



Marine and Sediment Assessment Group 2014 Work Plan

The best decisions are based on Sound information.

Date: December 19, 2013

To: Recipients

From: Scott Mickelson and Kim Stark

Subject: Transmittal of the 2014 Work Plan for the Marine and Sediment Assessment Group

This memorandum and attachments present the 2014 Work Plan for the Marine and Sediment Assessment Group of the King County Department of Natural Resources and Parks Water and Land Resources Division. The work plan includes both routine marine monitoring programs and Wastewater Treatment Division capital support projects such as the Brightwater marine outfall, Sediment Management Plan, and East Waterway and Lower Duwamish Waterway Superfund projects. Included with the memorandum are matrix tables that provide sampling locations, sampling frequency, and parameters measured for the 2014 routine monitoring programs, as well as maps showing sampling locations. Also included is a summary of the Marine and Sediment Assessment Group's work accomplishments for 2013.

Station locations and analytical parameters may change from year to year. Any changes are based on an evaluation of previous years' data to determine if the data collected are meeting monitoring objectives for both the ambient and outfall monitoring programs and/or budgetary constraints. Marine and Sediment Assessment Group staff evaluate data each year to determine what changes are necessary, including what parameters should continue to be analyzed.

For the 2014 work plan, there are four major changes, due to the water quality proviso received from the King County Council. The routine, monthly, offshore water column monitoring program will be increased to a twice-monthly sampling event, beginning in February 2014. All constituents will be sampled/measured during both sampling events, including bacteria, conventionals, field-measured parameters, and phytoplankplankton.

Starting in early to mid-2014, samples will be collected at eight stations and analyzed for quantitative phytoplankton species abundance using the new FlowCam instrument. These samples will aid in method development and building the image library necessary for future analyses. Samples will be collected twice monthly at the same time samples are collected for the offshore ambient and outfall water-column monitoring program.

Beginning in early 2014, zooplankton samples will be collected twice monthly from four stations during the routine offshore water column monitoring sampling event. Zooplankton samples will be collected using both vertical and oblique tows. Vertical zooplankton tows will be collected twice-monthly throughout the year. Oblique tows (focusing on salmonid prey) will be collected twice monthly during March through October. This work will be performed in partnership with the University of Washington, staff from which will identify and enumerate zooplankton species in each sample.

High-precision/accuracy pH monitoring of Puget Sound marine waters will begin development in 2014, with King County as the lead agency. The County will be soliciting technical advice from regional experts in pH monitoring in natural waters, purchasing equipment, and undertaking pilot studies.

There is no sediment monitoring scheduled during 2014, either in association with routine marine monitoring programs or Wastewater Treatment Division capital project monitoring programs.

2014 Marine Offshore Water Column Monitoring Program

Marine water column samples have previously been collected monthly from 18 offshore stations. Ten outfall monitoring stations are located at outfalls for the Brightwater, West Point, South, and Vashon wastewater treatment plants, the Alki and Carkeek combined sewer overflow (CSO) treatment plants, the Elliott West and Henderson/MLK/Norfolk CSO treatment facilities, and the Barton Street and Hanford Street CSOs. Eight ambient monitoring stations are located at Point Jefferson, Elliott Bay, Fauntleroy/Vashon, East Passage, the Lower Duwamish Waterway (two stations), and Quartermaster Harbor (two stations). Beginning in February 2014, water column samples will be collected twice a month from 14 of these 18 stations. The four stations located in the Duwamish Waterway (two ambient stations and two outfall stations) will continue to be sampled on a monthly basis.

Discrete water samples will be collected from between one and seven depths at each offshore station, depending on the total station depth. Conductivity, temperature, depth (CTD) profiles will be conducted throughout the entire water column at 15 of the 18 stations – those stations sampled from King County's research vessels *Liberty* or *Chinook*.

Laboratory analytes will include fecal coliform and enterococcus bacteria, chlorophyll-*a* and pheophytin pigments, suspended solids, and nutrients (ammonia, nitrite/nitrate nitrogen, orthophosphate phosphorus, and silica). Total nitrogen will be analyzed on a subset of 13 samples. Bacteria samples will be collected from one to three sampling depths at each of the outfall monitoring stations, including the surface (1 meter), the deepest depth, and an intermediate (trapping) depth at the deeper outfall stations. Bacteria samples will only be collected from the surface at ambient monitoring stations, with the exception of the Quartermaster Harbor and Duwamish Waterway samples. Bacteria samples will be collected from both depths at each Quartermaster Harbor and Duwamish Waterway station. All other laboratory parameters will be analyzed on samples collected from every depth.

