all depths except the surface.
- Low nitrate/nitrite and silica levels at the surface in addition to high chlorophyll-*a* values indicate the continuance of the regularly-occurring spring phytoplankton bloom which began in mid-to-late April. The timing of the phytoplankton bloom, and the phytoplankton's subsequent uptake of nutrients for growth, is consistent with historical data.
- The phytoplankton bloom was more pronounced in the southern portion of the Central Basin during early May and evident at all five stations sampled on May 10th.
- Near-bottom dissolved oxygen values were at healthy levels and all sites were above the state water quality standard.
- Higher dissolved oxygen levels persisted through early May from top to bottom of the water column, reflecting the growth of aquatic plants and algae which produce oxygen. This shows typical spring conditions.

One type of phytoplankton (*Thalassiosira* sp., a diatom) species blooming in May, pictured under a microscope. These small algae typically grow in the spring throughout Puget Sound. (Source: Gabriela Hannach)

FOR MORE INFORMATION

- **King County Marine & Sediment Assessment Group:** http://green2.kingcounty.gov/marine
- **Download Water Column Data:** http://green2.kingcounty.gov/marine/Download
- **West Point Marine Monitoring:** http://www.kingcounty.gov/depts/dnrp/wtd/system/west/west-point-restoration/marine-monitoring.aspx
- **Wastewater Incidence Response:** http://kingcounty.gov/depts/dnrp/wtd/response/incident-response.aspx

Appendix: May, Part 1, Marine Water Quality Data

The following graphs and tables display data from the May 1st and 2nd and May 8th – 10th marine monitoring events. General water quality data are shown by site. For the offshore sites, parameters shown include water temperature, salinity, dissolved oxygen, relative chlorophyll fluorescence, total suspended solids, percent light transmission, nutrient concentrations, and fecal indicator bacteria. Nutrients include nitrate and nitrite, ammonia, orthophosphate, and silica water samples. Starting April 11th, nitrate concentrations were also measured through the water column from top to bottom with a Submersible Ultraviolet Nitrate Analyzer (SUNA). For this report, SUNA nitrate data are preliminary, and subsequent review may result in revisions to final data. For the beach sites sampled in the second half of the month, parameters shown include fecal indicator bacteria, nitrate and nitrite, and ammonia. For this sampling event, only bacteria data were collected for the weekly beach sites. For more explanation of parameters and sampling methods, see the marine monitoring program website: http://green2.kingcounty.gov/marine/

Description of station locators from the map on the first page (Figure 1) are given in the table below. Data from a subset of stations from the routine monitoring program are displayed to provide context for data collected near the West Point Treatment Plant and Treatment Plant Outfall. For more details on all monitoring stations, see the marine monitoring plan.

Table A-1. Sampling stations that include data in this summary report. The following data graphs and tables in the Appendix are from the stations highlighted in blue.

Offshore Stations

Locator	Description
JSUR01	Brightwater Treatment Plant Outfall
KSBP01	Point Jefferson
CK200P	Carkeek CSO Treatment Plant Outfall
KSSK02	West Point Treatment Plant Outfall
EBO	Emergency Bypass Outfall for West Point
LTBC43	Elliott West CSO Treatment Plant Outfall
LTED04	Central Elliott Bay
LTXQ01	Henderson/MLK CSO Treatment Plant Outfall
LSEP01	South Treatment Plant Outfall
LSKQ06	Alki CSO Treatment Plant Outfall
LSNT01	Mid-Passage between Fauntleroy/Vashon
LSVV01	Barton CSO Outfall
MSJN02	Vashon Treatment Plant Outfall
NSEX01	East Passage

Beach Stations

Locator	Description
ITCARKEEKP	Carkeek Park
KSLU03	Golden Gardens
KSSN04	West Point North, Discovery Park
KSSN05	West Point South, Discovery Park
LSHV01	Alki Beach
LSKS01	Constellation Park
KSYV02	Magnolia

