Sequim-Dungeness Clean Water District Pollution Identification & Correction Plan Trends Monitoring Program 2019 Annual Report

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Introduction

In 2001, Clallam County established a shellfish protection district named the Sequim-Dungeness Clean Water District (District, or CWD) by adopting Chapter 27.16 of Clallam County Code (CCC). A map of the CWD is in in Appendix A. The boundaries of the District include "The Dungeness Watershed and those waters influenced by it through the irrigation system, and other independent tributaries to the Strait of Juan de Fuca, from Bagley Creek east to and including the Sequim Bay Watershed." (The boundaries of the District generally coincide with the boundaries of Clallam County's Marine Recovery Area, or MRA, where the County is also required to implement an enhanced Onsite Sewage Management Plan under RCW 70.118A).

State law (RCW 90.72) directs formation of shellfish protection districts where nonpoint pollution threatens water quality "…upon which the continuation or restoration of shellfish farming or harvesting is dependent." By 1997 water quality monitoring had begun to show increasing bacterial pollution in and around Dungeness Bay. In 2000, 2001, and 2003, the Washington State Department of Health downgraded portions of the Dungeness Bay shellfish growing area due to bacterial pollution understood to stem from nonpoint sources within the watershed.

In May 2015, Clallam County Environmental Health, with the assistance of staff and volunteers from Streamkeepers of Clallam County, initiated a Baseline Trends Monitoring Program to track surface water quality in the Sequim-Dungeness Clean Water District. The Pollution Identification & Correction Plan called for this effort for the Sequim Bay-Dungeness Watershed Clean Water District (PIC Plan). Created by PIC Project Partners for the District in 2014, the PIC Plan is one element of the shellfish downgrade response plan for the Sequim-Dungeness Clean Water District. The Baseline Trends Monitoring study area includes major freshwater drainages within the District.

This is the fifth annual PIC Trends Monitoring Report, covering calendar year 2019. The information gathered through PIC Trends Monitoring, and presented in annual reports, helps guide Pollution Identification and Correction activities within the Clean Water District.

Water quality in Dungeness Bay appears to be improving with shellfish growing area upgrades in 2011, 2015, and 2016. Over the years, stakeholders have collaborated and conducted Total Maximum Daily Load (TMDL) studies, created a water cleanup plan, and implemented an onsite septic management plan for the county, amongst other things. As a corollary, minor shellfish growing area upgrades in Sequim Bay may soon lead to increased public access to recreational shellfish harvest.

Sampling Approach and Results

The objective of the Baseline Trends Monitoring Program is to consistently monitor long-term water quality in order to evaluate trends at or near the mouths of waterways throughout the Clean Water District. This information helps prioritize waterways for further targeted investigation and eventual pollution cleanup as described in the PIC Plan. Further, trends monitoring builds upon at least two decades of prior water quality studies. As in past investigations, we focused on water quality parameters associated with human sewage and animal waste such as fecal coliforms and nutrients.

Sampling locations were selected as close to the discharge points of the streams as practical given ownership, access, and tidal conditions. Twelve streams were designated Tier 1 sites and nine streams were designated Tier 2 sites. Tier 1 sites were sampled monthly for both fecal coliforms (fecal or FC) and nutrients (nitrate-nitrogen, nitrite-nitrogen, ammonia-nitrogen/NH3), phosphate-phosphorous, silicate-silica, total nitrogen, and total phosphate). Tier 2 sites were sampled quarterly (January, April, August, November) for fecal coliforms only.

In addition to bacteria and nutrients sampling, water temperature, and salinity data were recorded at all sample sites. Table 1 describes sites and sampling conducted while Figures 1-3 show sample site locations.

Barometric pressure, dissolved oxygen, pH, specific conductance, and turbidity data are readily recorded alongside standard in-situ measurements with a YSI Pro-DSS multi-parameter water quality meter. Stream stage is recorded where appropriate reference points exist and meters present on the Dungeness River and McDonald Creek provide readily accessible discharge data. This data is not presented in its entirety in this report, but all data produced from this project is available from the Clallam County Water Resources Database (http://www.clallam.net/SK/watersheds.html). Data collection not specifically called for in the Pollution Identification and Correction Quality Assurance Project Plan (QAPP) is performed following the Streamkeepers Program QAPP (Chadd et al. 2017a).

Table 1: Site locations and type of sampling performed from January 2019 through December 2019. Tier 1 sites were sampled monthly for fecal coliforms (F) and nutrients (N). Tier 2 sites were sampled quarterly for fecal coliforms only. Water temperature and salinity data were collected at all sites on every visit. Dung. Bay/R. = Dungeness Bay/River. Seq. Bay = Sequim Bay. SJF = Strait of Juan de Fuca.

	Stream/Site Name	Receiving Waters	Jan-19	Feb-19	Mar-19	Apr-19	May-19	Jun-19	Jul-19	Aug-19	Sep-19	Oct-19	Nov-19	Dec-19
Tier 1 Streams	Dungeness 0.7	Dung.Bay	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
	Meadowbrook 0.2	Dung.Bay	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
	Meadowbrook Slough 0.23	Dung.Bay	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
	Golden Sands Slough 0.0	Dung.Bay	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
	Cooper 0.1	Dung.Bay	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
	Cassalery 0.0/0.6 (Tide Dependent)	Dung.Bay	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
	Matriotti 0.3a	Dung. R.	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
	Lotzgesell 0.1	Dung. R.	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
	Sequim Bay State Park Creek 0.0/0.1 (Tide Dependent)	Seq. Bay	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
	Bell 0.2	Seq. Bay	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
	Johnson 0.0	Seq. Bay	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
	Jimmycomelately 0.15	Seq. Bay	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N	F N
Tier 2 Streams	Bagley 0.7a	SJF	F			F				F			F	
	Siebert 1.0	SJF	F			F				F			F	
	Agnew Creek/Ditch 0.3	SJF	F			F				F			F	
	McDonald 01.6	SJF	F			F				F			F	
	Hurd 0.2	Dung. R.	F			F				F			F	
	Gierin 1.8	Dung.Bay	F			F				F			F	
	Dean 0.17	Seq. Bay	*			F				*			*	
	No Name 0.03	Seq. Bay	F			F				F			F	
	Chicken Coop 0.24	Seq. Bay	F			F				F			F	

* No access at Dean Creek during January, August, or November quarterly monitoring tours due to bridge failure.

Figure 1: PIC Baseline Trends Monitoring sample sites, Dungeness Bay area (Washington State Department of Ecology real-time flow meter located at Dungeness 0.8)
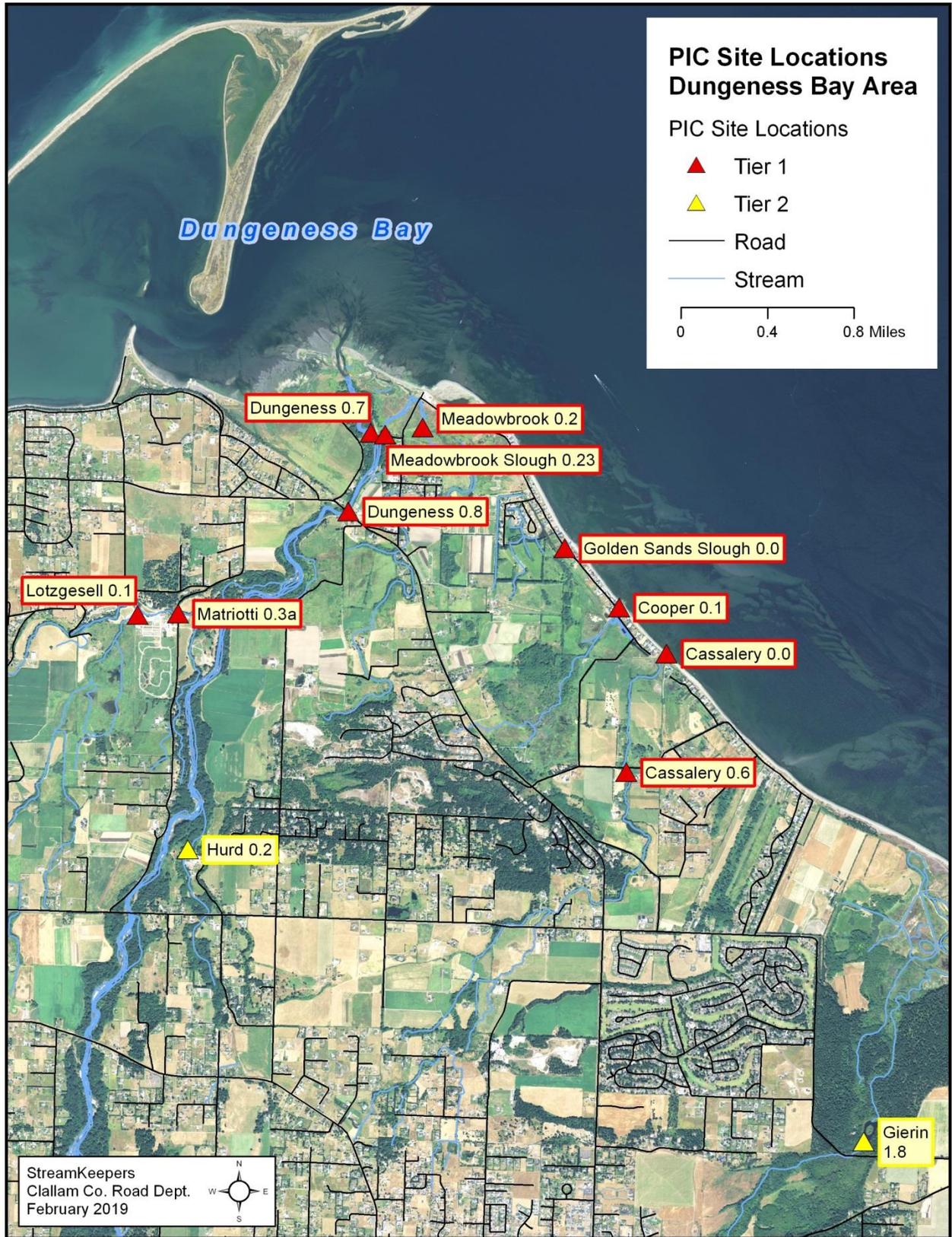
Figure 2: PIC Baseline Trends Monitoring sample sites, Sequim Bay area
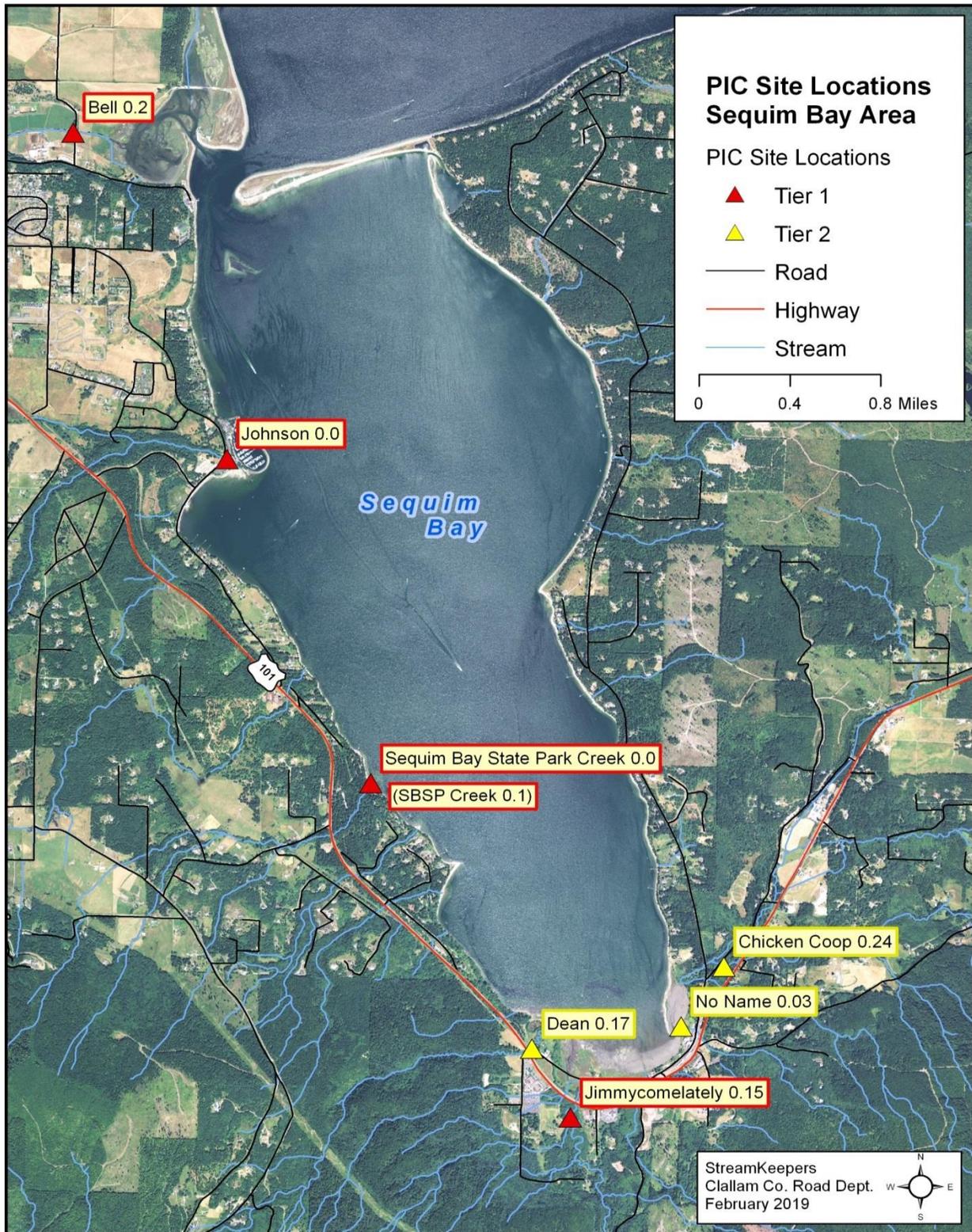
Figure 3: PIC Baseline Trends Monitoring sample sites, waters west of Dungeness Bay
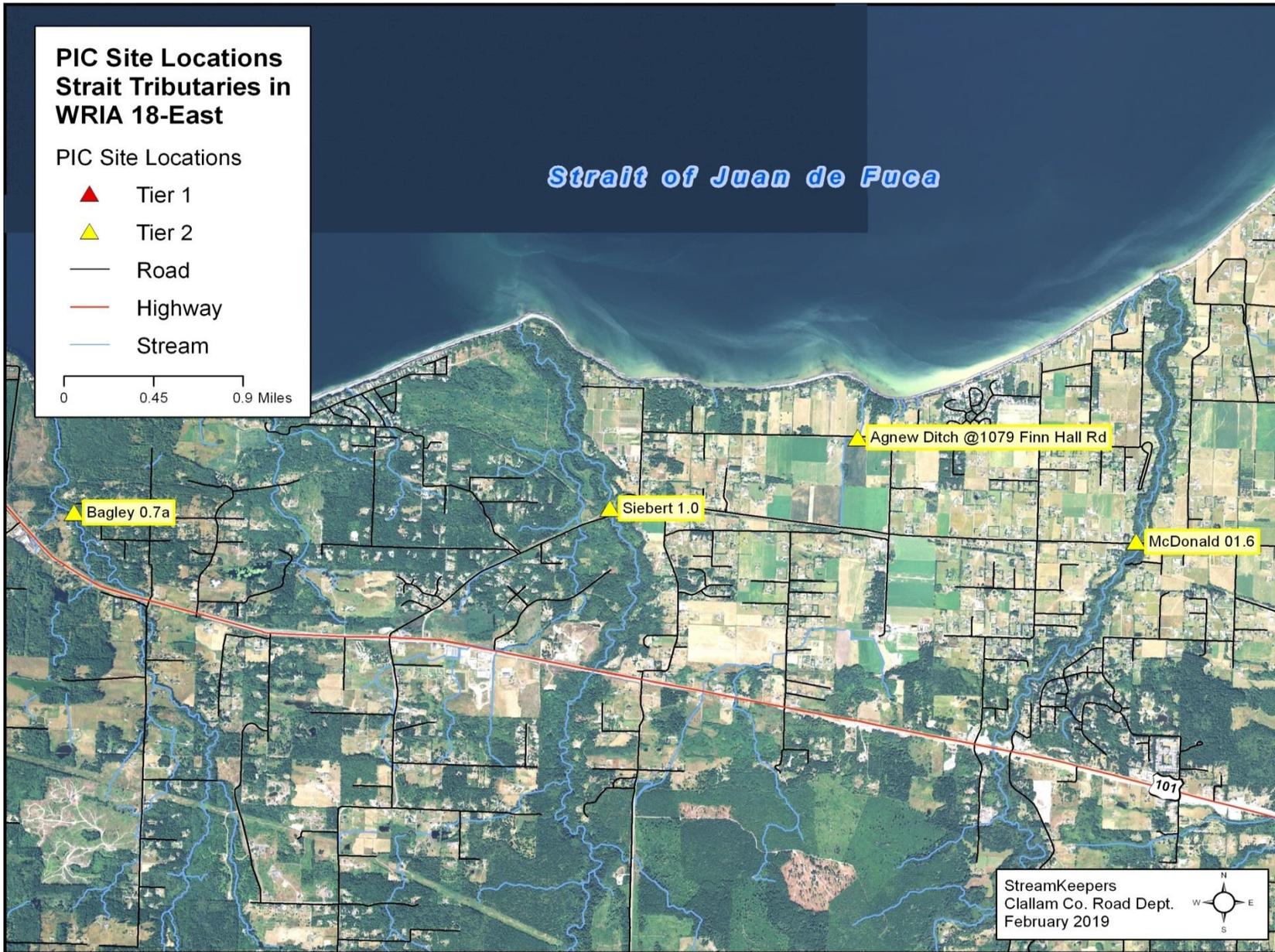
Data Caveats

