

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 March 17, 2017

OVERVIEW

As part of a long-term water quality monitoring program, King County monitors water quality at 12 offshore and 20 beach locations (see Figure 1), including stations near the West Point Treatment Plant main outfall, to provide and understanding of water quality within the Puget Sound Central Basin. The county maintains a long-term dataset, over 50 years at some locations, which provides insight into natural variation. This monitoring program and dataset forms 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.

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 reduced treatment at the West Point plant, the sampling frequency at a subset of four existing offshore monitoring stations will be increased to a weekly basis. In addition, a new site will be added at the emergency bypass outfall and also sampled on a weekly basis. This frequency and variety of biological, chemical, and physical conditions that are measured as indicators of water quality and ecosystem function for the County's marine water quality monitoring are sufficient to evaluate the most relevant water quality conditions that have the potential to result in any acute adverse effects to Puget Sound aquatic organisms. The most recent data results available from February 21st and 22nd are summarized for a subset of variables measured, and are provided below. More data results are available in the appendix.

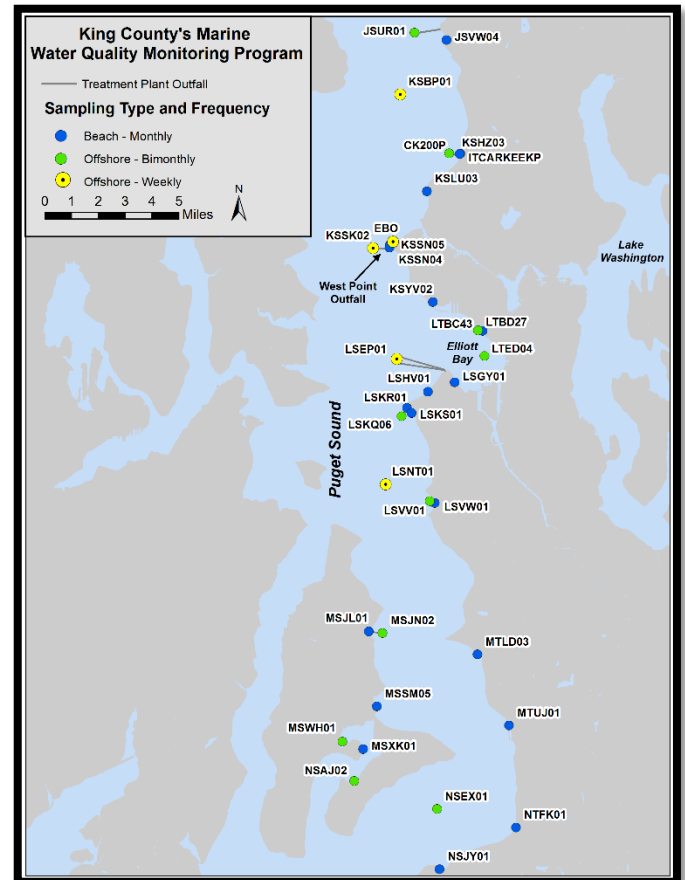


Figure 1. Map of King County's marine water quality monitoring stations.

BACTERIA

Fecal coliforms, along with *Enterococcus*, are a type of indicator bacteria that King County routinely monitors at freshwater and marine beaches, as well as offshore waters. 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 they can be 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 as a 14 colony forming unit/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 individual samples to the bacteria standards for reference indicates that concentrations of fecal coliforms from surface waters at all offshore stations, including KSSK02 off of West Point, were well below both geometric mean and peak standards during both sampling events in February (Figure 2). Sub-surface bacteria concentrations were all below state water quality criteria as well. Concentrations of fecal coliforms offshore at Carkeek Park (CK200P, Feb. 8th) and the South Plant Outfall (LSEP01, Feb. 22nd) slightly elevated above normal, although still below state water quality criteria.

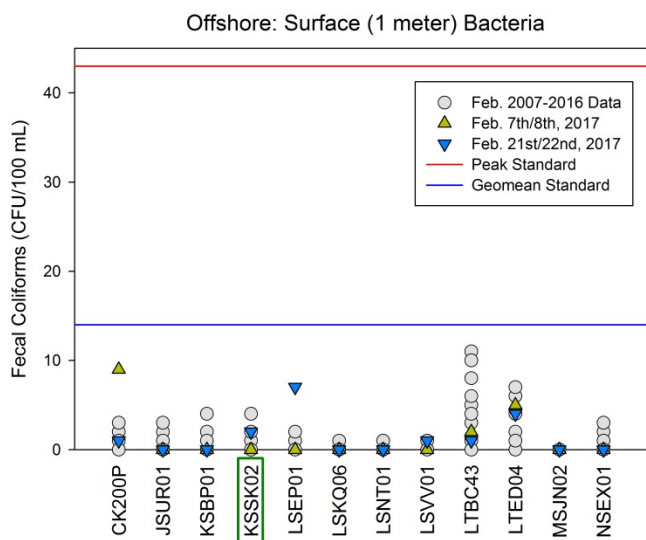


Figure 2. Bacteria concentrations of near surface (1 meter) samples at the offshore stations in Central Puget Sound during the February 2017 sampling events are shown with historical levels. Note: station KSSK02, West Point outfall, highlighted.

Immediately following the damage to West Point and subsequent bypasses of wastewater, fecal bacteria concentrations measured at beach stations near West Point were elevated and the County posted beaches for closure to water contact recreation. Data collected during the beach closures were regularly reported online, available at King County’s “Incident Response” website (see link below). Fecal bacteria concentrations declined over several days following a bypass on February 16th, and all beaches were re-opened on February 21st. Additional beach monitoring for the Marine Monitoring Program from February 21st and 22nd indicated that fecal bacteria levels at most stations were typical for February with low concentrations at the two stations at Discovery Park near West Point (see Appendix, Figure A-6). A slightly elevated

concentration was measured on February 22nd at Golden Gardens (KSLU03, north of West Point). However, based on low levels at this station on previous days indicates that it was unlikely to be associated with West Point discharges.