Offshore Water Quality: KSSK02 – West Point Outfall

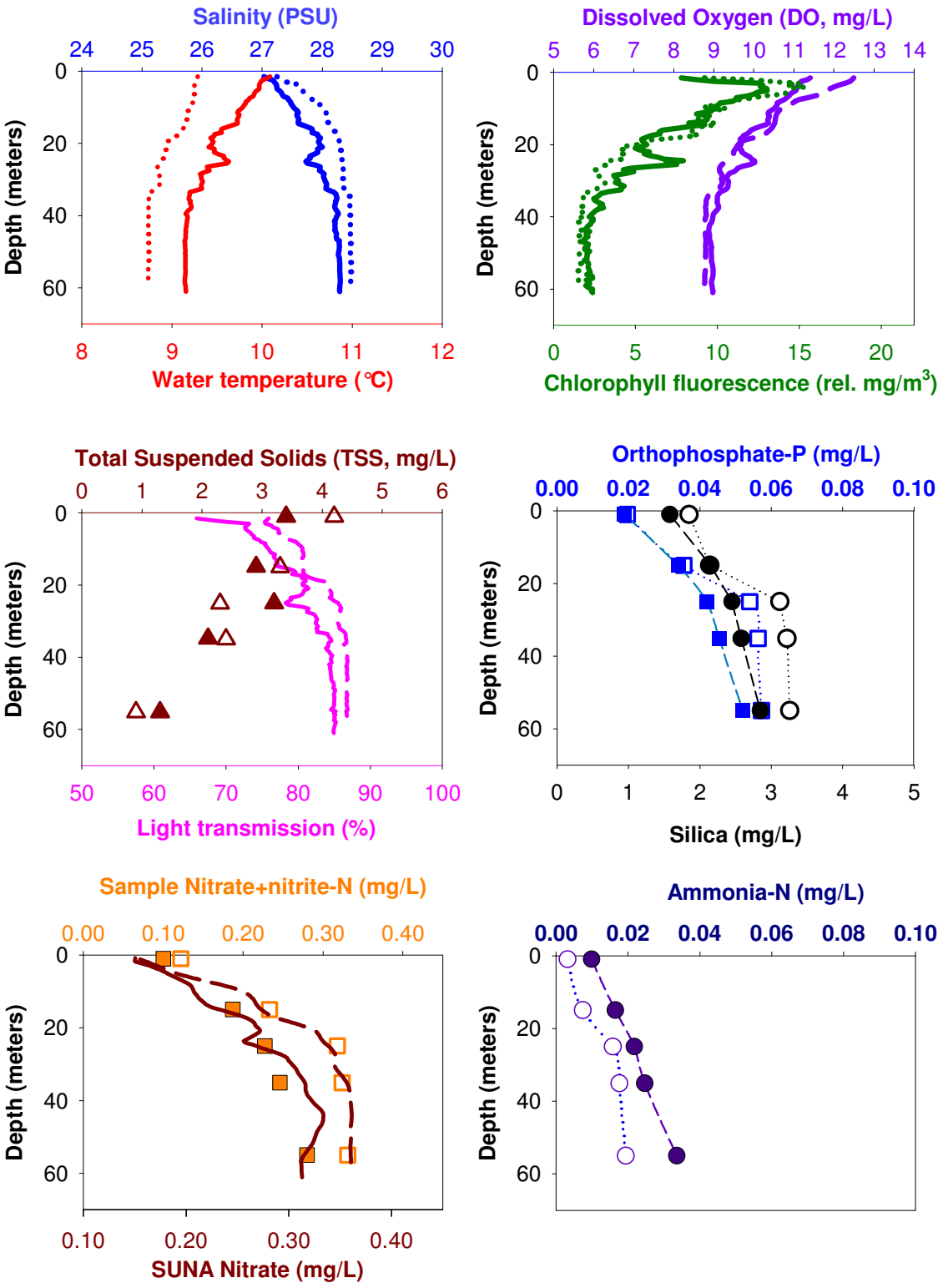

Figure A-1. Offshore water column profile (lines) and discrete water quality results (points) from the first two weeks of May 2017 at the West Point Outfall. Dashed lines and open symbols represent the May 1st/2nd sampling event and solid lines and solid symbols represent the May 10th sampling event. On the lower left plot, preliminary averaged SUNA nitrate data are shown with lines, while the water sample results (squares) are combined nitrate and nitrite concentrations.