In situ data will be collected at all but three offshore stations using a CTD profiler with a sensor array. CTD profile data will include the following parameters; dissolved oxygen, salinity, temperature, density (calculated), transmissivity, photosynthetically active radiation (PAR), and fluorescence (as a measure of chlorophyll). Surface PAR and Secchi depth measurements will also be collected at all of the offshore stations collected from the *Liberty* or *Chinook*. Secchi depth is collected as well at the two Quartermaster Harbor stations. Field measurements for dissolved oxygen and temperature will be collected using a Hydrolab® instrument at the two Quartermaster Harbor stations and the Henderson/MLK/Norfolk CSO station.

2014 Marine Plankton Monitoring Program

Both phytoplankton and zooplankton samples will be collected beginning in 2014. The phytoplankton monitoring program will continue at the three stations sampled in previous years until the FlowCam is operational. Twice-monthly sampling and analysis will occur in March through October at stations located at Point Jefferson, East Passage, and Quartermaster Harbor. Semi-quantitative analysis will occur for two depths at the Point Jefferson and East Passage stations (1m and the chlorophyll maximum layer as determined by the fluorometer on the CTD) and only at the 1m depth at the Quartermaster Harbor site. Nutrient and chlorophyll-*a* samples will be collected and analyzed concurrent with the phytoplankton samples.

Starting in 2014, samples will be collected at eight stations and analyzed for quantitative phytoplankton species abundance using the County's new FlowCam instrument. These samples will aid in method development and building the image library necessary for future analyses. Unlike the semi-quantitative phytoplankton samples, samples for quantitative analysis will be collected year-round. These samples will be collected twice monthly at the same time samples are collected for the offshore ambient and outfall water column monitoring program.

Zooplankton samples will be collected from four stations in the Central Puget Sound Basin, including Elliott Bay. Vertical zooplankton tows will be conducted twice-monthly at all four stations on a year-round basis. These tows will be to a maximum depth of 100 m, dependent upon overall station depth. Oblique zooplankton tows will be performed twice-monthly at all four stations during the months of March through October to focus on salmonid prey. These tows will be to a depth of 30 m. The four stations sampled include Point Jefferson and East Passage (with synoptically collected phytoplankton samples), the South Treatment Plant outfall site, and central Elliott Bay.

2014 Marine Moorings Program

Marine moorings that include *in situ* water quality data-gathering sensors are currently deployed at four locations – the Seattle Aquarium (two depths), Dockton Park (one depth), the Quartermaster Harbor Yacht Club (one depth) and on a buoy off of Point Williams in southwest Seattle (one depth). These marine mooring systems gather data at 15-minute intervals for dissolved oxygen, salinity, temperature, fluorescence (chlorophyll), and turbidity. A SUNA nitrate sensor also collects data at the Point Williams mooring site. Meteorological data are also collected by the mooring systems deployed at the Seattle Aquarium and Dockton Park.

Continuous data gathering involves a high degree of data management, quality control, and website maintenance to make the data available publicly. The marine mooring web page was redesigned in 2009 to facilitate better public access to the data and enhanced data analysis and reporting tools. The Marine and Sediment Assessment Group will continue to provide support for web maintenance, quality control, and data analysis.

2014 Marine Beach Water Quality Monitoring Program

Water samples will be collected monthly from 20 marine beach stations and one stream station located in Piper's Creek. Nine outfall-vicinity monitoring stations are located inshore of the West Point (two stations) and Vashon treatment plant outfalls, the Alki (two stations), Carkeek, and Elliott West CSO treatment plant outfalls, and the South Magnolia and Barton CSO outfalls. All 20 of the monitoring stations will be sampled monthly for analysis of fecal coliform and enterococcus bacteria, temperature, salinity, and nutrients (ammonia, nitrite/nitrate nitrogen, and orthophosphate phosphorus). The Piper's Creek stream station will be monitored for bacteria, temperature, and nutrients. A subset of six beach water samples will also be analyzed for Total Nitrogen.

Brightwater Marine Outfall Technical Support

The following Brightwater marine outfall project work will be undertaken during 2014:

- Preparation of the final report summarizing results of the nearshore benthic surveys at the trench construction site for the Washington State Departments of Fish and Wildlife and Natural Resources.
- Consultant oversight and coordination for eelgrass dive survey activities and final project report.
- Conducting two ROV surveys of the eelgrass transplant areas and outfall pipes.
- Final agency meeting and update.