NUTRIENTS

Nutrients, such as nitrogen compounds (ammonia and nitrate) and orthophosphate, are essential elements for aquatic plants. Silica is a micronutrient needed by some microscopic plants (phytoplankton) 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.

Nutrients at all the offshore stations between February 21st and 22nd were within normal values based upon past February values. All ammonia values were low and well below the lowest (chronic) water quality criterion, which is based upon temperature, salinity, and pH factors (anticipated to be about 1.6 mg/L for the conditions in February).

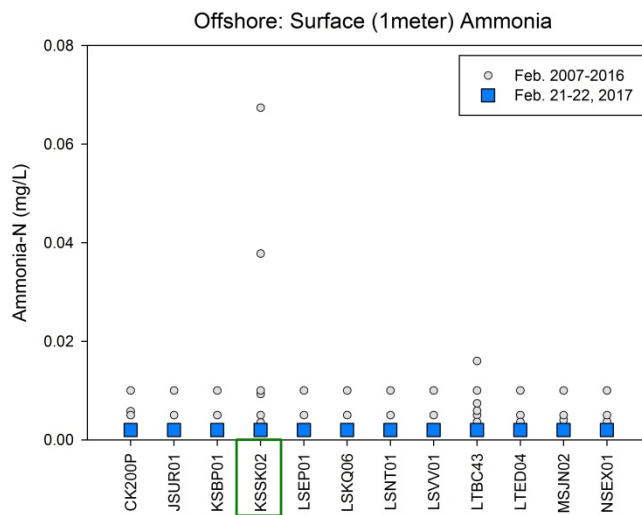


Figure 3. Ammonia concentrations in surface (1m) samples at offshore stations in Central Puget Sound during the February 2017 sampling events are shown with historical levels. Results with the same value are plotted on top of each other. Note: For samples where ammonia was not detected, the method detection limit value is shown. Detection limits have changed from 0.01 to the current 0.005 mg/L with laboratory advancements. Note: station KSSK02, West Point outfall, highlighted.

Both nitrate and orthophosphate were also within normal ranges for all sites. Surface silica values were high at all sites and highest at the West Pt. outfall and Elliott Bay stations, likely from the large amount of rain (surface salinities were low indicating the presence of freshwater)

that increased sediments to Puget Sound via rivers and streams (see Appendix, Figure A-5).

DISSOLVED OXYGEN

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

In deep waters in particular, it can be too dark for aquatic plants to live and is separated from surface mixing with the air, so processes like decomposition by bacteria can result in low dissolved oxygen. Human inputs of organic materials and decay of aquatic plants at depth may decrease oxygen levels. In addition, deep waters from the Pacific Ocean enter Puget Sound in the winter and spring, and can result in naturally occurring low dissolved 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 offshore sample data from February 21st and 22nd show typical conditions for February across King County's monitoring stations in Central Puget Sound, and all sites show near-bottom oxygen levels above the state water quality standard (Figure 4).

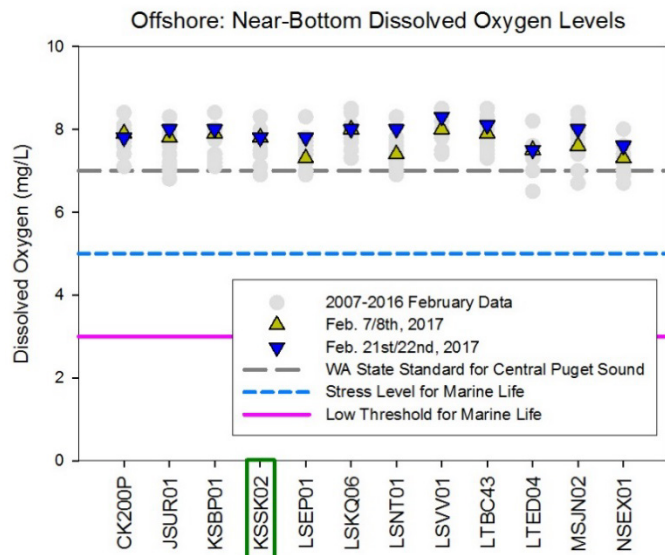


Figure 4. King County measures dissolved oxygen in the water column from top to bottom as an indicator of water quality. In Puget Sound, the lowest dissolved oxygen levels are typically found near the seafloor, so the near-bottom dissolved oxygen levels from the February 2017 sampling events are shown with historical levels. Note: station KSSK02, West Point outfall, highlighted in green.

SUMMARY

Water sample results collected between February 21st and 22nd, 2017 are summarized below. Additional results are provided in the Appendix.

- Concentrations of fecal coliforms at all offshore stations were low compared to water quality standards and similar to historical levels in February.
- Following initially elevated concentrations of bacteria at West Point and nearby beaches for several days after bypass discharges from West Point, bacteria levels at beach stations decreased to typical low levels based on historical February conditions.
- Ammonia was below detectable levels in surface waters at all sites and low throughout the water column.
- All nutrient results were within expected values with the exception of silica. Silica values in the surface layer were high at all sampling sites and highest at West Point and Elliott Bay in association with large rainfall and river freshwater flow into Puget Sound.
- Nutrients at beaches were within normal ranges.
- Near-bottom dissolved oxygen values were at healthy levels and all above the state water quality standard.