- Data qualifiers used are per Washington State Department of Ecology's (Ecology) Environmental Information Management (EIM) system.
- Rejected (REJ) data are not used in our analyses.
- Field replicates were averaged with primary samples.
- Field blanks were recorded and used for quality assurance (QA)/quality control (QC) analyses but were not used in this report to generate statistics or figures.
- Some sites are tidally influenced, as can be seen in the salinity data presented below. The sampling procedure dictates sampling during low-tide conditions, but this is not always possible. Alternate sites were sampled at Cassalery Creek and Sequim Bay State Park when tides prohibited collection of freshwater observations at the primary sample sites due to the lack of accessibility or impacts marine water has on the quality of the sample.

Data Quality Analysis

Various data quality analyses helped PIC Project Partners decide where Measurement Quality Objectives (MQO) had been met.

Blanks Analysis—Fecal Coliforms

In general, one fecal coliform field blank is prepared each sampling tour. From January 2019 through December 2019, all fecal coliform field blanks were "non-detects." This would indicate proper handling of grab samples, as no fecal coliform data were rejected due to blanks anaylsis. All field blanks were qualified "U" since the analyte was not detected at or above the reported result.

In addition to field blanks, the Clallam County Water Laboratory prepares and analyzes a lab blank 1) before running samples, 2) after every ten samples, and 3) after running all samples. Lab blank results are not reported to the PIC Baseline Trends Monitoring Program. Rather, these blanks serve as an internal control for the laboratory. For the period of this report no fecal coliform data were rejected or qualified due to laboratory blanks. Clallam County Environmental Health Laboratory is accredited by Ecology and follows Membrane Filter Standardized Method SM9222D.

Blanks Analysis—Nutrients

At least one nutrient field blank (FB) is prepared for each PIC Basleline Trends Monitoring tour. Table 2 summarizes nutrient field blank results. UW Marine Chemistry Laboratory provides annual Minimum Detection Limits (MDL). Synthesized Reporting Limit (RL) is calculated as the larger of 3.18 * Annual MDL *or* FB mean + 1 Standard Deviation (SD), per Chadd et al. 2017a. For 2019, reporting limit was determined in all cases using 3.18 * MDL as this value consistently exceeded FB mean + 1 SD.

For 2019, the reporting limits continue to be defined by the MDLs multiplied by the factor 3.18, as previously recommended by Ecology. The fraction of field blanks exceeding the reporting limit is <5% since April 2018. November 2019 field blanks were above the reporting limit, but field issues were corrected by the subsequent monitoring event.

Beyond field blanks, UW Marine Chemistry Laboratory internal QA/QC involves nutrient lab blank preparation and analysis. These analyses are not presented here, as the lab only reports data that have passed internal controls. To date, laboratory nutrient blanks have never prompted data qualification or corrective action.

Table 2: Nutrients field blank (FB) results and synthetic reporting limit (RL) calculations (All values in [μg/L]. Field blank outliers were excluded from mean, standard deviation (SD), and RL calculations.)

Arrival date	[PO$_4$-P]	[SiO$_4$-Si]	[NO$_3$-N]	[NO$_2$-N]	[NH$_4$-N]	TP	TN	
7-Jan-19	0.5	4.1	0.5	0.0	5.2	4.7	3.4	
26-Feb-19	0.7	9.6	0.0	0.0	0.7	0.6	16.7	
12-Mar-19	1.5	11.6	0.9	0.0	0.2	1.5	32.0	
15-Apr-19	0.0	11.5	0.1	0.0	1.3	0.8	51.5	
14-May-19	0.4	7.4	0.4	0.05	1.0	2.9	78.0	
11-Jun-19	0.1	5.6	0.3	0.0	0.0	1.5	20.4	
9-Jul-19	0.1	3.8	0.6	0.0	1.1	0.0	15.2	
12-Aug-19	0.4	14.4	0.2	0.06	0.5	0.9	22.9	
10-Sep-19	0.4	14.4	0.7	0.0	1.3	1.1	74.3	
8-Oct-19	0.6	13.6	0.4	0.0	6.7	0.6	60.6	
12-Nov-19	36.4	20.4	0.4	0.0	0.8	28.1	24.9	
10-Dec-19	1.4	0.0	0.3	0.0	5.4	4.1	132.4	
2019 MDL	0.5	9.3	13.4	1.0	4.9	1.1	27.6	
3.18 * MDL	1.6	29.6	42.6	3.2	15.6	3.5	87.8	From QAPP
2019 RL per QAPP	**1.6**	**29.6**	**42.6**	**3.2**	**15.6**	**3.5**	**87.8**	
# of FB > RL, 2018	0	1	0	0	1	0	0	
# of FB > RL, 2019	1	0	0	0	0	3	1	
Total FB > RL (all)	**1**	**1**	**0**	**0**	**1**	**3**	**1**	**7**
% FB > RL	**4.8%**	**4.8%**	**0.0%**	**0.0%**	**4.8%**	**14.3%**	**4.8%**	**4.8%**

*Field blanks (FB) greater than RL are shaded in pink.

Field Replicate Analysis—Fecal Coliforms

Field replicates of fecal coliform grab samples are collected at the rate of one for every 5% of sites or at least one per sampling event. Field replicates help assess precision and confidence in sampling procedures.

Primary samples and replicates from each sampling event are compared in terms of relative standard deviation (RSD). In general, Clallam County Water Laboratory analyzes the field replicate and a laboratory duplicate of the field replicate; the mean of these two values is reported as "replicate" in Table 3, below.

QAPP section 6.2 describes the desired level of agreement between qualifying pairs of primary FC samples and field replicates (after pairs with averages below 20 CFU/100mL have been excluded). Half of all pairs should have less than or equal to 20% RSD, ninety percent of qualifying pairs should have less than or equal to 50% RSD, and all qualifying pairs should have less than 85% RSD. Table 4, below, compares observed results against these criteria for the reporting period.

No fecal coliform data were qualified based on field replicate analyses, as replicate pairs met measurement quality objectives described in QAPP section 6.2 (Chadd et al. 2017b).

Table 3: Fecal coliform field replicate results. Here each field replicate and a laboratory duplicate of the field replicate are averaged and reported as a single, composite value called "replicate.")