Brightwater Marine Outfall Structural Integrity and Biological Assessment Project

The purpose of this project is to determine if marine organisms attached to the pipe may affect the structural integrity of the Brightwater marine outfall HDPE pipes over time. A secondary purpose is to document the presence and abundance of marine organisms on the pipes and concrete collars over time. A goal of this project is to obtain sufficient and quality data to aid state natural resource agencies in assessing the effectiveness and amount of habitat artificial structures provide to various marine organisms.

HDPE pipe segments were placed on the seafloor in 2012 at three locations in close proximity to the marine outfall and also a reference site further away. The pipe material will be allowed to remain in place for pre-defined time intervals: 2, 5, and 10 years. Twenty-seven approximately 2-ft² portions of pipe were placed at the -100 ft, -300 ft, and -600 ft MLLW depths adjacent to the south outfall pipe. Three replicates were placed at each depth and for each time interval. In 2014, 12 samples will be retrieved (3 from each depth and the reference site) by a contractor.

Immediately following retrieval of the 12 samples, the samples will be placed in tubs/containers filled with seawater onboard the vessel. Each site will have its own tub so as not to cross-contaminate samples in the event organisms become detached. Each 2-ft² portion will be assessed for total percent cover by placing a mesh grid over the sample and estimating the biota coverage in each grid cell. The mesh grid will contain 8 cells, each 6 inches x 6 inches. Macroscopic biota will be identified and enumerated in each grid cell and recorded on field sheets. Whenever possible, organisms will be identified down to the species level, however, all organisms will be identified down to the class level at a minimum.

West Point, South, and Brightwater Treatment Plants – NPDES Permit Work

New NPDES permits for the West Point and South treatment plants were issued in 2009 and new NPDES permits for the Brightwater and Vashon treatment plants were issued in 2011. New permits for the West Point and South treatment plants are scheduled to be issued in 2014. The following work will be performed in 2014 in support of the wastewater treatment plant NPDES permits:

- Final reports will be issued on sediment characterization efforts at the Brightwater and South treatment plants, as well as sediment monitoring at 10 CSO outfall sites, after incorporation of comments from Ecology.
- The Marine and Sediment Assessment Group will provide technical assistance during negotiations on the upcoming draft West Point and South wastewater treatment plant NPDES permits.

Inter-Laboratory Nutrient Calibration Study

King County will continue to partner with the Washington State Department of Ecology on an inter-laboratory nutrient calibration study. The goals of the study are to:

- determine direct comparability of nutrient data currently collected and analyzed for central Puget Sound sites;
- provide a means to share data and utilize each agency's results collected for current and historical monitoring projects in Puget Sound;
- provide an understanding (degree, extent, and affected species) of similarities/differences of nutrient results provided by each agency to be used for a combined water quality index assessment and trend analysis for Central Basin stations; and
- provide comparative data for evaluation of laboratory performance and methods, should a transition or need for utilization of another analytical lab arise for future monitoring/projects.

To date, three rounds of nutrient standards analysis and two rounds of field side-by-side split sample analysis have been completed. Based on the results of these rounds of sampling, the following work will be undertaken in 2014, in support of this ongoing inter-laboratory calibration effort:

- Twice during 2014 (to be determined), standards for all four nutrients will be submitted to both laboratories in a range of concentrations similar to the previous pilot studies, to be analyzed as a continuing inter-laboratory calibration check.
- Twice during 2014 (to be determined), side-by-side field sample splits from both the King County and Ecology water quality monitoring programs will be analyzed by both laboratories for all four nutrients of interest.

Delivery of nutrient standards to the University of Washington will be coordinated between agency staff. King County and the University of Washington laboratories will follow their standard protocols for analysis of nutrients.

Water Quality Assessment and Monitoring Study (Elliott Bay)

Additional examination of water quality data will be conducted in 2014 including quality control and analysis of sediment data. Data will be used to prepare an area report summarizing current conditions and long-term trends in water quality in Elliott Bay as well as the results of the literature review. Sampling and analysis plans will be prepared and studies will be conducted that fill identified data gaps. A final synthesis report will be prepared that will incorporate the results of the data gap studies with the Elliott Bay area report. This information will be used to evaluate the best way to control pollution and improve water quality in relation to the county's CSO update.