Offshore Water Quality: KSBP01 – Point Jefferson

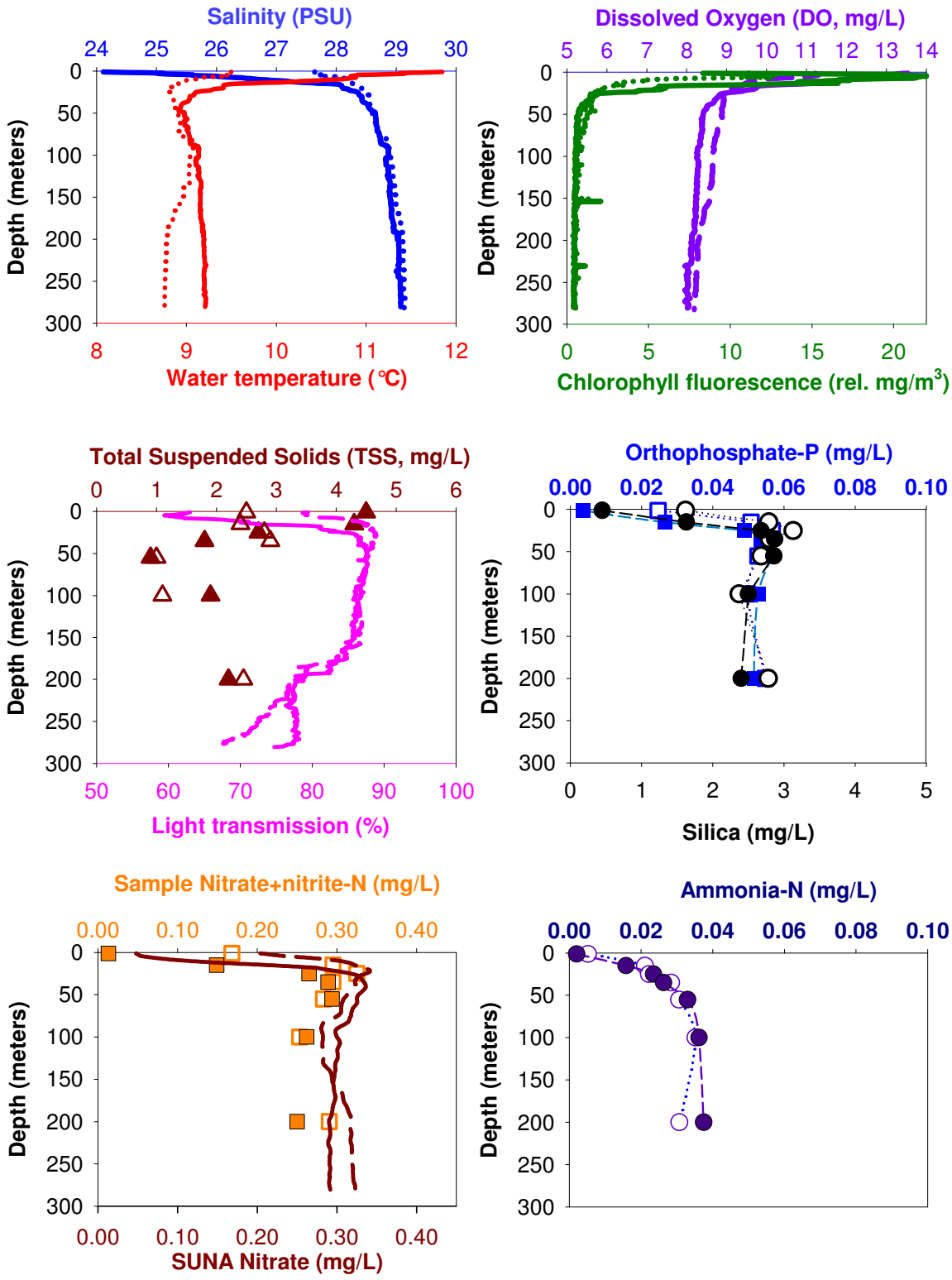

Figure A-2. Offshore water column profile (lines) and discrete water quality results (points) from the first two weeks of May 2017 at Point Jefferson. Dashed lines and open symbols represent the May 1st/2nd sampling event and solid lines and solid symbols represent the May 10th sampling event. On the lower left plot, preliminary averaged SUNA nitrate data are shown with lines, while the water sample results (squares) are combined nitrate and nitrite concentrations.