Date	Type	FC CFU	Mean	%RSD
1/7/2019	Replicate	13		
	Primary	32	22.5	59.7%
1/8/2019	Replicate	69		
	Primary	88	78.5	17.1%
2/26/2019	Replicate	16		
	Primary	34	25.0	50.9%
3/12/2019	Primary	12		
	Replicate	10	11.0	N/A Excluded
4/15/2019	Replicate	16		
	Primary	6	11.0	N/A Excluded
4/22/2019	Replicate	10		
	Primary	20	15.0	N/A Excluded
5/14/2019	Replicate	108		
	Primary	108	108.0	0.0%
6/11/2019	Primary	418		
	Replicate	388	403.0	5.3%
7/9/2019	Replicate	146		
	Primary	146	146.0	0.0%
8/12/2019	Replicate	688		
	Primary	496	592.0	22.9%
8/13/2019	Replicate	246		
	Primary	246	246.0	0.0%
9/10/2019	Replicate	227		
	Primary	240	233.5	3.9%
10/8/2019	Replicate	98		
	Primary	102	100.0	2.8%
11/12/2019	Replicate	28		
	Primary	24	26.0	10.9%
11/19/2019	Replicate	103		
	Primary	94	98.5	6.5%
12/10/2019	Replicate	45		
	Primary	44	44.5	1.6%
				Total pairs: 16
				Excluded pairs: 3
				Qualifying pairs: 13

Primary/replicate pairs with means less than 20 CFU are excluded from MQO analysis.

Table 4: Fecal coliform data Measurement Quality Objectives

QC tiers	Pairs in Tier	% Pairs in Tier	% Pairs Required	MQO Met?
Pairs <= 20% RSD	10	76.9%	50.0%	YES
Pairs <= 50% RSD	11	84.6%	90.0%	YES
Pairs <= 85% RSD	13	100.0%	100.0%	YES

Field Replicate Analysis—Nutrients

Nutrient field replicates are also collected alongside 5% of all samples (or at least one replicate each sampling event). These replicates are again compared against their primary samples to calculate Relative Standard Deviation. Primary/replicate pairs with means less than five times the reporting limit are excluded from RSD calculation. QAPP Table 1 (Chadd et al. 2017b) describes acceptable annual median RSD values, and sampling results are compared against the criteria below.

Nutrient sample replicate analysis generally showed a high degree of precision among primary/replicate pairs and no data were qualified as a result of this analysis.

Table 5: Nutrients field replicate results and QC analysis for data pairs with mean > 5 RL

Analyte	Data Pairs	Median RSD	RSD Criterion	Data Qualified
Ammonia	0		15%	none
Nitrate	12	0.40%	10%	none
Nitrite	0		10%	none
Phosphate	12	0.50%	10%	none
Silicate	12	0.40%	10%	none
Total N	12	0.90%	10%	none
Total P	12	0.60%	10%	none

Field Replicate Analysis—Physical and Chemical Parameters

The PIC Baseline Trends Water Quality Monitoring Program calls for in situ measurements of water temperature and salinity at all sample sites.

Barometric pressure (BP), dissolved oxygen (DO), pH, specific conductance (SpC), and turbidity measurements are also collected (though not required), given the ease of data collection with multiparameter water quality meters. These data are collected in accordance with the Streamkeepers Program QAPP (Chadd 2017a). The quality of these data are reported here, though results are not included in the below discussion. Again, all data are available from the Clallam County Water Resources Database.

Measurement quality objectives of physical and chemical data are described in terms of maximum allowable percent relative standard deviation and/or maximum allowable difference between primary samples and replicates. Where two criteria are provided, at least one must be

met for data to pass unqualified and avoid corrective action. Table 6, below, summarizes comparison of environmental data against MQO criteria. Salinity and tempreature criteria stem from the PIC Project QAPP (Chadd et al. 2017b) while all other criteria are inherited from the Streamkeepers Program QAPP (Chadd 2017a).

Table 6. Physical/chemical water quality field replicate QC analysis.

Parameter	Units	Data Pairs	Max RSD (by pairs)	RSD Criterion	Max Difference Observed	Difference Criteria	Data Qualified
BP	Hg	15			0.02	0.05	none
DO	mg/L	16		1% per pair	0.4	0.2	Yes 1/7/19 & 4/22/19
pH	N/A	15			0.1	0.2	none
Salinity	PSU (ppt)	15		5% per pair	0.00	0.2	none
Sp Cond	μs/cm	16	0.4%	5% per pair			none
Water T	∘C	16			0.1	0.2	none
Turbidity	FNU	16		7% per pair	1	1	none

Laboratory Standards Checks—Nutrients

In addition to internal controls metioned previously, UW Marine Chemistry Laboratory uses check standards to assess bias stemming from analytical methods. Wherever standards are not met, analyses are repeated. Data reported by the lab have passed all internal QA/QC screening. To date no nutrient data have required qualification or corrective action following laboratory data quality analyses.

Compliance with Project QAPP and SOPs

In compliance with the project QAPP (Chadd et al. 2017b), environmental data were collected following standard operating procedures (SOP).

Water samples for the purpose of fecal coliform testing were collected in sterile polypropylene (PP) bottes, stored in coolers with ice packs for less than 8 hours, and analyzed at Clallam County Water Laboratory.

Meanwhile, samples for nutrients testing were collected in either acid-washed PP or acid-washed high-density polyethylene (HDPE) bottles, chilled with ice packs in coolers, and shipped overnight to UW Marine Chemistry Laboratory in Seattle, WA.

In situ physical and chemical water quality measurements (water temperature, dissolved oxygen concentration, pH, specific conductance, salinity, turbidity) were collected using a YSI ProDSS field meter which was calibrated prior to sampling events and checked afterward.

Where necessary, data have been flagged with appropriate qualifiers based on QA/QC measures.

Environmental Data Summary

PIC Baseline Trends Monitoring environmental data collected between January 1, 2019 and December 31, 2019 are presented in Appendix 1. These data are explored visually and descriptively, below. Rejected data have been excluded. Data not specifically called for in the project QAPP are not presented.

Fecal Coliforms

All PIC Baseline Trends Monitoring streams fecal coliform data for the reporting period are summarized below.

Figure 4: Fecal Coliforms, all CWD streams. Note log scale. X marks geometric mean; bottom and top of box represent observed 10th and 90th percentiles; ends of whiskers represent extremes.
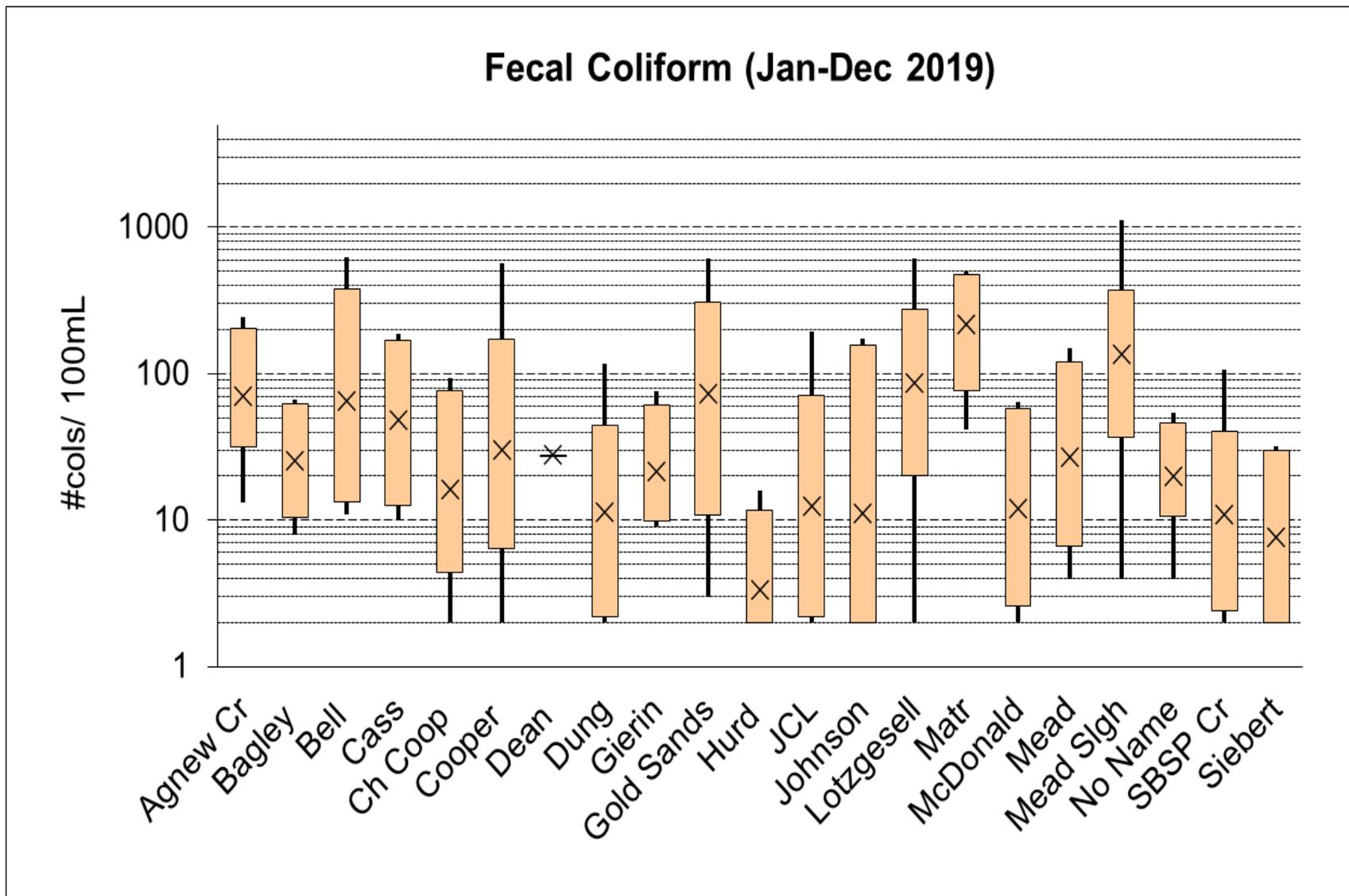
Nutrients

Nutrients results are summarized below. Nutrients data were collected monthly at Clean Water District Tier 1 streams only.

Figure 5: Nitrate as N. X marks median; bottom and top of box represent 1st and 3rd quartiles; ends of whiskers represent min. and max. values.
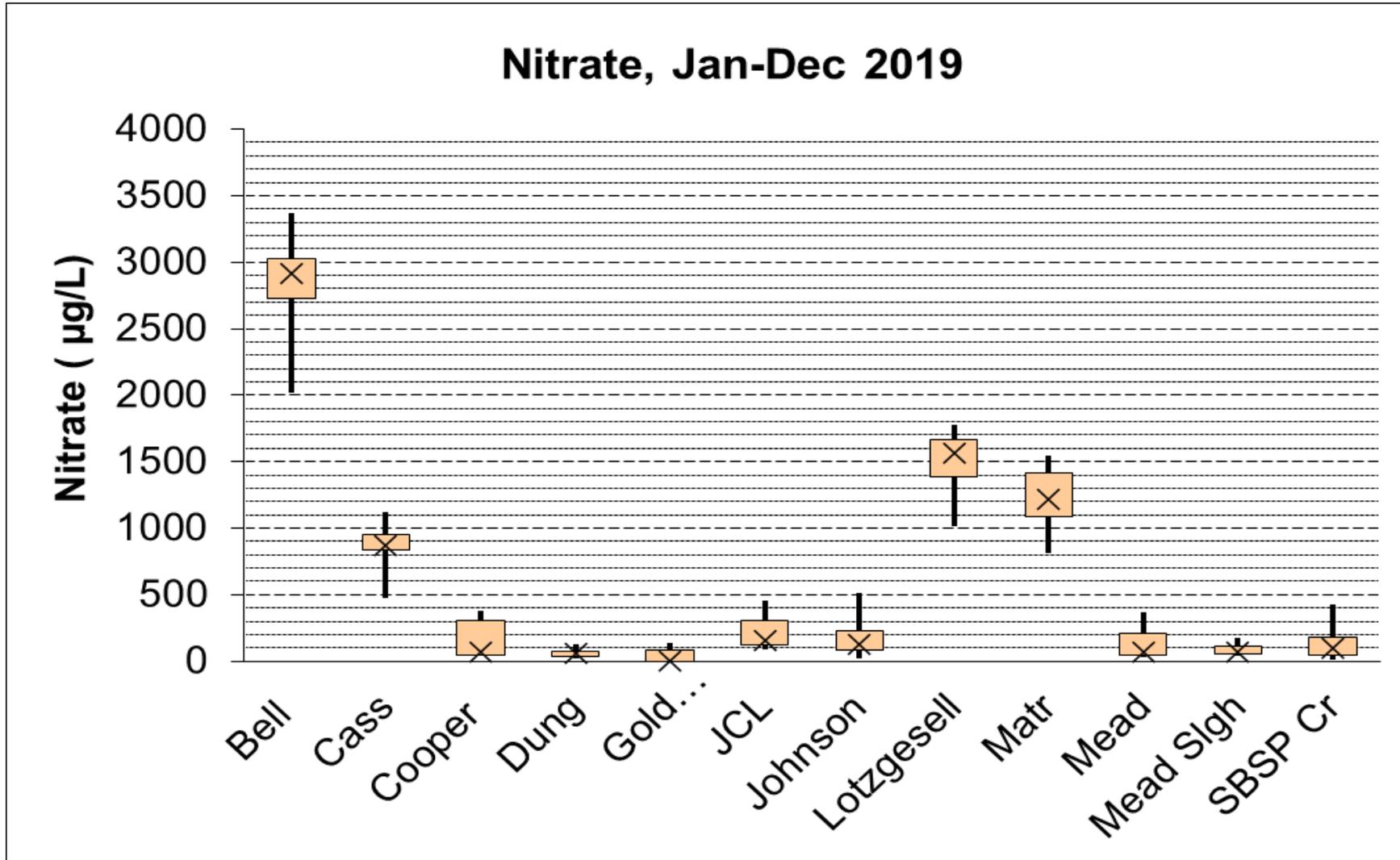
Figure 6: Nitrite as N. X marks median; bottom and top of box represent 1st and 3rd quartiles; ends of whiskers represent min. and max. values.