Projects in Development for 2014

King County will be the lead on developing a method for precise and accurate measurement of pH in its marine waters. During 2014, the Marine and Sediment Assessment Group will be soliciting input for regional experts on methods and equipment necessary for this type of pH measurement. It is anticipated that new equipment will be purchased in early to mid-2014 and pilot studies, both bench-scale and using real-time marine water samples, will be conducted.

Miscellaneous 2014 Work Items

- Support for the completion of Phase II of the Marine Monitoring web page, including uploading historical data and creation of web reporting tools.
- Support for the completion of a new, web-based, marine water quality monitoring reporting system, beginning with the 2008 and 2009 data reports.
- Support for the creation of a new marine benthic data website, including design, data population, testing, and reporting tools.
- Performance measure and environmental indicator updates.
- Preparation of sections for the RWSP Update report.
- Preparation of the 2015 marine and sediment assessment group work plan.
- Technical support for the Wastewater Treatment Division's Sediment Management Plan.
- Technical support for the Puget Sound Partnership.
- Data downloading and analysis for outside agencies, educational facilities, private entities, and the general public.

- Participation in and presentation at the Marine Waters Work Group workshop on 2013 monitoring data. Follow-up to the workshop will include an analysis and write-up of King County marine data for the 2013 Puget Sound Marine Waters Overview report.

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King County Marine and Sediment Assessment Group – 2013 List of Accomplishments

The following work items were accomplished by staff of the King County Marine and Sediment Assessment Group during 2013.

Ambient and Outfall Monitoring Programs

- Coordinated and implemented the collection of marine water, sediment, and phytoplankton samples for both the ambient and outfall monitoring programs.
- Completed internal programmatic annual review.
- Updated the KingStat marine environmental indicators.
- Provided sections for the annual RWSP update report.
- Completed analysis and quality control of 2012 marine data, including mooring data.
- Provided King County data write-ups for various 2012 data for the 2012 Puget Sound Marine Waters Overview Report published by PSEMP's Marine Waters Workgroup and assisted report preparation as co-editor.
- Completed several of the data summaries for the new annual reporting format on the marine group webpage.
- Oversaw ongoing operation of the marine moorings, including permitting and deployment of a new buoy-mounted mooring offshore of Point Williams in West Seattle. Performed quality control checks of the mooring data and did an analysis to determine if there was individual sonde bias and worked to improve data quality and efficiency of the mooring program.
- Began a long-term trend analysis of Puget Sound nutrients and physical water quality parameters.

NPDES Permit-Related Work

- Completed the draft report for the NPDES receiving water characterization study, in fulfillment of one requirement of the West Point, South Plant, Brightwater, and Vashon NPDES permits.

Brightwater Marine Outfall

- Completed two underwater video ROV surveys at the eelgrass transplant site and the twin outfall pipes (with the FSU ROV team). The ROV team also collected great video footage of how the outfall pipes are providing habitat for various marine organisms.
- Completed the eelgrass contract amendment for 2014.
- Completed permitting for deployment of experimental structural integrity/biota habitat project.

Water Quality Assessment and Monitoring Study (Elliott Bay)

- Collected and reviewed Elliott Bay water quality literature and data.
- Identified data gaps and proposed additional monitoring studies to fill those gaps.
- Completed quality control of long-term Elliott Bay data, including mooring, bacteria, offshore, and beaches data.
- Began or completed analysis of mooring, bacteria, offshore, and beaches data, which included identifying current impairments, detecting differences between sites, and examining long-term trends.

Lower Duwamish Waterway and East Waterway Superfund Projects

- Completed four major (multiple-part) data validation efforts for the LDW source control/investigation program including:
 - Air deposition study
 - Green River PAH/arsenic study
 - Brandon CSO basin study
 - Green River basin stream sediment study