Offshore Water Quality: EBO – Emergency Bypass Outfall

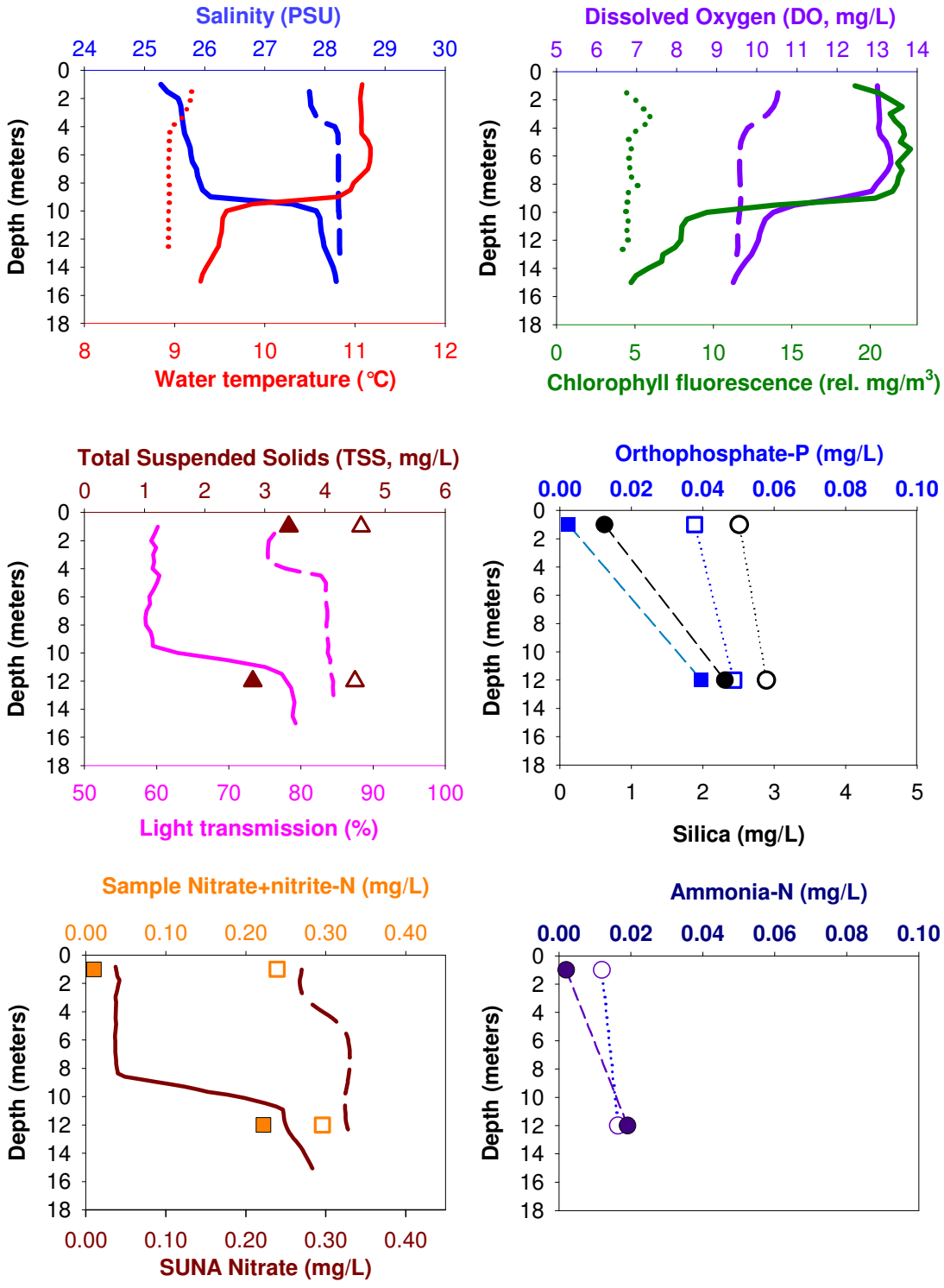

Figure A-3. Offshore water column profile (lines) and discrete water quality results (points) from the first two weeks of May 2017 at West Point's emergency bypass outfall. Dashed lines and open symbols represent the May 1st/2nd sampling event and solid lines and solid symbols represent the May 10th sampling event. On the lower left plot, preliminary averaged SUNA nitrate data are shown with lines, while the water sample results (squares) are combined nitrate and nitrite concentrations.