Nitrite, Jan-Dec 2019
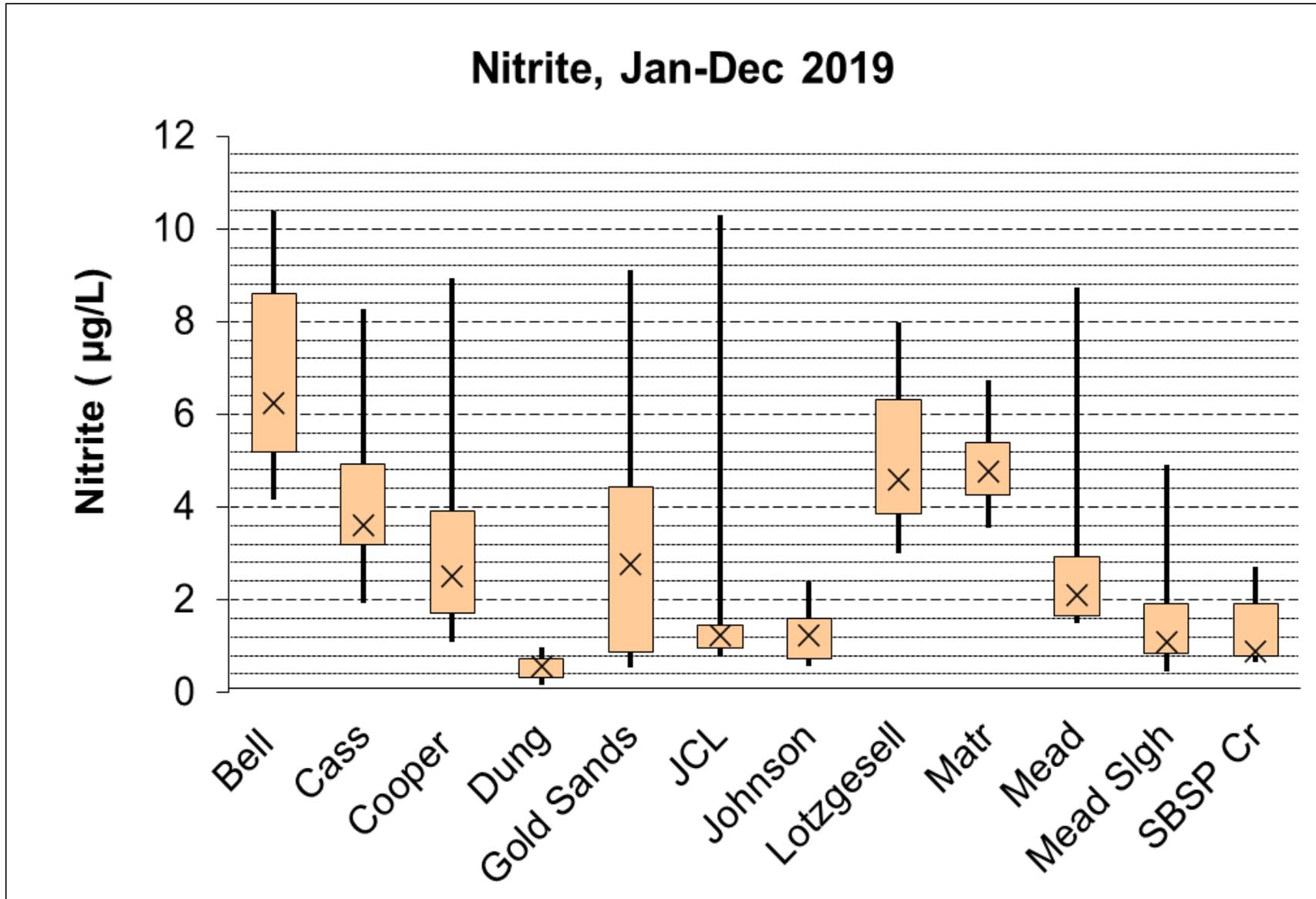
Figure 7: Ammonia. X marks median; bottom and top of box represent 1st and 3rd quartiles; ends of whiskers represent min. and max. values.

NH3, Jan-Dec 2019
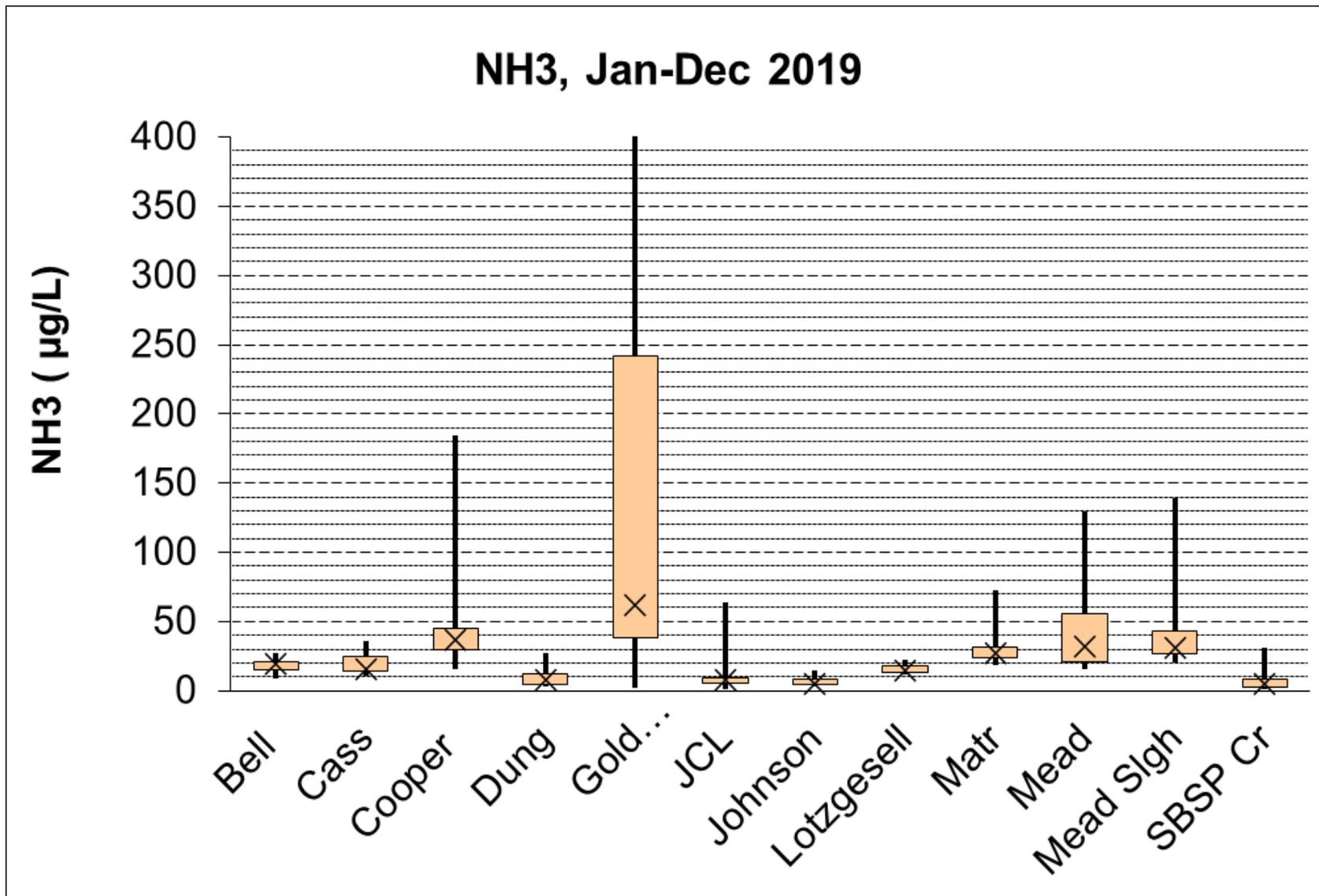
Figure 8: Phosphate as P. Note log scale. X marks median; bottom and top of box represent 1st and 3rd quartiles; ends of whiskers represent min. and max. values.
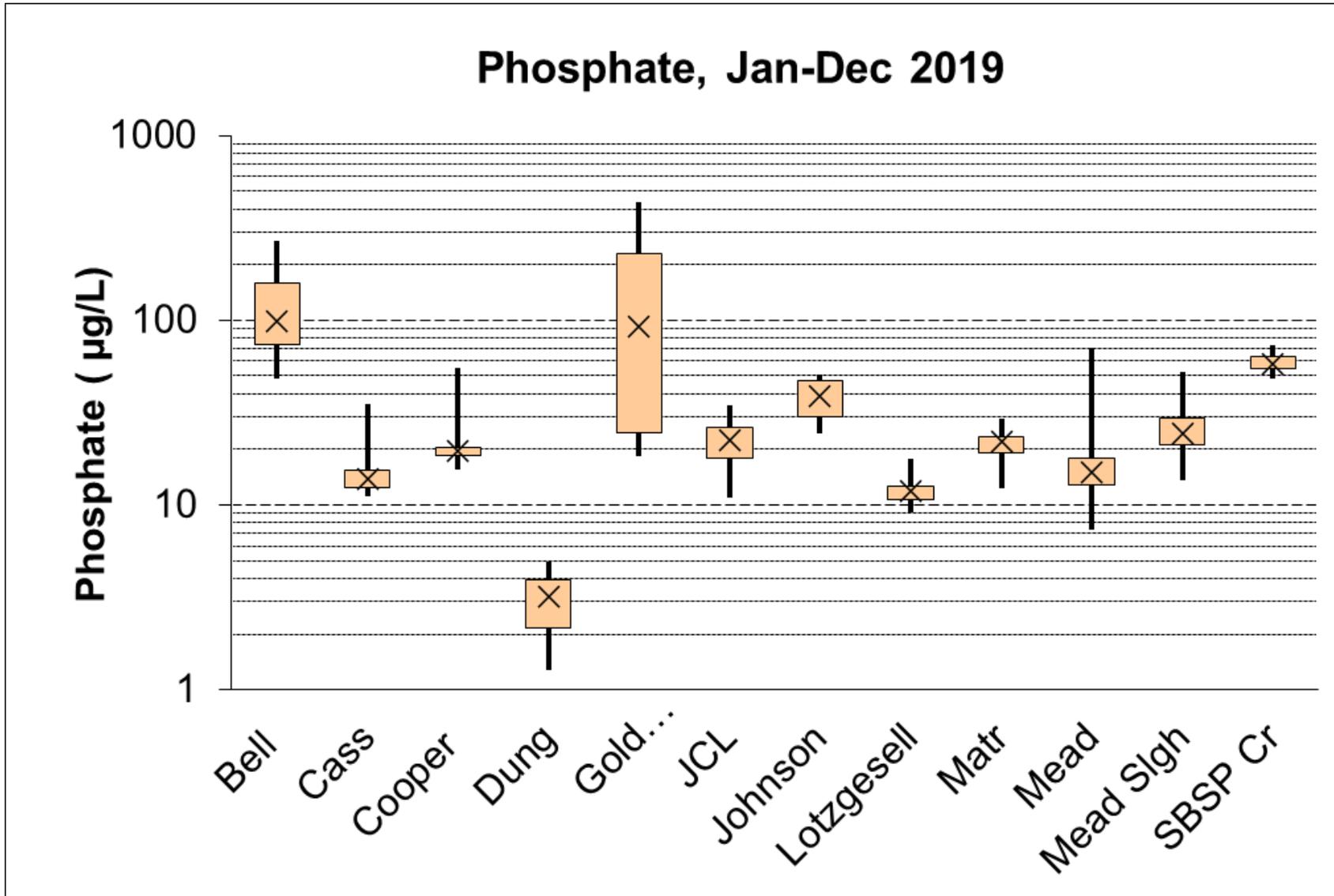
Figure 9: Total nitrogen. Note log scale. X marks median; bottom and top of box represent 1st and 3rd quartiles; ends of whiskers represent min. and max. values.
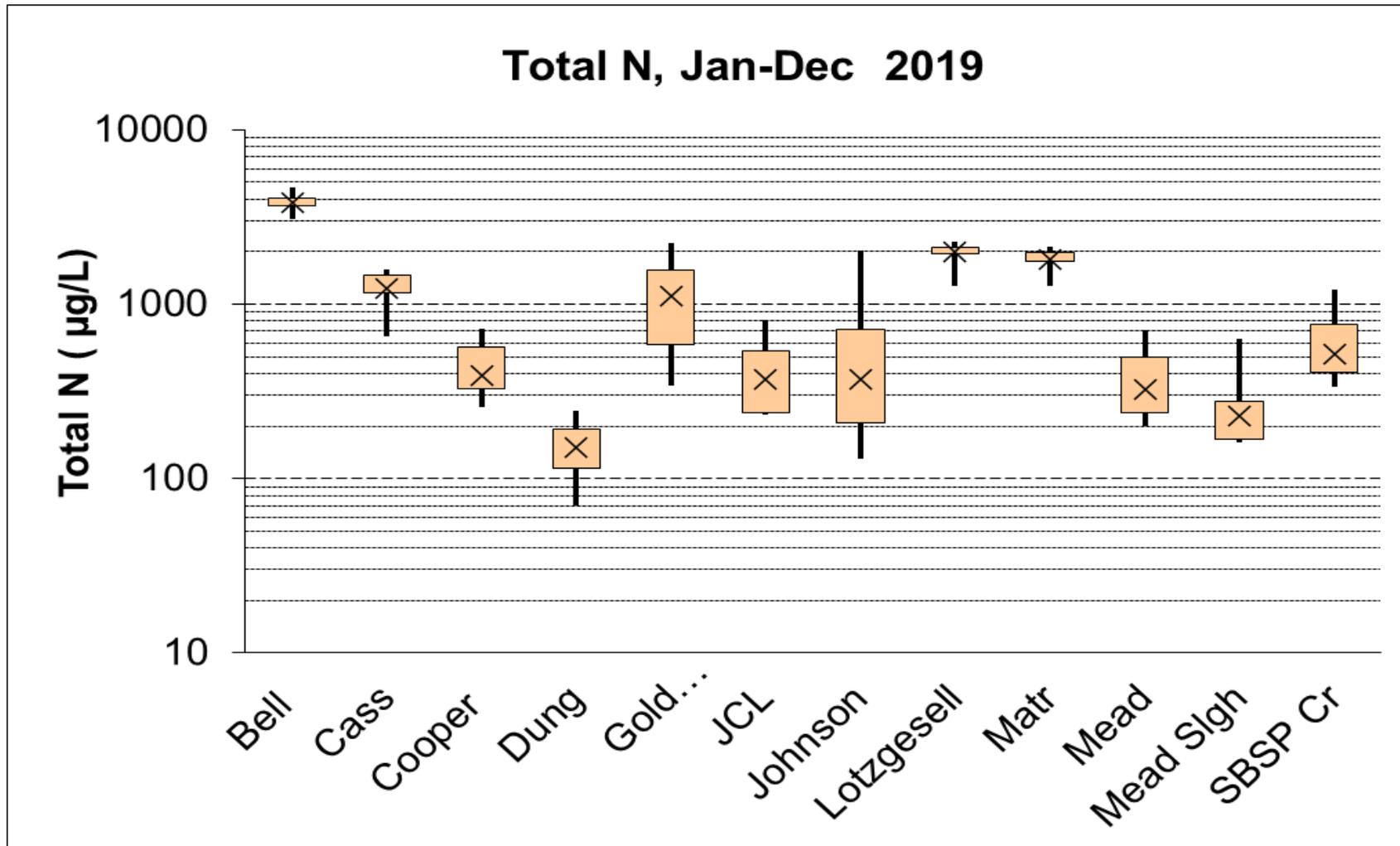
Figure 10: Total Phosphorus. Note log scale. X marks median; bottom and top of box represent 1st and 3rd quartiles; ends of whiskers represent min. and max. values.