- Dissolved oxygen levels were high throughout the top and bottom of the water column, and reflect typical conditions for February.



King County's research vessel Sound Guardian conducting marine water sampling. (Photo by S. Jaeger)

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://edit.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: February 2017 Marine Water Quality Data

The following graphs and tables display data from February 2017 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. For the beach sites, parameters shown include fecal indicator bacteria, nitrate and nitrite, and ammonia. 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. Location of 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	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
KSYV02	Magnolia CSO
LSHV01	Alki Beach

Offshore Water Quality: KSSK02 – West Point Outfall

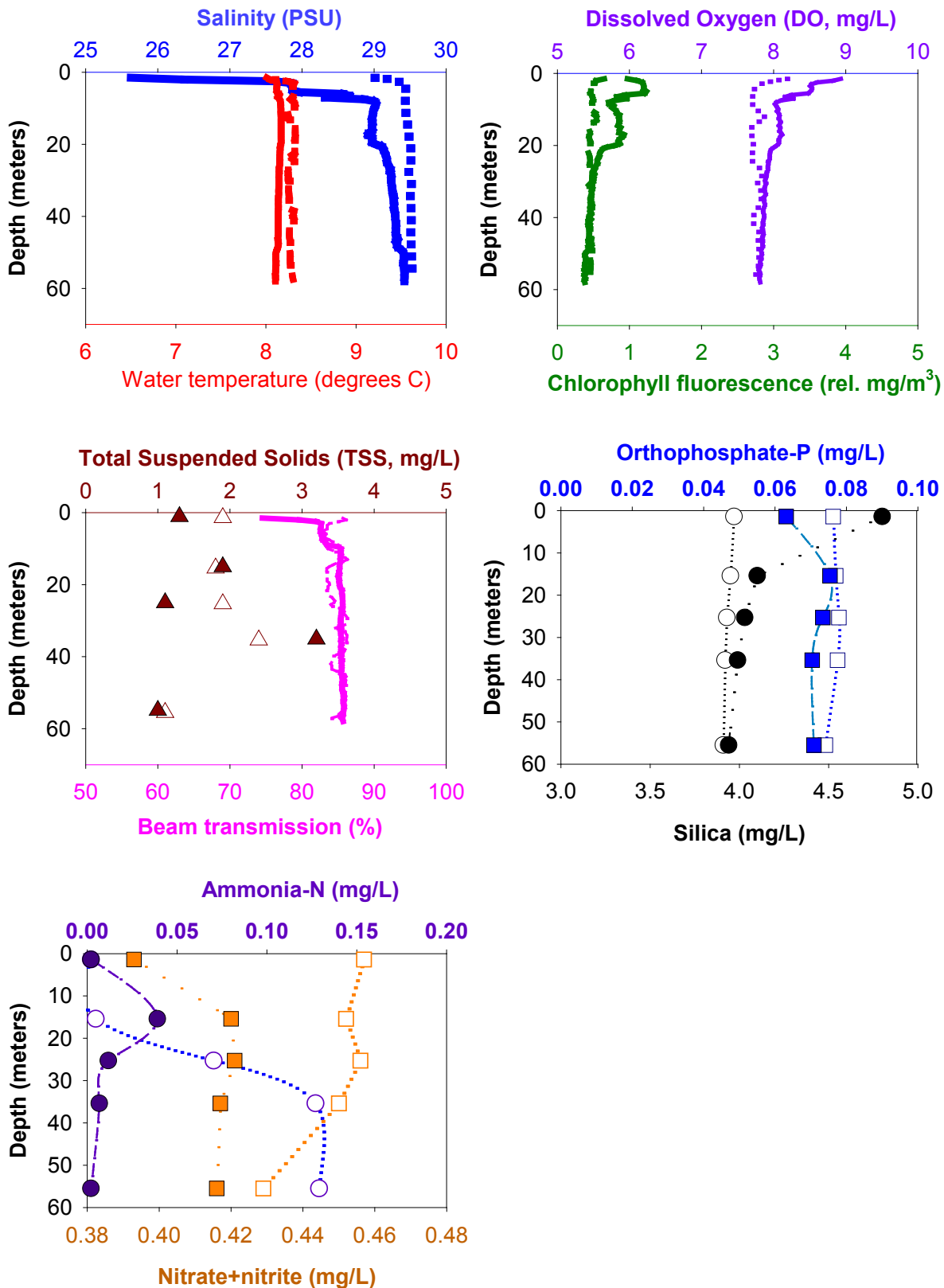


Figure A-1. Offshore water column profile (lines) and discrete water quality results (points) from February 2017 at the West Point Outfall. Dashed lines and open symbols represent the February 7th/8th sampling event and solid lines and solid symbols represent the February 21st/22nd sampling event.