Offshore Water Quality: LSEP01 – South Plant Outfall

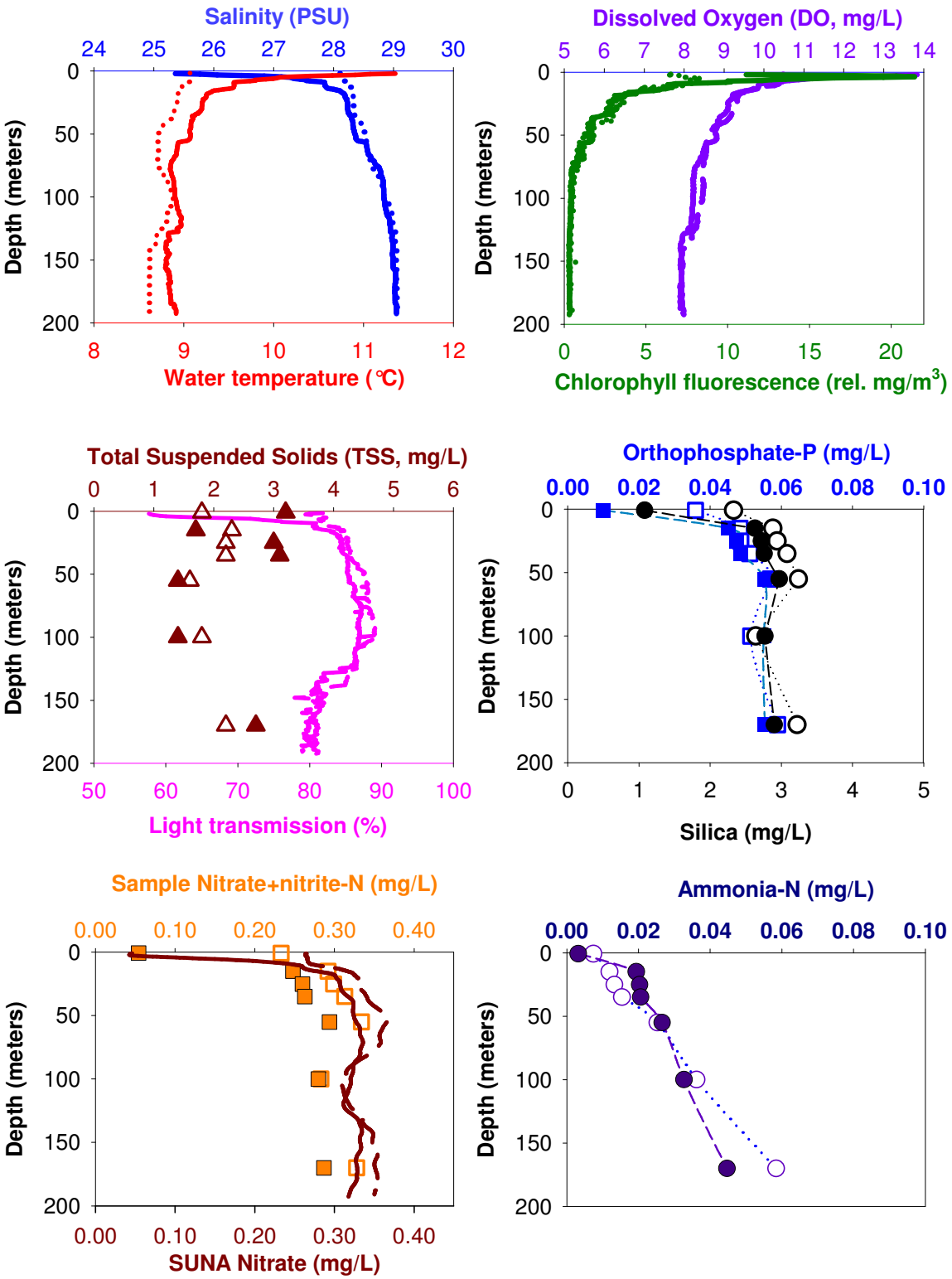

Figure A-4. Offshore water column profile (lines) and discrete water quality results (points) from the first two weeks of May 2017 at the South Plant Outfall. Dashed lines and open symbols represent the May 1st/2nd sampling event and solid lines and solid symbols represent the May 10th sampling event. On the lower left plot, preliminary averaged SUNA nitrate data are shown with lines, while the water sample results (squares) are combined nitrate and nitrite concentrations.