Total Phosphorus, Jan-Dec 2019
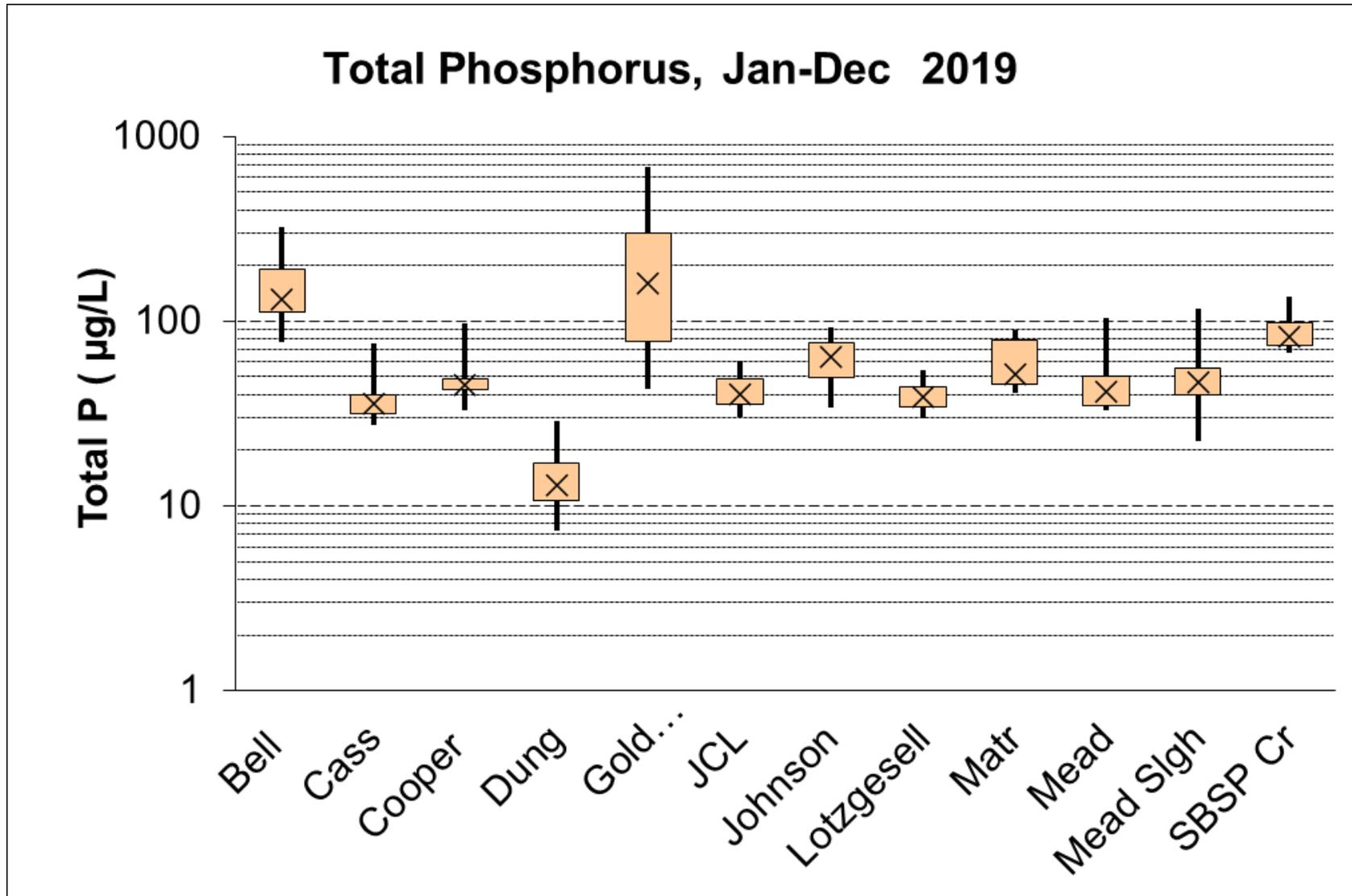
Water Temperature and Salinity

Summaries of water temperature and salinity data covering the reporting period follow. Physical and chemical data are collected monthly at Tier I streams and quarterly at Tier II streams. Additional measurements collected following the Streamkeepers program QAPP include barometric pressure, dissolved oxygen, pH, specific conductance, and turbidity data. These measurements are not specifically required by the PIC QAPP and are not discussed here, though they are available from the Clallam County Water Resources Database.

Figure 11: Water Temperature. X marks median; bottom and top of box represent 1st & 3rd quartiles; ends of whiskers represent min. and max. values. For evaluative purposes, the State's maximum 7-day average of daily maxima for salmonid core summer habitat (the designated use for all sites) is 16°C (Ecology, 2006).

Figure 12: Salinity (PSU). X marks median; bottom and top of box represent 1st and 3rd quartiles; ends of whiskers represent min. and max. values.