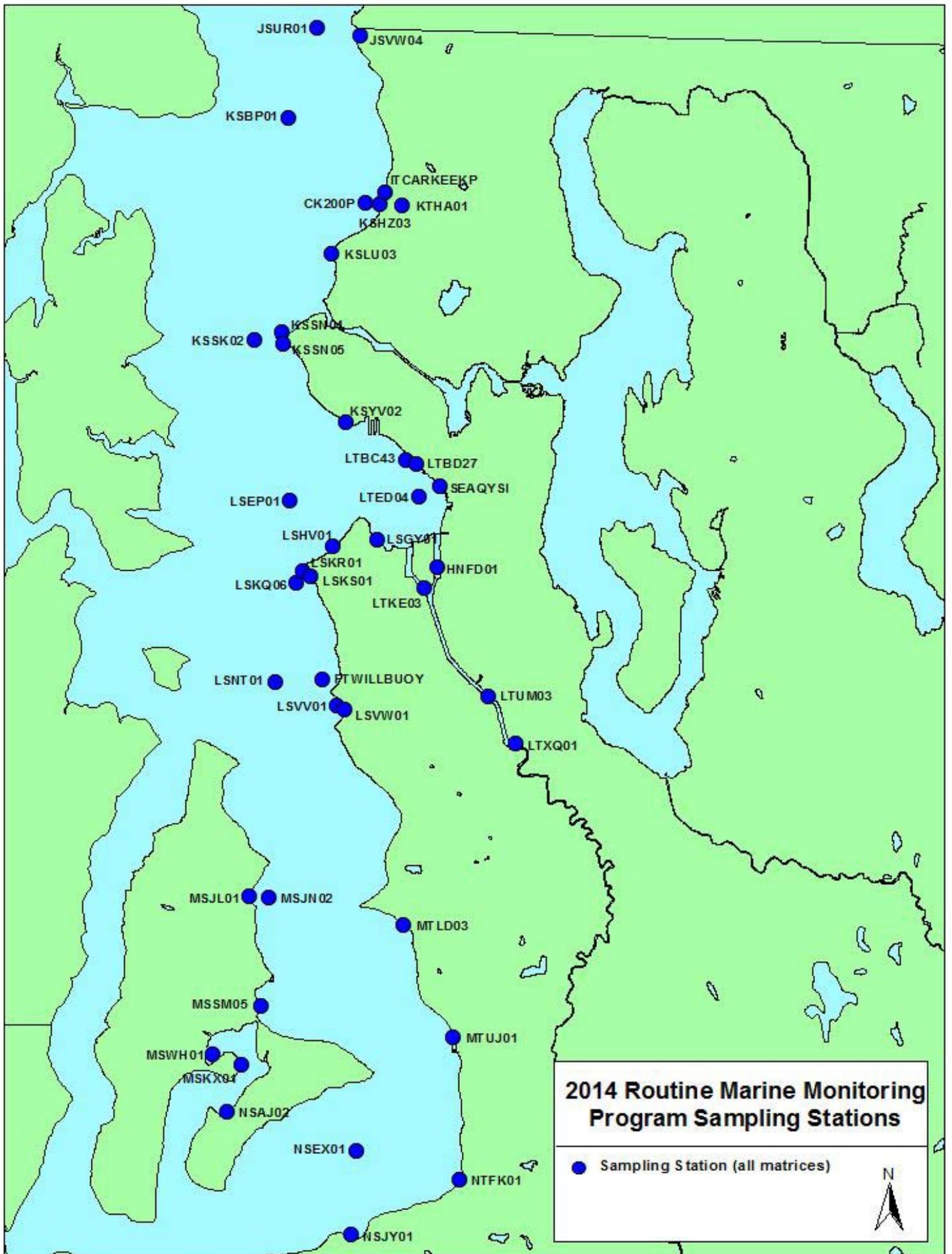
Miscellaneous Project Work

- Provided support for the EPA Quartermaster Harbor Nutrient Management Study grant.
- Completed 12 major data download/analysis requests for internal clients, outside agencies, educational institutions, consultants, and the general public.
- Participated in regional monitoring groups associated with the Puget Sound Partnership (such as the Nearshore Monitoring Subgroup and the Marine Waters Working Group) and the Washington State BEACH Program. Vice-chair of the Marine Waters Workgroup.
- Assisted in a draft report on existing and future sediment and water conditions in the Duwamish River in association with the Brandon/Michigan CSO treatment facility project. .
- Participated in public outreach events including the Seattle Aquarium's Family Science Weekend, the Western Purple Martin Working Group, and the Clean Water Act anniversary celebration.

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Attachments that accompany this work plan include:

- A map showing the locations of all 2014 routine marine monitoring stations and marine moorings.
- A table of all routine marine monitoring sampling locations with stratum sampled (stream, beach, offshore), matrices monitored, and station coordinates.
- Maps and analytical matrix tables for both of the routine marine monitoring programs for 2014 – offshore water column (color-coded) and beach water.