Offshore Water Quality: KSBP01 – Point Jefferson

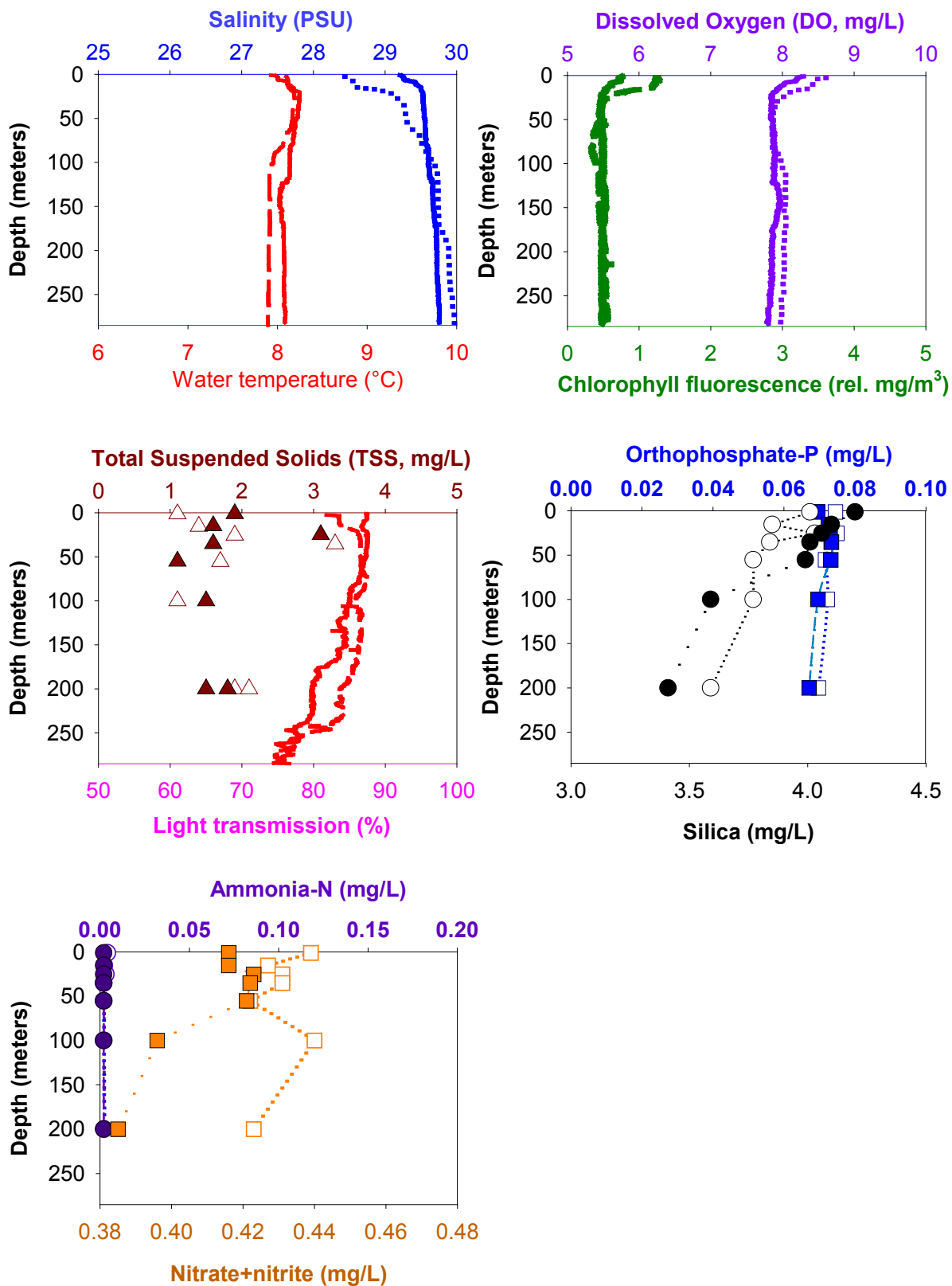


Figure A-2. Offshore water column profile (lines) and discrete water quality results (points) from February 2017 at the West Point Outfall. Dashed lines and open symbols represent the February 7th/8th sampling event and solid lines and solid symbols represent the February 21st/22nd sampling event.

Offshore Water Quality: EBO – Emergency Bypass Outfall

Data collected from the Emergency Bypass Outfall are not yet available. This station was first sampled on March 6th, 2017. Data from that sampling event will be reported in the next data summary.