Salinity (Jan-Dec 2019)
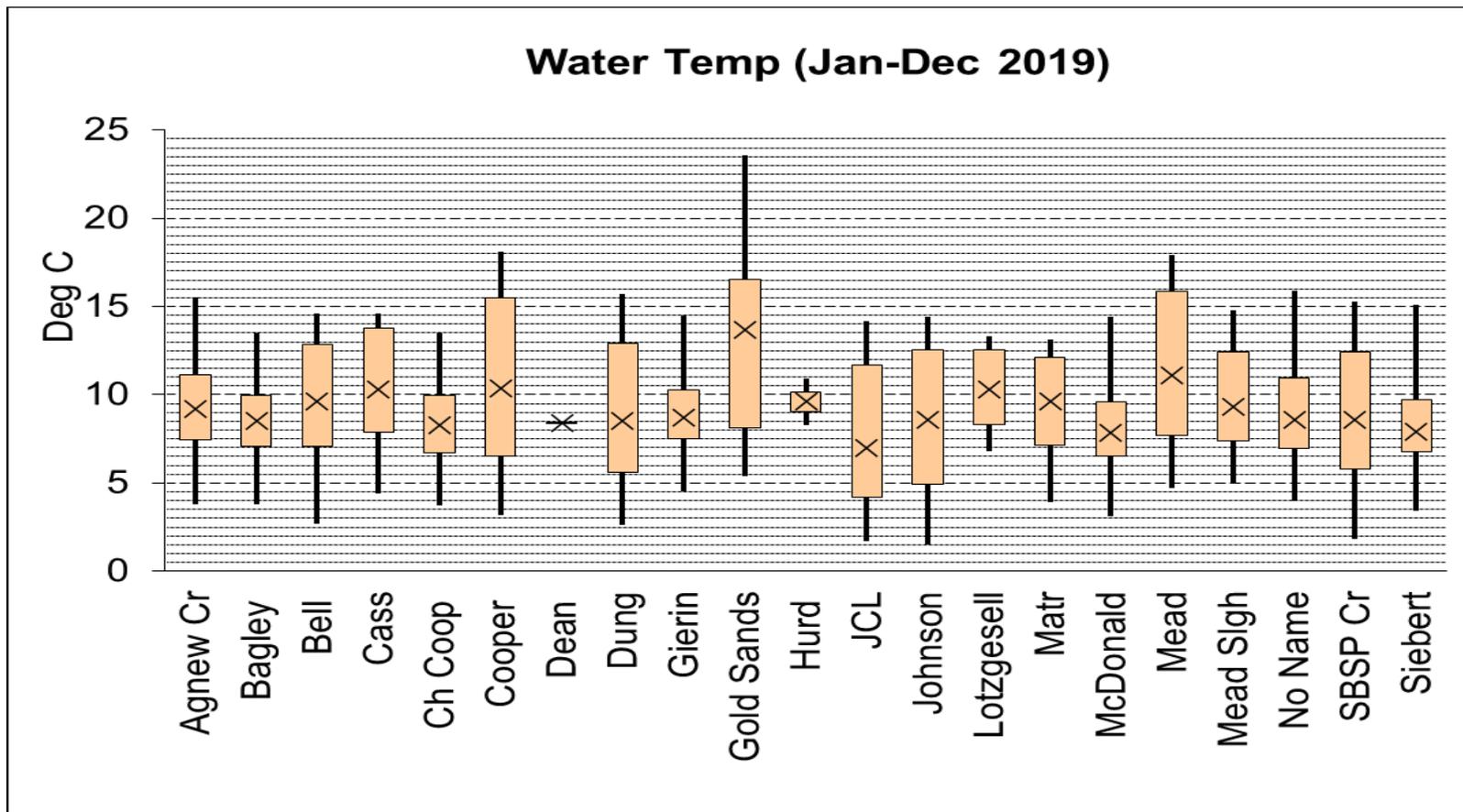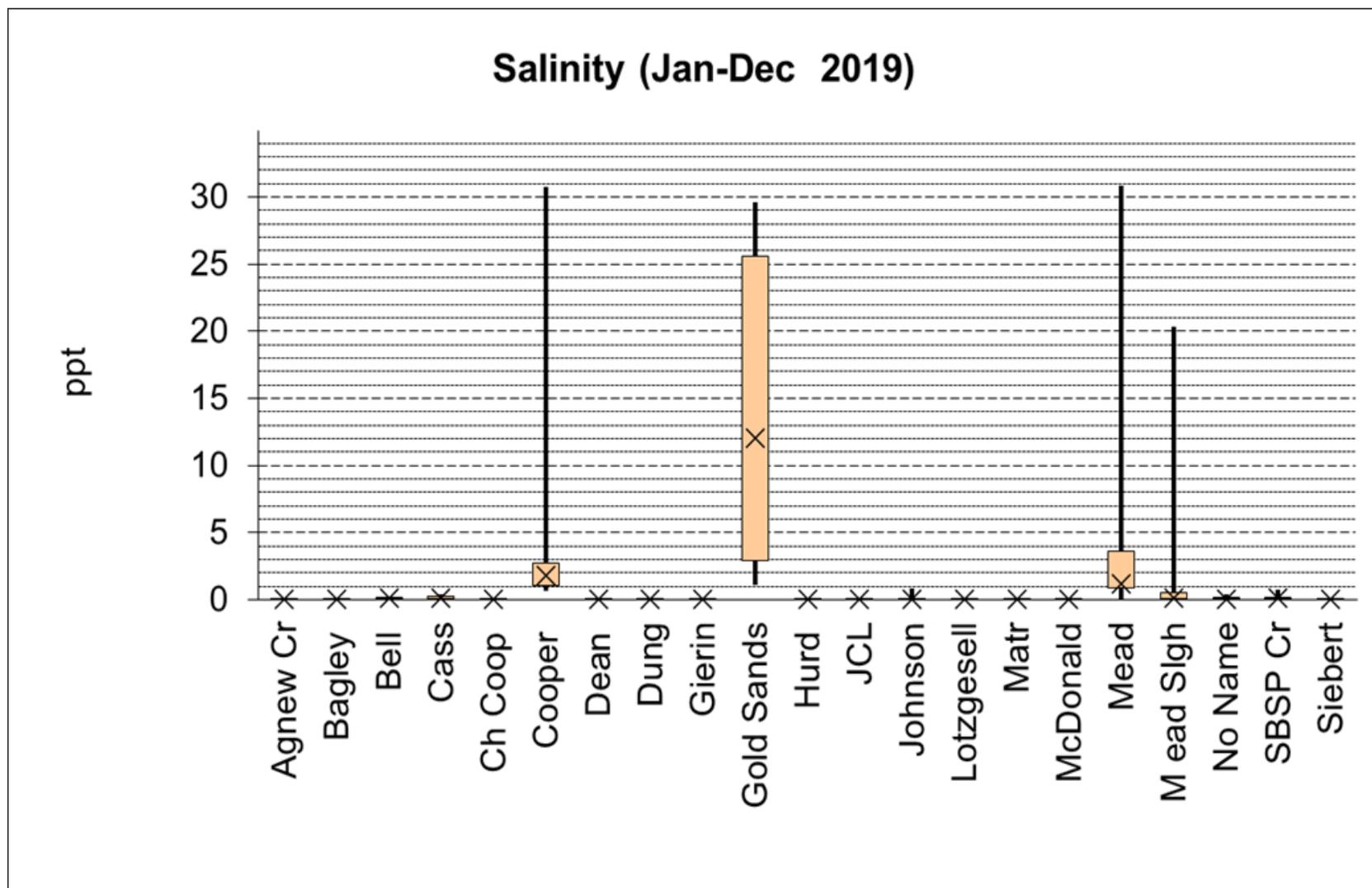
Discussion

Fecal Coliforms

Pollution Identifican and Correction work revolves around seeking and correcting upland sources of bacterial pollution that impact streams and receiving marine waters—especially where shellfish harvest activities exist. Baseline Trends Water Quality Monitoring helps highlight sub-watersheds for selection as PIC Focus Areas for further targeted investigation and pollution control. To date, Baseline Trends data have helped select Golden Sands and Meadowbrook Sloughs (2015-2017 PIC Focus Area), lower Matriotti and Lotzgesell Creeks (2017-2019 PIC Focus Area), and, most recently, upper Matriotti and lower Bell Creeks (2019-2022 PIC Focus Area).

In general, fecal bacteria concentrations have improved over the years. However, Figure 4 illustrates that many sites showed an increased range in concentrations with slightly elevated geometeric means overall when compared with 2018 data. Data appeared to indicate relatively high bacteria concentrations in Meadowbrook Slough, Golden Sands Slough, Matriotti Creek, Bell Creek and Lotzgesell Creek with geometric means, 90th percentiles, and upper extremas exceeding those of other waterways. Golden Sands Slough bacteria concentrations continued to appear lower overall than in past years, however, concentrations were somewhat elevated at the end of 2019. Bell Creek and upper Matriotti Creek were selected as the PIC "Phase 2" Implementation focus area that began in December of this year.

While improvements have been made in the watershed, and the problem areas above do not appear to be impacting marine water quality at the moment, the data highlights the need for continued water quality monitoring efforts.

In 2018, the hope was that water quality would improve following corrections to 2 failing septic systems. However, 2019 PIC Baseline Trends data indicates a lack of improvement in Meadowbrook Slough bacteria concentrations. Continued monitoring may help determine 1) if benefits are out of phase with corrections (i.e. following a history of failing septic systems—possibly on the order of decades—does it take time for the basin to recover), 2) if the volume of water in the slough could be changing, thereby influencing bacteria concentrations, or 3) if some unknown source of bacterial pollution remains and adverseley impacts the waterway.

Anecdotal reports describe the water level of Meadowbrook Slough dropping significantly in 2018, apparently coupled with the migration of the Meadowbrook Creek mouth away from the slough. This observation continued throughout 2019. A spillway at the upper end of Meadowbrook Slough also lets Dungeness River water through the Dungeness River Dike and into the slough. Further analysis of 2019 Meadowbrook Slough stage data indicated that the flow of water through this spillway may have changed and resulted in a lower flow and thus higher fecal coliform bacteria concentrations. However, monthly stage data could prove insufficient in separating trends in Meadowbrook Slough stage from seasonal and tidal influence.

PIC Project Partners elected to include lower Bell Creek as part of the 2019-2022 PIC Focus Area in an effort to seek and eliminate any potential sources of bacterial pollution and avoid

taking steps backward from gains in shellfish growing area upgrades that occurred in 2018. Initial work began in the 2019-2022 Focus Area in December 2019. PIC Baseline Trends Monitoring data from Bell Creek were used as a line of evidence to justify the shellfish growing area upgrade (along with many other reasons including good marine water quality). On October 9, 2018 an uncharastically high bacteria "hit" of 1,424 CFU/100mL was recorded at the Bell Creek PIC Baseline Trends Monitoring site on Schmuck Road (Bell 0.2). From May to October of 2019, high fecal concentrations were observed up to 624 CFU/100mL. For the time being, marine water quality still appears good near DNR Beach 411A, and it is possible some mechanism of bacteria die-off or attenuation in Washington Harbor exists that is protective of marine water quality just outside the harbor.

Between 2018 and 2019, three key septic system installations appeared to largely eliminate various pollution problems in the Golden Sands Slough area. As the first PIC Focus Area (2015-2017), many problematic wastewater disposal problems were found, including holding tanks, direct discharges, and other non-conforming wastewater systems. Still, caution should be applied when interpreting Golden Sands Baseline Trends Monitoring data, as periodic high salinity measurements would indicate marine water influence. That is, marine water may sometimes have a dilution effect, reducing fecal coliform and/or nutrient concentrations of collected water samples. Additionally, data from the second half of 2019 indicated there may be a new issue needing resolution.

Nutrients

As seen in the Figures 5-10 above, Bell Creek and Golden Sands Slough stand out with relatively high levels of total nitrogen, total phosporous, ammonia, and phosphate as P as compared to other Clean Water district Streams. Geometric means, observed 3rd quartiles, and upper extremas rank higher than other streams for these parameters. There were high levels of nitrite and nitrate levels in Bell Creek and high levels of total nitrogen in Lotzgesell and Matriotti Creeks. The source for these elevated levels is unknown and must be investigated further. This data also informed project partners' decision while selecting the next PIC focus area mentioned above.

In addition, levels of nitrite and nitrate are high in Bell Creek, and Lotzgesell Creek and Matriotti Creek also appear higher in total nitrogen than than those observed in other Clean Water District Streams upon comparison of geometric means, 3rd quartiles, and maximum values.

Physical and Chemical Water Quality Parameters

Figures 9 and 10 above highlight water temperature and salinity. There were so signifcant deviations from data collected in 2018.

Cooper Creek, Golden Sands Slough, Meadowbrook Creek, and Meadowbrook Slough salinity data suggest at least periodic marine water influence at these sites. Because of this, secondary sample sites were added at Sequim Bay State Park Creek (0.1) and Cassalery Creek (0.6) to avoid complications with low flow events and tides that occasionally confound data collection.

The highest salinity measurements at Sequim Bay State Park Creek and Cassalery Creek come from the lower, primary sample sites when the secondary site was not used.

Cooper Creek, Golden Sands Slough, and Meadowbrook Creek sample sites generally lack shading from vegetation and various high water temperatures were recorded at these sites, largely during the summer months.

Conclusion

Long-Term PIC Baseline Trends Monitoring continues to help project partners adaptively manage the PIC Program and select focus areas where limited resources will lead to the greatest improvements in water quality.

Many needed corrections identified in the from 2015-2018 have taken place. Many of these corrections were related to repairs and installations of onsite septic systems. Some of these septic system installations happened thanks to low-interest loans (such as Clean Water Loans offered by Craft3) and/or cost-share funding accessed by Clallam Conservation District. To continue gains, Clallam County Environmental Health will have to keep track of recalcitrant wastewater disposal problems and use all available tools to compel use of conforming wastewater treatment only.

Parcel surveys and source investigations along Matriotti and Lotzgesell Creeks noted many potential critical areas problems, namely, removed vegetated buffers. Cleared stream corridor appears prevalent across properties of varying uses from commercial, to residential, to agricultural. Clallam County's Clean Water Strategy for Addressing Bacteria Pollution in Dungeness Bay and Watershed (Streeter and Hempleman 2004) notes: "Although not considered a pollution source, the lack of vegetation along ditches and stream banks limits the landscape's ability to filter contaminated run-off." However, the U.S. EPA considers infrared heat a pollutant (hence, why Ecology can develop TMDLs on temperature) and maintaining and/or restoring riparian buffers are often a best management practices to reduce temperature and increase infiltration. It is possible Matriotti and Lotzgesell Creek water quality will not improve appreciably—especially in terms of pathogens and water temperature—unless a concerted effort is made to protect the remaining vegetated corridor bording the streams and to restore vegetated buffers previously removed contrary to cricial areas codes.

The high levels of total nitrogen, total phosporous, and phosphate as P in Bell Creek and Golden Sands Slough, as well as the nitrite and nitrate levels in Bell Creek and total nitrogen in Lotzgesell and Matriotti Creeks, are of interest and will be investigated further.