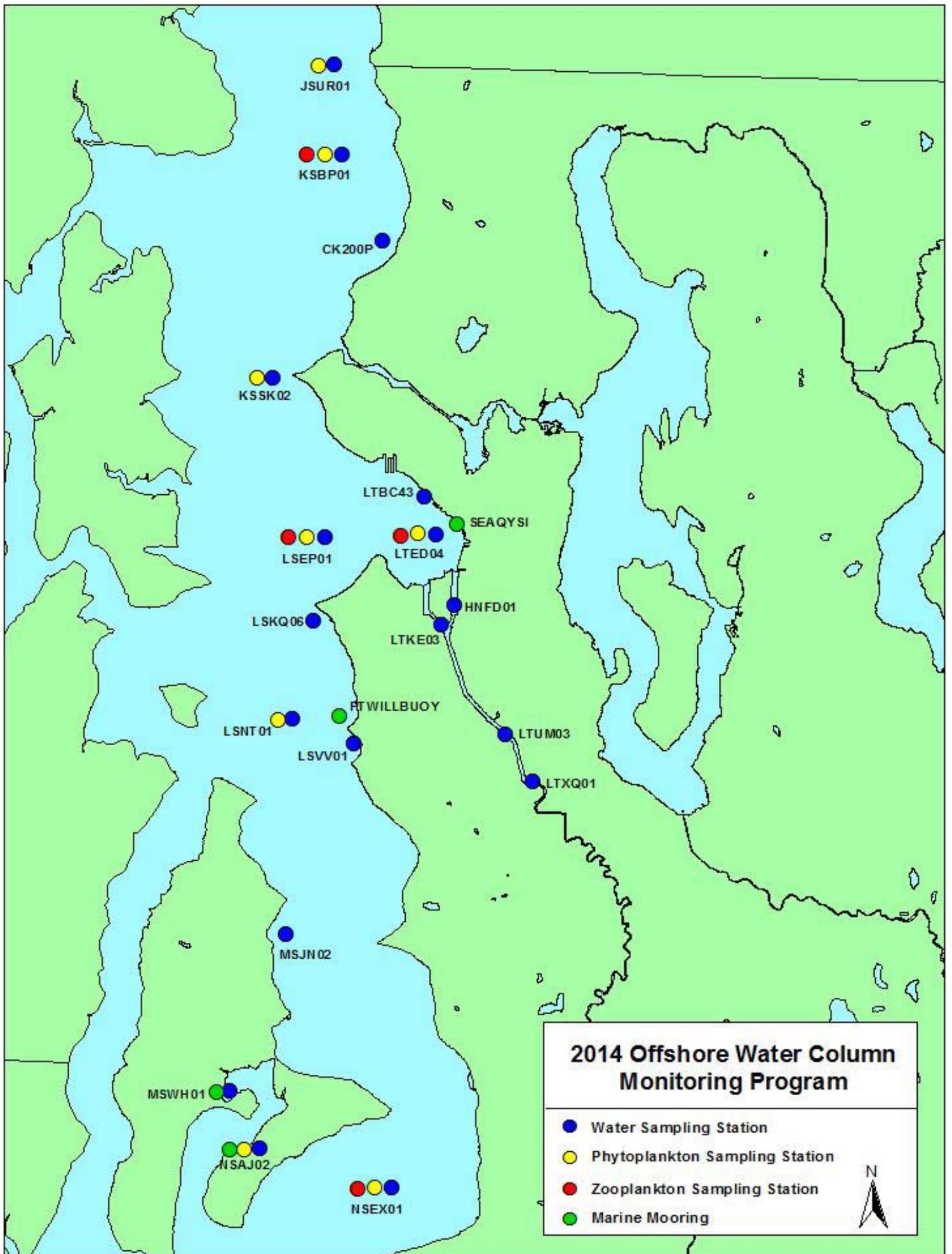


2014 Routine Marine Monitoring Program

Sampling Stations, Matrices Sampled, and Station Coordinates

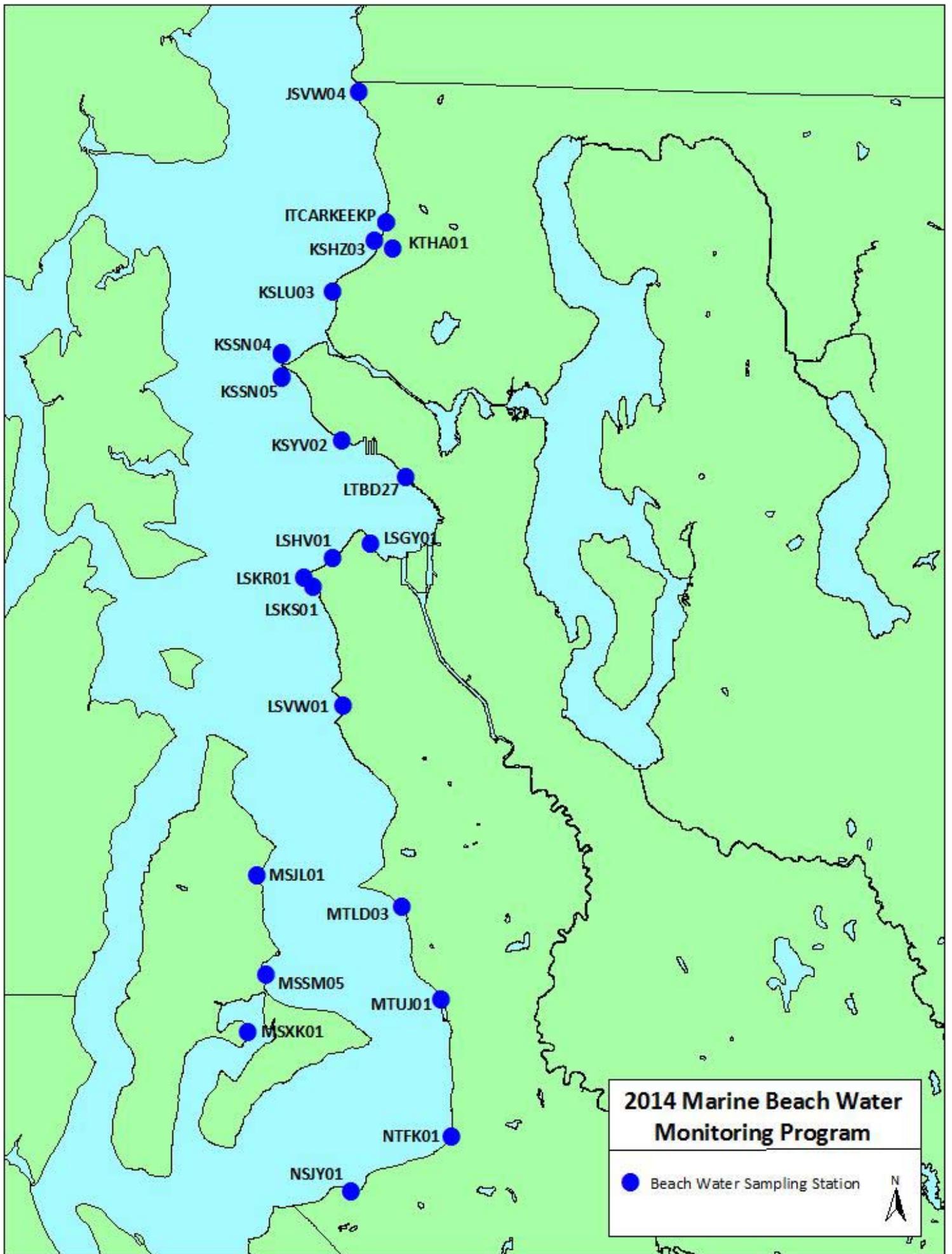
Locator	Description	Stratum	Matrices	Northing ¹	Easting ¹
JSVW04	Richmond Beach/Point Wells	Beach	Water	286171	1257194
ITCARKEEKP	Carkeek Park	Beach	Water	263756	1259915
KSHZ03	Piper's Creek Mouth	Beach	Water	263736	1259784
KTHA01	Piper's Creek	Stream	Water	262962	1262305
KSLU03	Golden Gardens	Beach	Water	256354	1253305
KSSN04	West Point North	Beach	Water	245729	1246032
KSSN05	West Point South	Beach	Water	245272	1245980
KSYV02	Magnolia CSO	Beach	Water	234547	1254488
LTBD27	SAM Sculpture Park	Beach	Water	228851	1264297
LSGY01	Seacrest Park	Beach	Water	218711	1258776
LSHV01	Alki Beach	Beach	Water	216852	1253532
LSKR01	Alki North	Beach	Water	213666	1249416
LSKS01	Richey Viewpoint	Beach	Water	212668	1250283
LSVW01	Fauntleroy Cove	Beach	Water	194969	1254846
MTLD03	Normandy Park	Beach	Water	165142	1263285
MTUJ01	Des Moines Creek Park	Beach	Water	151129	1269533
NTFK01	Redondo Beach	Beach	Water	131067	1270899
NSJY01	Dumas Bay Park	Beach	Water	122831	1255835
MSJL01	Vashon - Gorsuch Creek	Beach	Water	169666	1241897
MSSM05	Vashon - Tramp Harbor	Beach	Water	154908	1243459