Offshore Water Quality: LSEP01 – South Plant Outfall

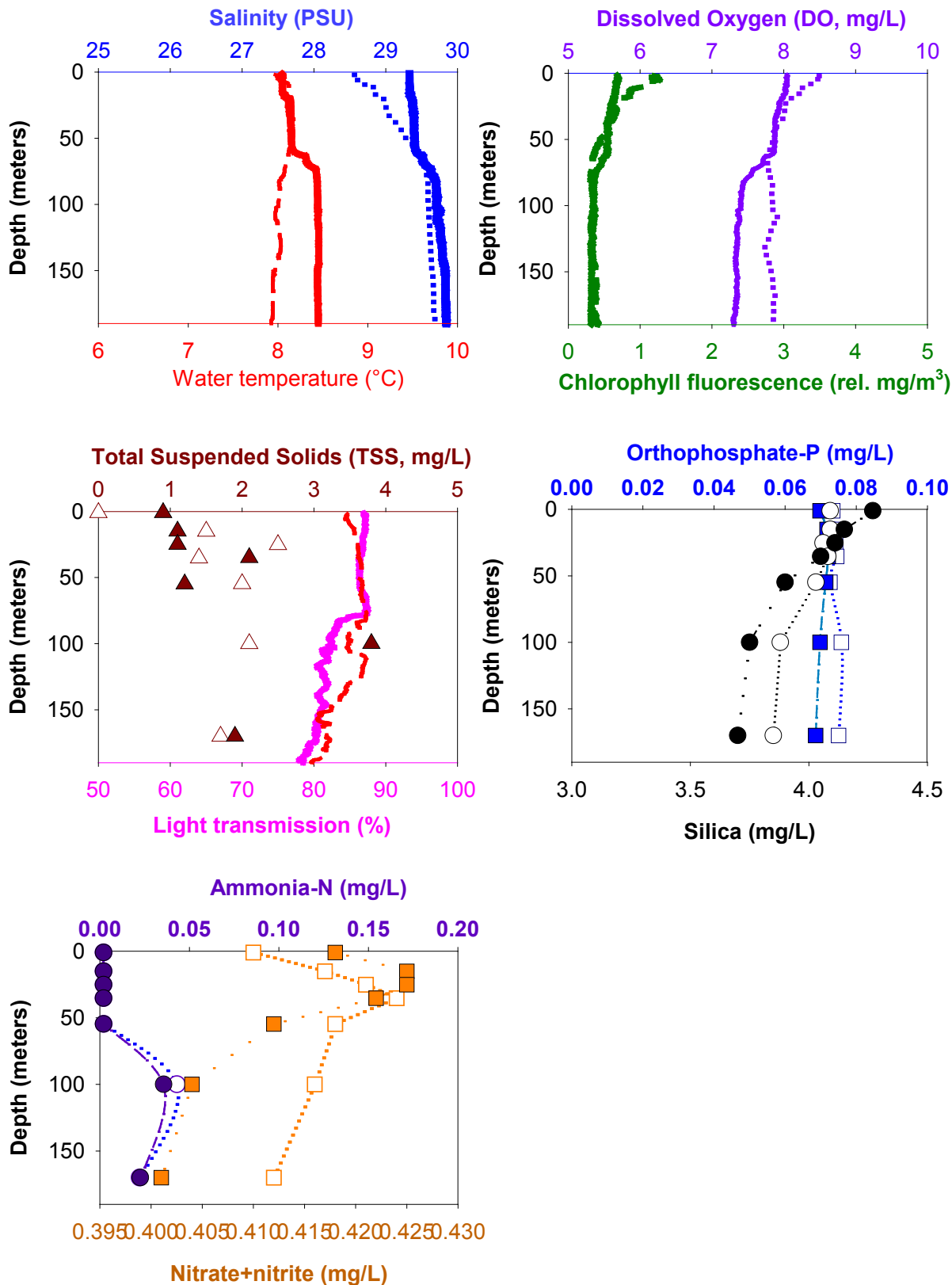


Figure A-3. Offshore water column profile (lines) and discrete water quality results (points) from February 2017 at the West Point Outfall. Dashed lines and open symbols represent the February 7th/8th sampling event and solid lines and solid symbols represent the February 21st/22nd sampling event.

Offshore Water Quality: LSNT01 – Point Williams

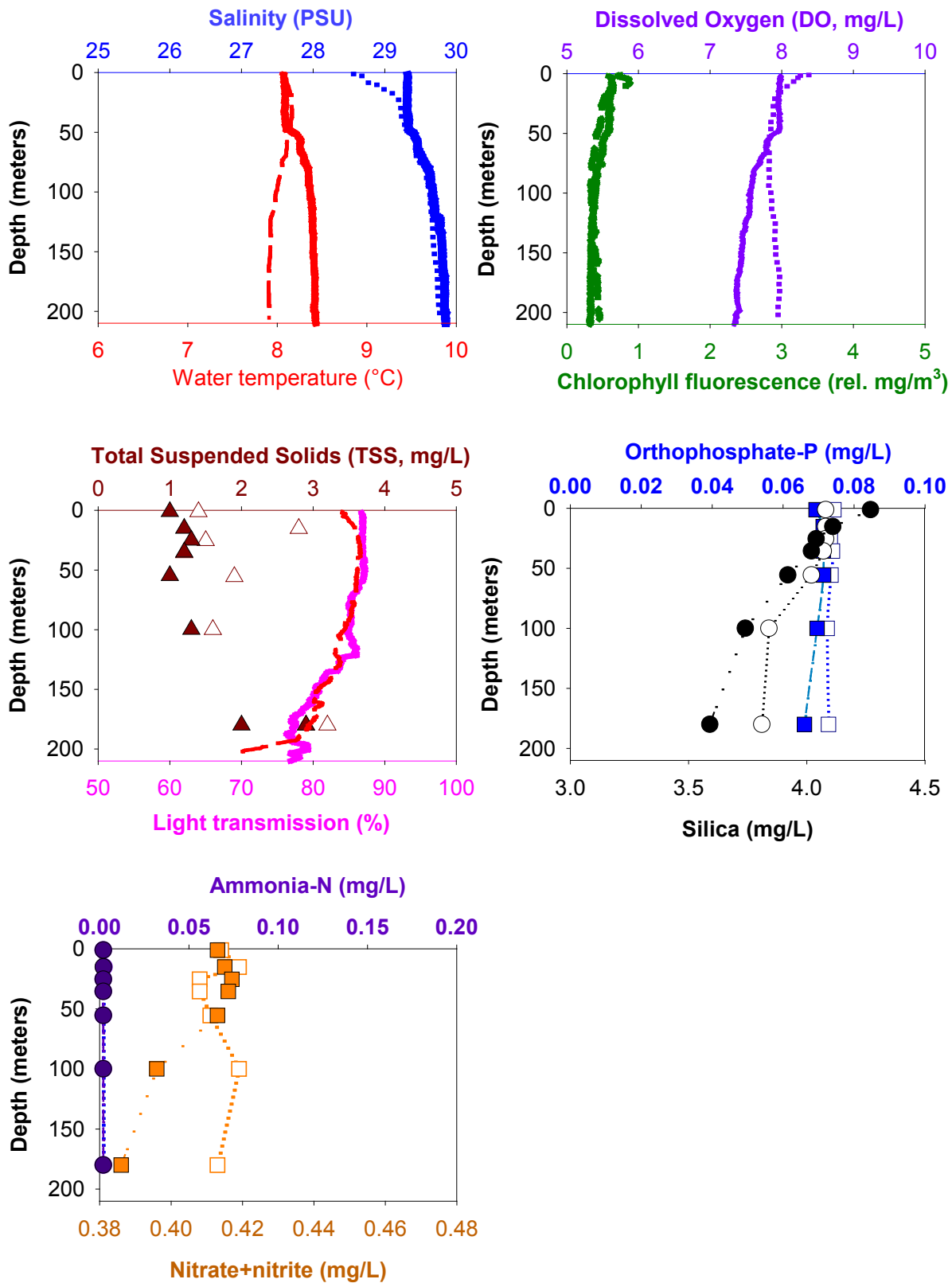


Figure A-4. Offshore water column profile (lines) and discrete water quality results (points) from February 2017 at the West Point Outfall. Dashed lines and open symbols represent the February 7th/8th sampling event and solid lines and solid symbols represent the February 21st/22nd sampling event.