In addition to ongoing PIC work, Environmenal Health and Environmental Protection Agency Region 10/Manchester Laboratory are exploring a possible Microbial Source Tracking (MST) study to complement pathogens reduction efforts in the Dungeness Watershed. Sites on Matriotti Creek and Meadowbrook slough are proposed for bacteria source tracking. This may help identify the range of pollution sources present in the watershed, while addressing bacteria "hotspots" that persist in spite of pollution corrections such as repair of failing septic systems

and exclusion of domesticated animals from streams. The additional line of evidence may help overcome the threshold required to tackle needed changes such as restoring vegetated buffers that help keep contaminated run-off out of streams.

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Appendix A: Map of Clean Water District
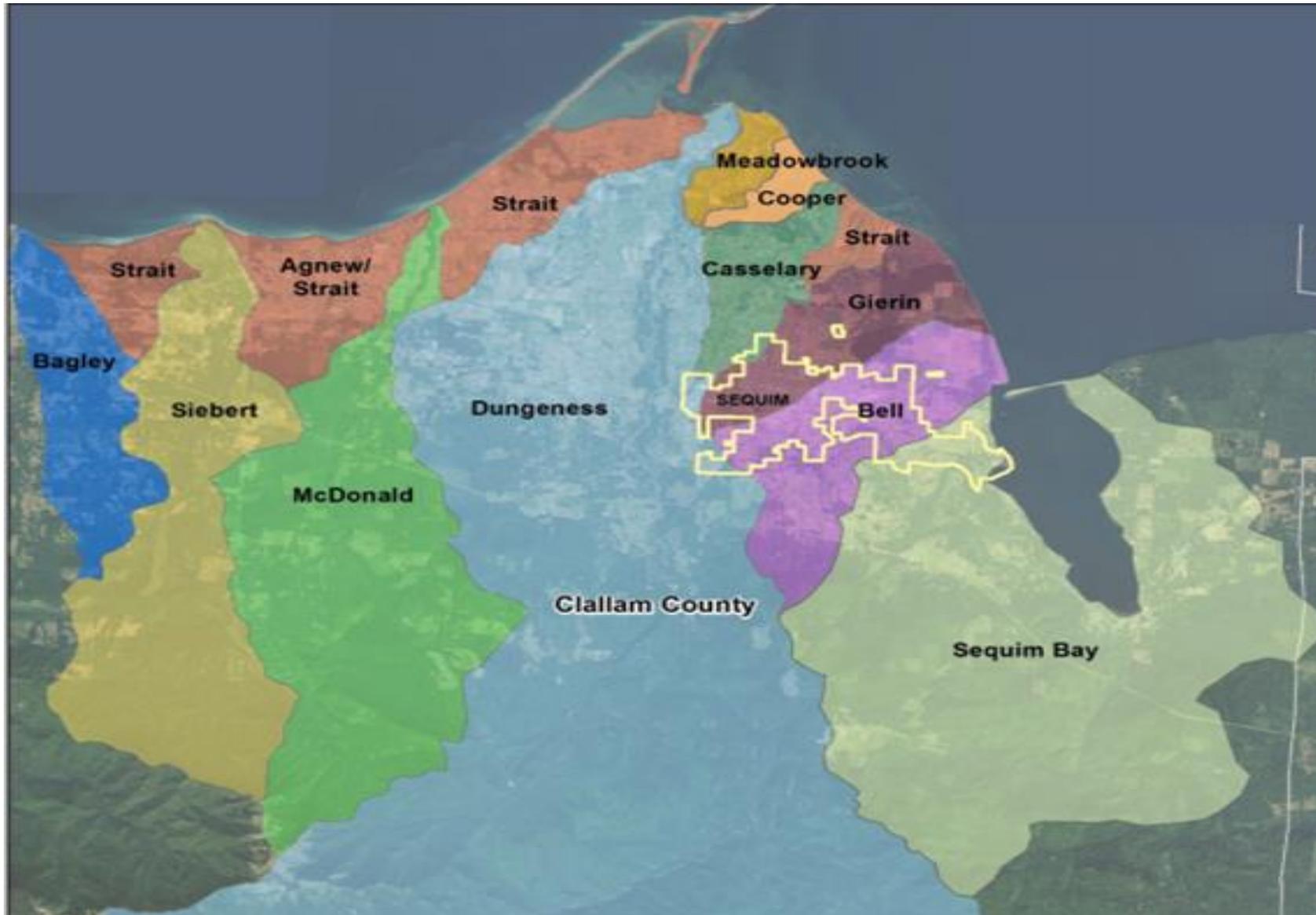
Appendix B: Data from January 2019 – December 2019

Data can be retrieved from Clallam County's Water Resources Database and (http://www.clallam.net/SK/watersheds.html) and EPA's WQX database
(https://www.epa.gov/waterdata/water-quality-data-wqx).

Site	Date	FC CFU/ 100mL	NO$_3$-N µg/L	NO$_2$-N µg/L	NH$_3$-N µg/L	PO$_4$-P µg/L	SiSO$_4$- Si µg/L	TN µg/L	TP µg/L	Temp. H$_2$O deg. C	PSU
Agnew Creek/Ditch 0.3	1/8/2019	75								3.8	0.1
Agnew Creek/Ditch 0.3	4/22/2019	13								9.7	0.1
Agnew Creek/Ditch 0.3	8/13/2019	246								15.6	0.1
Agnew Creek/Ditch 0.3	11/19/2019	100								8.7	0.1
Bagley 0.7a	1/8/2019	16								3.8	0
Bagley 0.7a	4/22/2019	8								8.8	0.1
Bagley 0.7a	8/13/2019	52								13.5	0.1
Bagley 0.7a	11/19/2019	66								8.2	0.09
Bell 0.2	1/7/2019	19	21	2926	10	122	8672	4168	180	5.3	0.2
Bell 0.2	2/26/2019	21	13	2546	6	105	7893	3993	146	2.7	0.2
Bell 0.2	3/12/2019	11	20	2762	5	94	7393	3805	117	5.3	0.2
Bell 0.2	4/15/2019	13	18	2017	5	74	7438	3093	113	7.7	0.2
Bell 0.2	5/14/2019	108	27	2907	7	148	7179	3753	183	10.5	0.2
Bell 0.2	6/11/2019	398	22	3370	8	267	8558	4661	324	12.9	0.2
Bell 0.2	7/9/2019	146	14	2613	6	187	7955	3585	212	12.8	0.2
Bell 0.2	8/12/2019	624	19	2769	10	228	8521	3723	264	14.6	0.2
Bell 0.2	9/10/2019	231	9	3065	5	84	9282	3826	113	13.5	
Bell 0.2	10/8/2019	99	16	3222	4	48	9686	3808	106	9.9	0.2
Bell 0.2	11/12/2019	27	19	2967	6	51	9503	3380	77	9.4	0.2
Bell 0.2	12/10/2019	45	26	3009	9	71	8646	4125	107	7.9	0.2
Cassalery 0.0	2/26/2019										
Cassalery 0.0	3/12/2019	170	25	856	6	35	5921	1563	76	6.2	0.4
Cassalery 0.0	4/15/2019										
Cassalery 0.0	5/14/2019	12	18	870	3	15	6295	1431	42	11.3	0.4
Cassalery 0.0	6/11/2019	54	14	873	4	11	6377	1206	29	14.5	0.2

Site	Date	FC CFU/ 100mL	NO$_3$-N µg/L	NO$_2$-N µg/L	NH$_3$-N µg/L	PO$_4$-P µg/L	SiSO$_4$-Si µg/L	TN µg/L	TP µg/L	Temp. H$_2$O deg. C	PSU
Cassalery 0.0	7/9/2019	164	16	880	3	14	6706	1235	31	14.0	0.3
Cassalery 0.0	8/12/2019	112	15	913	3	15	6747	1210	32	14.6	0.2
Cassalery 0.0	9/10/2019	72	25	825	2	15	6841	1121	40	13.8	0.3
Cassalery 0.6	1/7/2019	38	35	1021	4	12	6699	1472	36	6.3	0.12
Cassalery 0.6	2/26/2019	10	16	1124	6	13	6541	1577	40	4.4	0.1
Cassalery 0.6	3/12/2019										
Cassalery 0.6	4/15/2019	38	13	998	4	11	6567	1485	32	8.2	0.12
Cassalery 0.6	5/14/2019										
Cassalery 0.6	6/11/2019										
Cassalery 0.6	7/9/2019									12.8	0.1
Cassalery 0.6	8/12/2019										
Cassalery 0.6	9/10/2019										
Cassalery 0.6	10/8/2019	186								10.3	0.1
Cassalery 0.6	11/12/2019	18	11	475	4	21	7950	653	40	9.8	0.1
Cassalery 0.6	12/10/2019	26	24	783	8	14	6882	950	27	7.9	0.1
Chicken Coop 0.24	1/8/2019	10								3.7	0.1
Chicken Coop 0.24	4/22/2019	2								7.7	0.1
Chicken Coop 0.24	8/13/2019	94								13.5	0.1
Chicken Coop 0.24	11/19/2019	36								8.8	0.1
Cooper 0.1	1/7/2019	12	41	357	4	21	7915	712	49	4.9	3.5
Cooper 0.1	2/26/2019	24	29	336	2	17	7664	614	45	3.2	
Cooper 0.1	3/12/2019	40	16	297	2	26	7745	548	35	5.7	0.7
Cooper 0.1	4/15/2019	6	19	60	1	18	6952	418	48	10.1	1.11
Cooper 0.1	5/14/2019	10	31	40	1	16	6976	284	39	12.4	1.8
Cooper 0.1	6/11/2019	2	29	40	2	19	7402	258	45	18.1	1.4
Cooper 0.1	7/9/2019	38	45	35	3	20	7724	367	46	16.7	4.3
Cooper 0.1	8/12/2019	176	59	44	4	20	8342	330	52	17.7	2
Cooper 0.1	9/10/2019	42	46	46	4	20	9104	350	49	15.1	1.8
Cooper 0.1	10/8/2019	564	34	77	1	19	4820	327	44	10.6	1.1
Cooper 0.1	11/12/2019	136	185	236	9	55	4183	723	96	9.4	30.8

Site	Date	FC CFU/ 100mL	NO$_3$-N µg/L	NO$_2$-N µg/L	NH$_3$-N µg/L	PO$_4$-P µg/L	SiSO$_4$-Si µg/L	TN µg/L	TP µg/L	Temp. H$_2$O deg. C	PSU
Cooper 0.1	12/10/2019	20	40	375	6	19	8494	541	33	6.8	0.8
Dean 0.17	4/22/2019										
Dean 0.17	11/19/2019	28								8.4	0.1
Dungeness 0.7	1/7/2019	2	6	79	0	5	3453	155	29	4.3	0.06
Dungeness 0.7	2/26/2019	2	3	131	1	4	3891	244	13	2.6	0.1
Dungeness 0.7	3/12/2019	4	12	67	1	3	3671	146	9	4.7	0.1
Dungeness 0.7	4/15/2019	8	5	32	0	2	3662	155	10	7.0	0.07
Dungeness 0.7	5/14/2019	10	9	25	0	2	2702	137	13	8.8	0
Dungeness 0.7	6/11/2019	12	4	20	0	2	2689	74	12	12.9	0.05
Dungeness 0.7	7/9/2019	10	18	30	0	3	3016	70	7	13.0	0.1
Dungeness 0.7	8/12/2019	28	27	65	1	4	3382	204	23	15.7	0.1
Dungeness 0.7	9/10/2019	116	12	77	1	5	3563	191	16	14.6	0.1
Dungeness 0.7	10/8/2019	46	15	49	1	1	3435	196	20	9.5	0.1
Dungeness 0.7	11/12/2019	18	5	42	1	3	3505	85	13	8.2	0.1
Dungeness 0.7	12/10/2019	12	4	73	1	3	3364	124	11	5.9	0.1
Gierin 1.8	1/8/2019	9								4.5	0.1
Gierin 1.8	4/22/2019	26								8.5	0.1
Gierin 1.8	8/13/2019	76								14.5	0.1
Gierin 1.8	11/19/2019	12								8.9	0.2
Golden Sands Slough 0.0	1/7/2019	19	72	115	4	85	7282	1224	172	5.8	10.6
Golden Sands Slough 0.0	2/26/2019	3	270	138	6	173	7113	1619	230		2.9
Golden Sands Slough 0.0	3/12/2019	74	27	123	3	100	6266	1298	149	5.4	1.1
Golden Sands Slough 0.0	4/15/2019	10	2	0	1	36	2568	680	106	15.6	14.2
Golden Sands Slough 0.0	5/14/2019	142	61	1	1	114	6125	1023	203	15.1	13.5
Golden Sands Slough 0.0	6/11/2019	173	35	0	1	24	2906	621	79	23.6	24.6
Golden Sands Slough 0.0	7/9/2019	60	40	1	1	21	2528	498	74	11.4	28.7
Golden Sands Slough 0.0	8/12/2019	82	62	3	2	19	1295	342	43	19.7	29.6
Golden Sands Slough 0.0	9/10/2019	192	59	3	3	25	1610	385	61	17.5	28.5
Golden Sands Slough 0.0	10/8/2019	322	1155	1	2	404	11978	2080	682	13.7	6
Golden Sands Slough 0.0	11/12/2019	618	1135	11	9	438	12004	2237	602	9.4	3