MSXK01	Vashon - Burton Acres Park	Beach	Water	146481	1240772
JSUR01	Point Wells	Offshore	Water/Phyto	287580	1250910
KSBP01	Jefferson Head	Offshore	Water/Phyto/Zoo	275439	1248062
CK200P	Carkeek CSO TP Outfall	Offshore	Water	263819	1257728
KSSK02	West Point TP Outfall	Offshore	Water/Phyto	245121	1242740
LTBC43	Elliott West CSO TP Outfall	Offshore	Water	228985	1263430
SEAQYSI	Seattle Aquarium	Offshore	Mooring	225168	1267840
LTED04	Elliott Bay	Offshore	Water/Zoo	223909	1264675
HNFD01	East Waterway	Offshore	Water	214139	1267488
LTKE03	Duwamish River	Offshore	Water	211418	1265871
LTUM03	Duwamish River	Offshore	Water	196629	1274591
LTXQ01	Henderson/MDL CSO TP Outfall	Offshore	Water	190313	1278053
LSEP01	South TP Outfall	Offshore	Water/Phyto/Zoo	223360	1247399
LSKQ06	Alki CSO TP Outfall	Offshore	Water	212065	1248334
PTWILLBUOY	Point Williams	Offshore	Mooring	205989	1252069
LSNT01	Fauntleroy/Vashon	Offshore	Water/Phyto	198653	1245194
LSVV01	Barton CSO Outfall	Offshore	Water	195347	1253935
MSJN02	Vashon TP Outfall	Offshore	Water	169328	1244585
NSEX01	East Passage	Offshore	Water/Phyto/Zoo	134701	1255331
MSWH01	Quartermaster Harbor	Offshore	Water/Mooring	147976	1236667
NSAJ02	Quartermaster Harbor	Offshore	Water/Mooring/Phyto	140223	1239011