Offshore Water Quality: LSNT01 – Point Williams

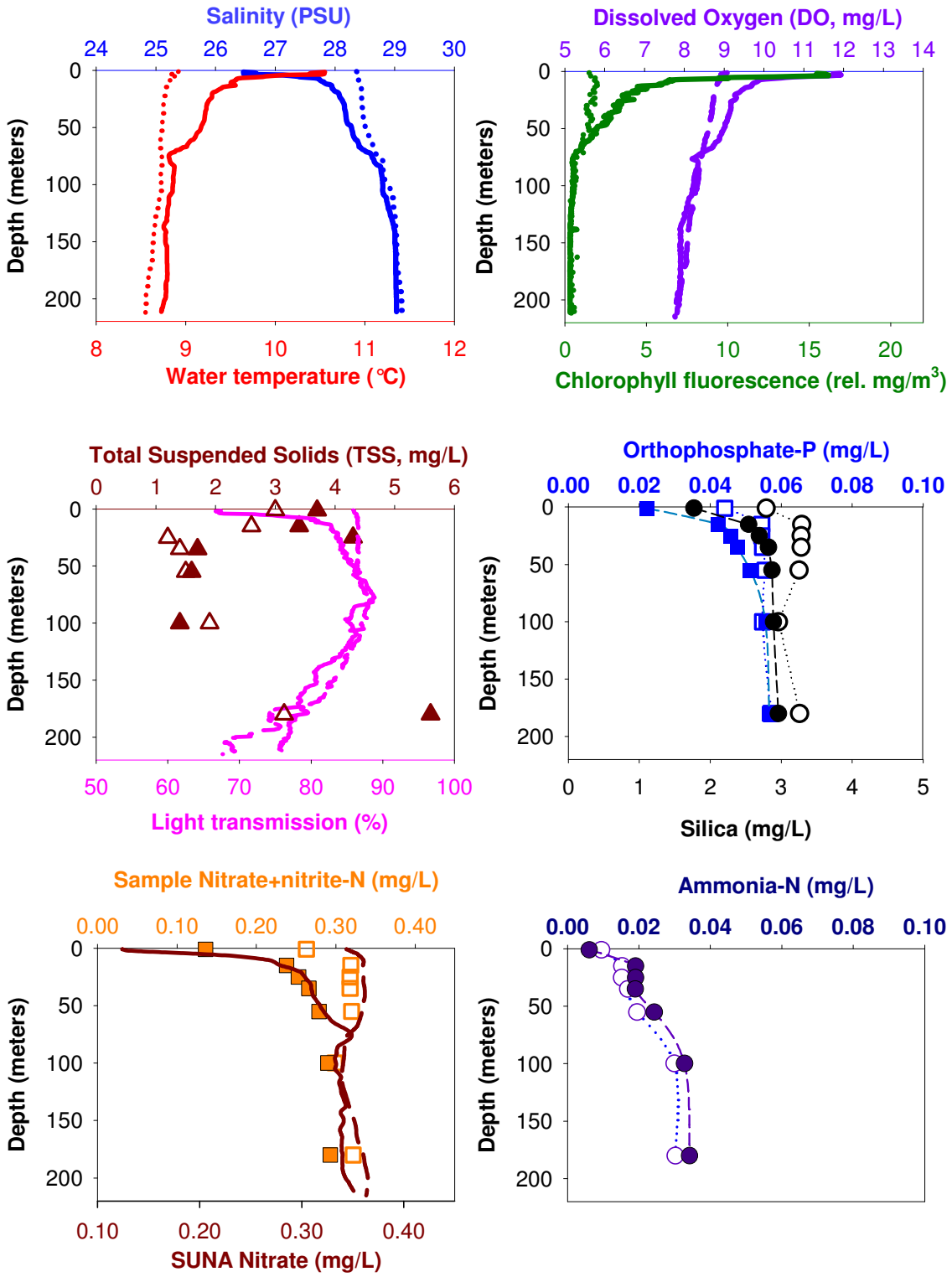

Figure A-5. Offshore water column profile (lines) and discrete water quality results (points) from the first two weeks of May 2017 at Point Williams. Dashed lines and open symbols represent the May 1st/2nd sampling event and solid lines and solid symbols represent the May 10th sampling event. On the lower left plot, preliminary averaged SUNA nitrate data are shown with lines, while the water sample results (squares) are combined nitrate and nitrite concentrations.