Site	Date	FC CFU/ 100mL	NO$_3$-N µg/L	NO$_2$-N µg/L	NH$_3$-N µg/L	PO$_4$-P µg/L	SiSO$_4$-Si µg/L	TN µg/L	TP µg/L	Temp. H$_2$O deg. C	PSU
Golden Sands Slough 0.0	12/10/2019	114	233	70	8	436	9244	1551	511	6.9	2.8
Hurd 0.2	1/8/2019	2								8.3	0.1
Hurd 0.2	4/22/2019	2								9.3	0.1
Hurd 0.2	8/13/2019	16								10.9	0.1
Hurd 0.2	11/19/2019	2								9.9	0.08
Jimmycomelately 0.15	1/7/2019	4	9	458	2	13	8181	809	50	3.9	0.06
Jimmycomelately 0.15	2/26/2019	2	9	442	1	13	9244	714	33	1.7	0.1
Jimmycomelately 0.15	3/12/2019	2	1	264	1	20	9080	462	30	2.4	0.1
Jimmycomelately 0.15	4/15/2019	4	3	182	1	11	8262	514	36	5.2	0.05
Jimmycomelately 0.15	5/14/2019	18	8	143	1	19	9430	348	48	9.7	0.1
Jimmycomelately 0.15	6/11/2019	196	7	110	1	22	9688	237	36	11.5	0.1
Jimmycomelately 0.15	7/9/2019	72	5	86	1	23	9383	232	36	12.2	0.1
Jimmycomelately 0.15	8/12/2019	60	6	125	1	29	9365	239	43	14.2	0.1
Jimmycomelately 0.15	9/10/2019	42	26	163	1	35	9373	380	54	13.6	0.1
Jimmycomelately 0.15	10/8/2019	8	64	145	10	33	9147	368	61	8.7	0.1
Jimmycomelately 0.15	11/12/2019	4	11	95	2	23	9104	238	42	4.3	0.1
Jimmycomelately 0.15	12/10/2019	10	5	414	1	25	8619	619	39	5.3	0.1
Johnson 0.0	1/7/2019	2	5	388	2	43	9310	946	92	3.6	0.1
Johnson 0.0	2/26/2019	12	5	333	2	46	7768	2020	89	1.5	0.1
Johnson 0.0	3/12/2019	6	3	198	2	46	8343	688	74	3.1	0.1
Johnson 0.0	4/15/2019	2	4	166	2	30	8108	600	66	5.4	0.1
Johnson 0.0	5/14/2019	2	8	137	1	35	6623	354	51	9.8	0.1
Johnson 0.0	6/11/2019	66	15	106	1	34	5876	234	47	12.5	0.1
Johnson 0.0	7/9/2019	54	9	88	1	30	5423	188	41	12.6	0.1
Johnson 0.0	8/12/2019	166	13	55	1	24	4561	129	34	14.4	0.1
Johnson 0.0	9/10/2019	174	4	65	1	30	5301	209	54	13.9	0.9
Johnson 0.0	10/8/2019	14	4	109	1	50	9306	391	78	9.1	0.1
Johnson 0.0	11/12/2019	2	3	21	1	51	11167	210	75	8.1	0.2
Johnson 0.0	12/10/2019	2	8	517	1	48	9074	792	63	6.0	0.1
Lotzgesell 0.1	1/7/2019	40	14	1328	5	11	8246	1917	52	7.3	0.13

Site	Date	FC CFU/ 100mL	NO$_3$-N µg/L	NO$_2$-N µg/L	NH$_3$-N µg/L	PO$_4$-P µg/L	SiSO$_4$-Si µg/L	TN µg/L	TP µg/L	Temp. H$_2$O deg. C	PSU
Lotzgesell 0.1	2/26/2019	2	14	1569	3	10	8081	2131	39	6.8	0.1
Lotzgesell 0.1	3/12/2019	18	11	1560	3	18	8028	2013	39	8.3	0.1
Lotzgesell 0.1	4/15/2019	80	20	1444	4	13	7808	2214	55	10.1	0.14
Lotzgesell 0.1	5/14/2019	184	12	1710	4	9	8023	2296	37	11.0	0.1
Lotzgesell 0.1	6/11/2019	284	15	1562	5	9	7880	1996	31	12.7	0.1
Lotzgesell 0.1	7/9/2019	202	16	1632	7	12	8396	2054	33	12.5	0.1
Lotzgesell 0.1	8/12/2019	162	22	1745	7	12	8421	2088	30	13.3	0.1
Lotzgesell 0.1	9/10/2019	224	13	1781	4	12	8853	1796	41	13.1	0.1
Lotzgesell 0.1	10/8/2019	608								10.5	0.1
Lotzgesell 0.1	11/12/2019	138	16	1017	8	14	8850	1273	47	9.7	0.1
Lotzgesell 0.1	12/10/2019	44	20	1105	6	11	8058	1982	35	8.3	0.1
Matriotti 0.3a	1/7/2019	76	22	1156	5	22	8392	1977	77	5.9	0.1
Matriotti 0.3a	2/26/2019	42	25	1150	5	29	7882	2083	81	3.9	0.1
Matriotti 0.3a	3/12/2019	252	29	1116	4	29	7970	1801	55	6.7	0.1
Matriotti 0.3a	4/15/2019	426	26	815	4	24	7775	1751	72	7.3	0.14
Matriotti 0.3a	5/14/2019	316	31	1494	5	18	7797	2140	49	10.4	0.1
Matriotti 0.3a	6/11/2019	476	34	1293	5	21	7366	1801	49	12.0	0.13
Matriotti 0.3a	7/9/2019	254	22	1286	6	23	7624	1755	45	12.5	0.1
Matriotti 0.3a	8/12/2019	304	32	1410	6	23	7992	1892	41	13.1	0.1
Matriotti 0.3a	9/10/2019	498	19	1428	4	22	8672	2024	90	12.8	0.1
Matriotti 0.3a	10/8/2019	156	32	1550	4	12	9525	1813	86	10.1	0.1
Matriotti 0.3a	11/12/2019	434	73	944	7	20	9025	1274	46	9.2	0.1
Matriotti 0.3a	12/10/2019	82	24	1009	5	18	8787	1643	44	7.9	0.1
McDonald 01.6	1/8/2019	4								3.1	0
McDonald 01.6	4/22/2019	2								7.7	0.1
McDonald 01.6	8/13/2019	64								14.4	0.1
McDonald 01.6	11/19/2019	42								8.0	0.09
Meadowbrook 0.2	1/7/2019	4	72	164	3	14	6431	509	55	5.8	6.82
Meadowbrook 0.2	2/26/2019	6	32	238	3	9	6985	483	33	4.7	1.2
Meadowbrook 0.2	3/12/2019	16	52	174	2	7	6946	395	35	5.4	0.3

Site	Date	FC CFU/ 100mL	NO$_3$-N µg/L	NO$_2$-N µg/L	NH$_3$-N µg/L	PO$_4$-P µg/L	SiSO$_4$- Si µg/L	TN µg/L	TP µg/L	Temp. H$_2$O deg. C	PSU
Meadowbrook 0.2	4/15/2019	16	26	65	2	12	6630	307	34	10.9	1.3
Meadowbrook 0.2	5/14/2019	47	41	62	2	15	6044	325	45	12.2	2.6
Meadowbrook 0.2	6/11/2019	12	20	47	2	15	6347	224	35	17.7	1.1
Meadowbrook 0.2	7/9/2019	16	16	37	1	15	6452	213	36	16.0	2
Meadowbrook 0.2	8/12/2019	126	18	33	2	18	6795	200	42	17.9	0.6
Meadowbrook 0.2	9/10/2019	150	23	32	2	17	7404	256	43	15.8	0.1
Meadowbrook 0.2	10/8/2019	46								11.3	1
Meadowbrook 0.2	11/12/2019	76	129	327	9	71	1873	710	104	9.8	30.9
Meadowbrook 0.2	12/10/2019	44	58	363	4	65	1656	505	82	8.3	30.6
Meadowbrook Slough 0.23	1/7/2019	88	113	177	5	36	2871	415	62	6.4	15.6
Meadowbrook Slough 0.23	2/26/2019	36	21	140	1	14	4015	236	22	5.0	1.3
Meadowbrook Slough 0.23	3/12/2019	126	20	109	1	21	4238	214	33	5.4	0.3
Meadowbrook Slough 0.23	4/15/2019	4	25	53	0	21	4277	277	56	8.7	0.2
Meadowbrook Slough 0.23	5/14/2019	210	30	54	1	18	4197	220	35	8.7	0.1
Meadowbrook Slough 0.23	6/11/2019	382	32	43	1	22	4209	166	47	12.4	0.1
Meadowbrook Slough 0.23	7/9/2019	272	27	47	1	25	4474	164	46	12.4	0.1
Meadowbrook Slough 0.23	8/12/2019	268	27	76	1	29	4594	162	41	14.8	0.1
Meadowbrook Slough 0.23	9/10/2019	1111	33	93	1	28	4838	277	50	14.6	0.1
Meadowbrook Slough 0.23	10/8/2019	47	139	116	5	52	9313	632	116	12.5	0.1
Meadowbrook Slough 0.23	11/12/2019	311	33	57	1	32	4500	170	56	10.0	0.2
Meadowbrook Slough 0.23	12/10/2019	277	70	69	3	23	3580	271	43	7.7	20.4
No Name 0.03	1/8/2019	26								4.0	0.4
No Name 0.03	4/22/2019	4								7.9	0.1
No Name 0.03	8/13/2019	54								15.9	0.1
No Name 0.03	11/19/2019	28								9.3	0.1
Sequim Bay State Park Creek 0.0	3/12/2019	8	1	142	2	48	8159	755	75	3.6	0.1
Sequim Bay State Park Creek 0.0	6/11/2019	18	31	139	1	56	8960	494	68	12.4	0.2
Sequim Bay State Park Creek 0.0	8/12/2019	42	8	58	1	56	8770	338	68	15.3	0.4
Sequim Bay State Park Creek 0.0	9/10/2019	24	9	64	1	58	8730	376	88	14.3	0.8
Sequim Bay State Park Creek 0.0	11/12/2019	2	3	13	1	74	9220	370	92	8.0	0.2

Site	Date	FC CFU/ 100mL	NO$_3$-N µg/L	NO$_2$-N µg/L	NH$_3$-N µg/L	PO$_4$-P µg/L	SiSO$_4$-Si µg/L	TN µg/L	TP µg/L	Temp. H$_2$O deg. C	PSU
Sequim Bay State Park Creek 0.1	1/7/2019	2	2	256	3	53	8747	968	136	4.3	0.1
Sequim Bay State Park Creek 0.1	2/26/2019	12	5	424	3	65	8039	1222	114	1.8	0.1
Sequim Bay State Park Creek 0.1	4/15/2019	10	27	22	3	62	9267	813	127	6.7	0.1
Sequim Bay State Park Creek 0.1	5/14/2019	6	5	196	1	58	9328	634	75	9.7	0.2
Sequim Bay State Park Creek 0.1	7/9/2019	106	4	171	1	67	9339	544	80	12.4	0.2
Sequim Bay State Park Creek 0.1	10/8/2019	10	6	45	1	64	8697	414	84	9.2	0.2
Sequim Bay State Park Creek 0.1	12/10/2019	6	3	38	1	54	8829	415	70	6.3	0.2
Siebert 1.0	1/8/2019	2								3.4	0
Siebert 1.0	4/22/2019	2								7.9	0.1
Siebert 1.0	8/13/2019	32								15.1	0.1
Siebert 1.0	11/19/2019	26								7.9	0.08