Offshore Water Quality: Other Interesting Results

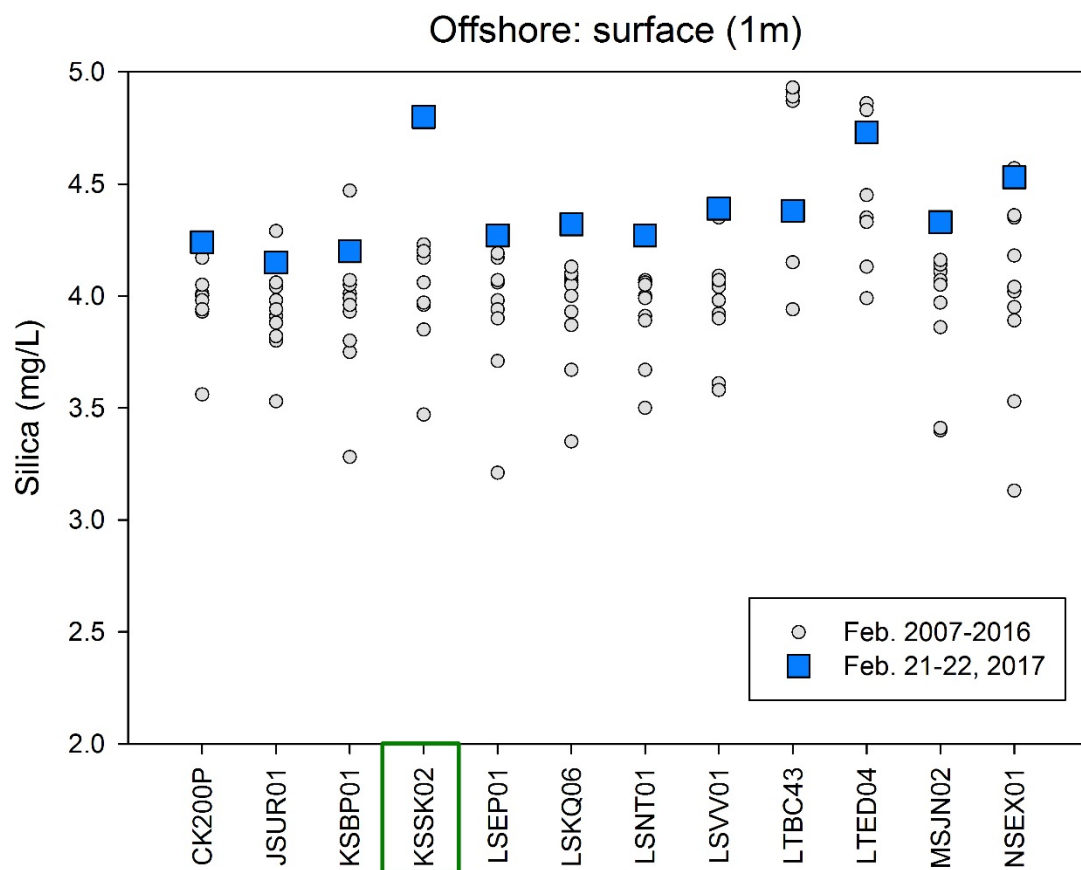


Figure A-5. Surface silica values for all offshore stations between February 21st and 22nd, 2017. Note high values for all stations.