Offshore Water Quality: Other Interesting Results

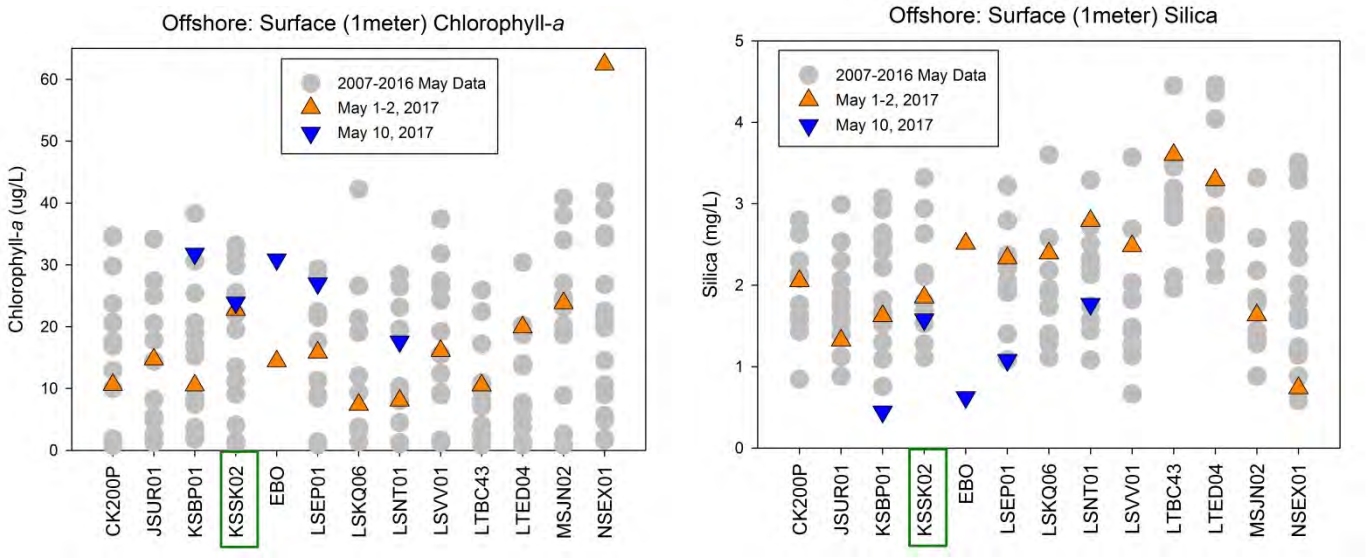

Figure A-6. Offshore surface water results for chlorophyll-*a* (on left) from the first two weeks in May 2017. Chlorophyll-*a* is a pigment present in phytoplankton and is used as an indicator of phytoplankton biomass. The high values indicate the presence of the spring phytoplankton bloom, particularly in the southern area of the Central Puget Sound Basin. Offshore surface water results for silica are shown on the right. The low values correspond with phytoplankton uptake.

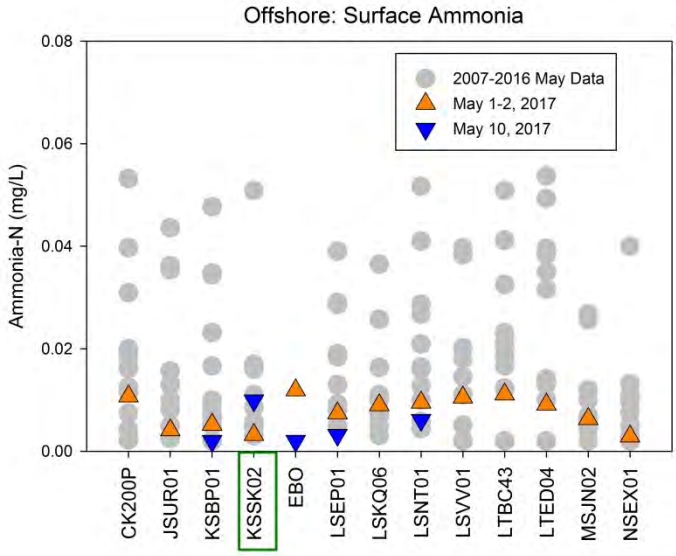

Figure A-7. Offshore surface water results for ammonia from the first two weeks in May 2017. The West Point outfall station is indicated by the green box.