Fecal Indicator Bacteria: Offshore and Beaches

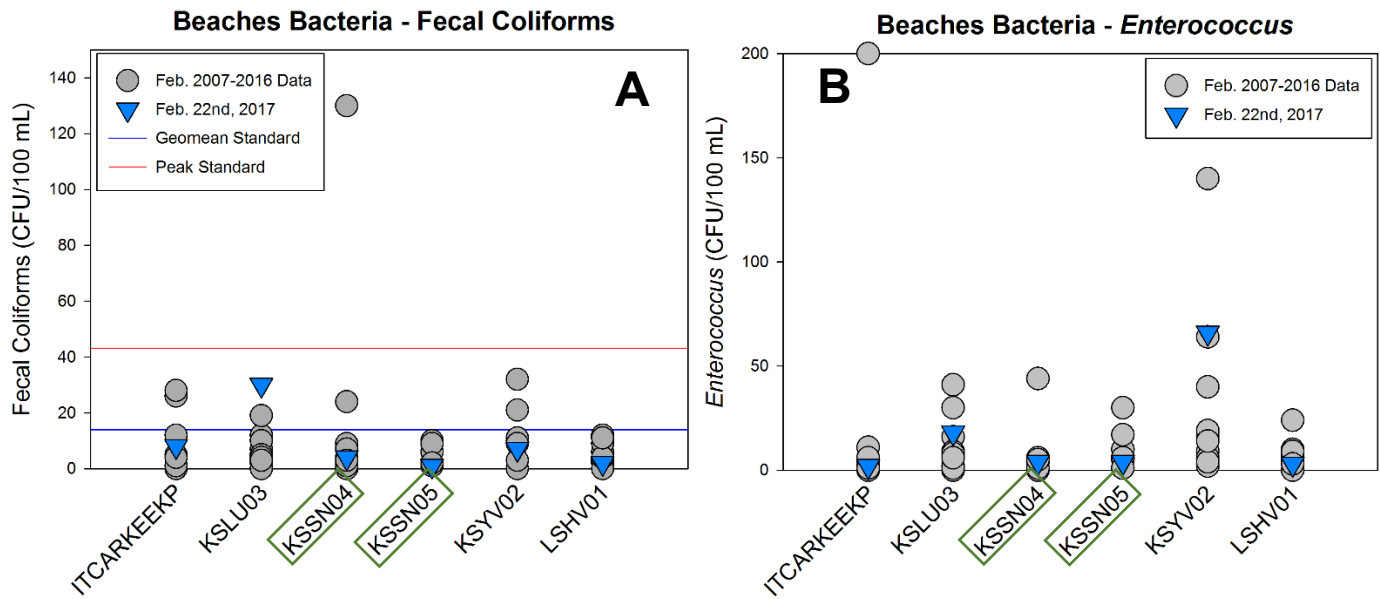


Figure A-6. Bacteria concentrations (**A.** Fecal coliforms; **B.** *Enterococcus*) of single samples collected at a subset of beach stations during the February 2017 sampling event are illustrated with historical bacteria concentrations. Although not appropriate to compare single samples to Washington 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. February offshore and beach fecal indicator bacteria concentrations at select monitoring sites. Stations near West Point Treatment Plant Outfall are highlighted.

	Station	Date	Depth	<i>Enterococcus</i> (CFU/100 mL)	Fecal Coliform (CFU/100 mL)
Offshore	KSBP01	2/8/2017	1.3	1	0
	KSSK02	2/8/2017	1.4	2	0
	KSSK02	2/8/2017	25.3	0	0
	KSSK02	2/8/2017	55.5	3	0
	LSEP01	2/7/2017	1	1	0
	LSEP01	2/7/2017	100	1	0
	LSEP01	2/7/2017	170	0	1
	LSNT01	2/7/2017	1.2	0	0
	KSBP01	2/21/2017	1	1	0
	KSSK02	2/21/2017	1.1	2	5
	KSSK02	2/21/2017	25	3	1
	KSSK02	2/21/2017	54.9	5	1
	LSEP01	2/22/2017	1	5	7
	LSEP01	2/22/2017	99.9	1	1
	LSEP01	2/22/2017	170	1	0
LSNT01	2/22/2017	1.1	0	0	
Beaches	ITCARKEEKP	2/22/2017	--	2	8
	KSLU03	2/22/2017	--	18	30
	KSSN04	2/22/2017	--	4	4
	KSSN05	2/22/2017	--	4	1
	KSYV02	2/22/2017	--	66	7
	LSHV01	2/22/2017	--	3	2