Fecal Indicator Bacteria: Offshore and Beaches

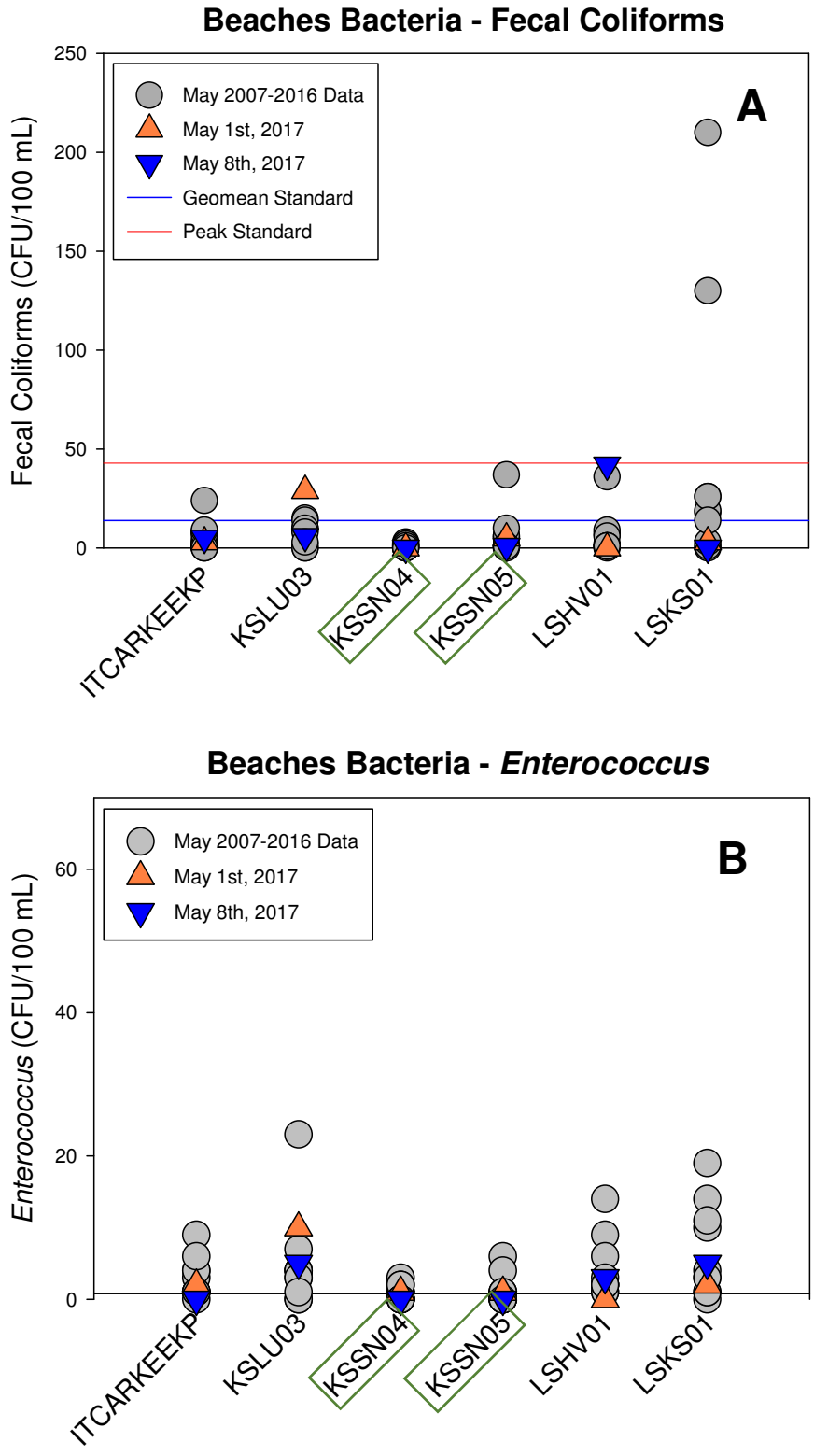

Figure A-8. Bacteria concentrations (**A.** Fecal coliforms; **B.** *Enterococcus*) of single samples collected at a subset of beach stations during the first two weeks of May 2017 sampling event are illustrated with historical bacteria concentrations. Although not appropriate to compare single samples to Washington State water quality criteria, the state's geometric mean and peak standards for primary contact recreational and shellfish harvesting uses are provided for reference. Note: KSSN04 and KSSN05, near the West Point outfall are highlighted.

Table A-2. Offshore fecal indicator bacteria concentrations at select monitoring sites during the first two weeks of May, 2017. Stations near West Point Treatment Plant Outfall are highlighted.

	Station	Date	Depth (m)	Fecal Coliform (CFU/100 mL)	*Enterococcus* (CFU/100 mL)
Offshore	KSBP01	5/1/2017	1.0	0	2
	KSSK02	5/1/2017	1.0	1	1
	KSSK02	5/1/2017	25.1	0	1
	KSSK02	5/1/2017	55.2	1	13
	EBO	5/1/2017	1.0	3	310
	EBO	5/1/2017	12.0	0	95
	LSEP01	5/2/2017	1.0	2	0
	LSEP01	5/2/2017	100.0	0	0
	LSEP01	5/2/2017	170.0	0	5
	LSNT01	5/2/2017	1.0	0	0
	KSBP01	5/10/2017	1.0	0	2
	KSSK02	5/10/2017	1.0	0	0
	KSSK02	5/10/2017	25.0	1	37
	KSSK02	5/10/2017	55.2	0	7
	EBO	5/10/2017	1.0	0	0
	EBO	5/10/2017	12.0	0	0
	LSEP01	5/10/2017	1.0	0	0
	LSEP01	5/10/2017	99.9	0	9
	LSEP01	5/10/2017	170.0	0	6
	LSNT01	5/10/2017	1.1	0	8
Beaches	ITCARKEEKP	5/1/2017	--	3	2
	KSLU03	5/1/2017	--	29	10
	KSSN04	5/1/2017	--	0	1
	KSSN05	5/1/2017	--	5	1
	LSHV01	5/1/2017	--	0	0
	LSKS01	5/1/2017	--	3	2
	ITCARKEEKP	5/8/2017	--	5	0
	KSLU03	5/8/2017	--	6	5
	KSSN04	5/8/2017	--	0	0
	KSSN05	5/8/2017	--	1	0
	LSHV01	5/8/2017	--	42	3
	LSKS01	5/8/2017	--	0	5