Beach Nutrients: Nitrate + Nitrite

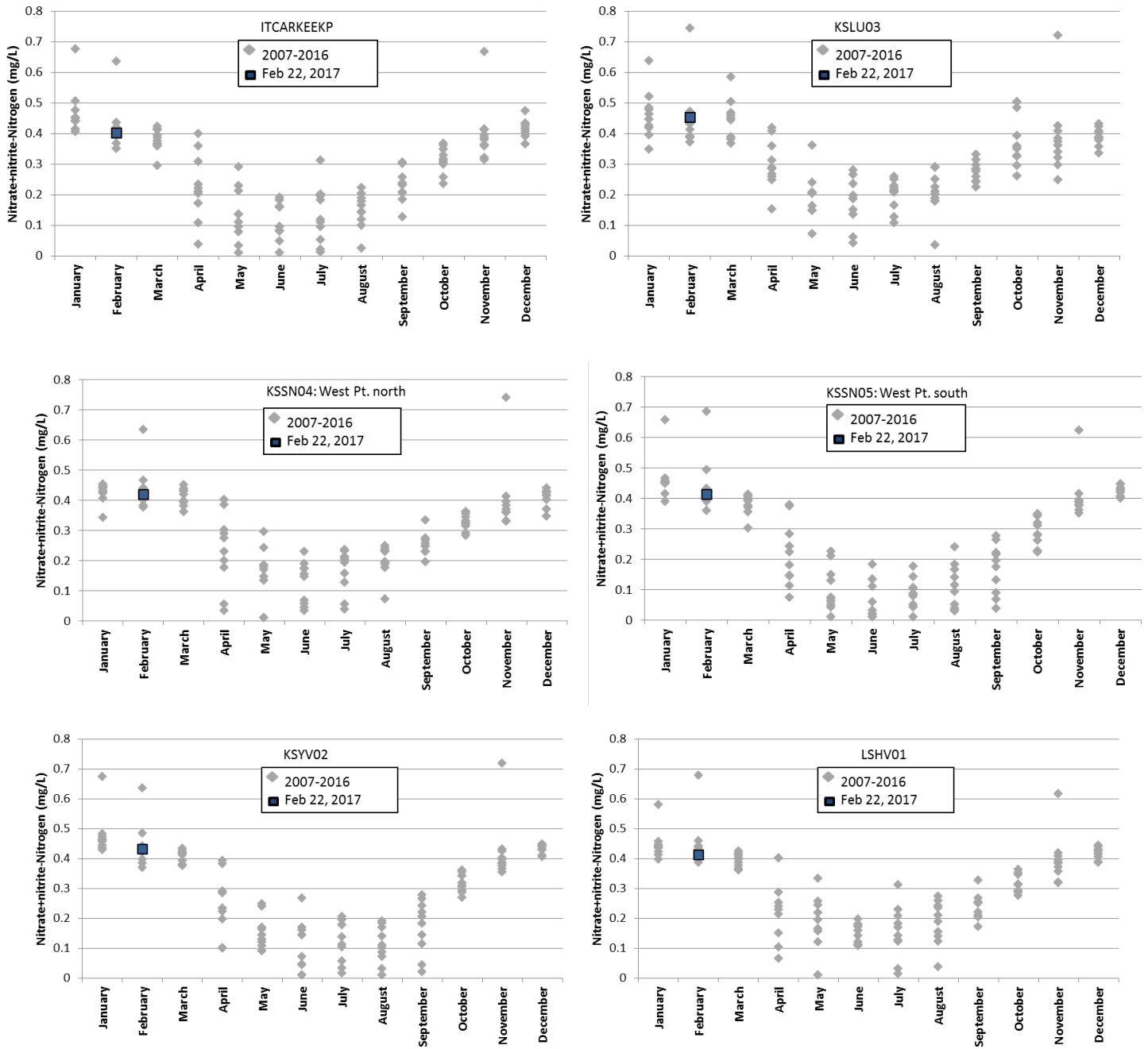


Figure A-7. Nitrate+nitrite values for six beach stations sampled on Feb 22, 2017 (blue squares) compared to historical values for February. Additional months are shown to indicate the yearly seasonal cycle and where the current month falls in that cycle.

Beach Nutrients: Ammonia

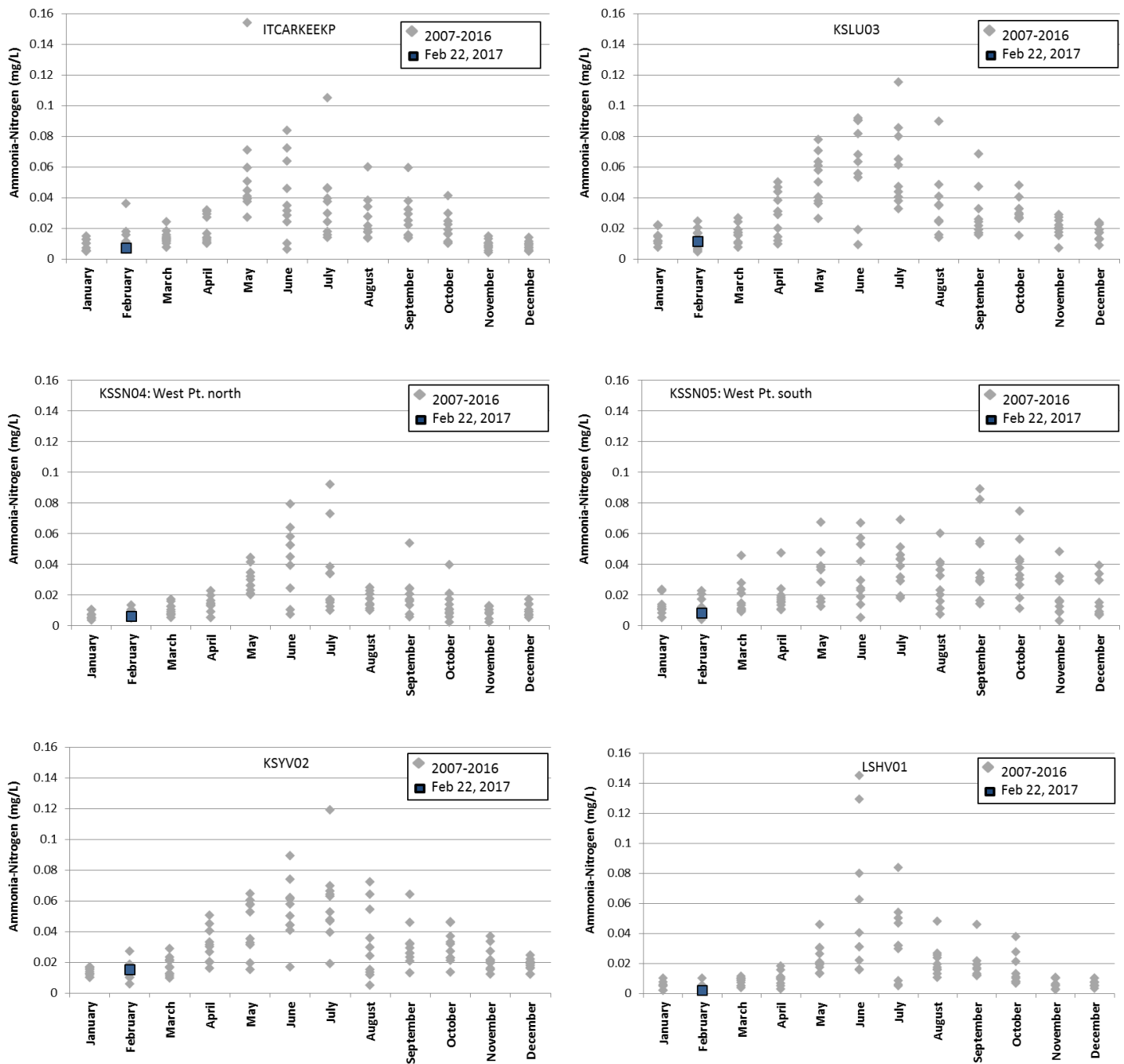


Figure A-8. Ammonia values for six beach stations sampled on Feb 22, 2017 (blue squares) compared to historical values for February. Additional months are shown to indicate the yearly seasonal cycle and where the current month falls in that cycle.