¹North American Datum 1983 (NAD83) - State Plane Coordinate System - Washington North 4601



2014 Marine Offshore Monitoring Program
Semi-Monthly Water Column Sampling Matrix

Station	Depth (m)	Bacteria		Conventionals										CTD						Field			PhytoPI		Zoopl									
		Enterococcus	Fecal Coliform	Ammonia Nitrogen	Nitrite + Nitrate Nitrogen	Total Nitrogen	Orthophosphorus	Silica	Chlorophyll-a	Phaeophytin	Total Suspended Solids	Dissolved Organic Carbon	Total Organic Carbon	Dissolved Oxygen - Winkler	Salinity	Chlorophyll, Field	Density, Field	Dissolved Oxygen, Field	Light Intensity (PAR), Field	Salinity, Field	Sample Temperature, Field	Surface Light Intensity (PAR), Field	Transmissivity, Field	Dissolved Oxygen, Field	Sample Depth	Sample Start Time	Secchi Transparency	Semiquantitative ⁴	Quantitative ⁵	Vertical Tow (100 m) ⁶	Oblique Tow (30 m) ⁹			
JSUR01	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1	1	1	1	1	1	1							
	15			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	25			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	35			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	55			1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
	100	1	1	1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
	175	1	1	1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
KSBP01	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1	1		1	1	1	1	1						
	2.5, 3.5, 5.5, 8, 10 ³			1	1		1	1	1	1					1	1	1	1	1	1	1	1		1	1		1	1						
	15			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	25			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	30																																1	
	35			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	55			1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
	100			1	1		1	1			1				1	1	1	1	1	1	1	1		1	1							1		
	200			1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
CK200P	1	1	1	1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1	1								
	15			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	25			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	35	1	1	1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	55	1	1	1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
KSSK02	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1	1		1	1	1								
	15			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	25	1	1	1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	35			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	55	1	1	1	1	1	1	1			1				1	1	1	1	1	1	1	1		1	1									
LTBC43	1	1	1	1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1	1								
	15	1	1	1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
LTED04	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1	1		1	1	1								
	15			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	25			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	30																																1	
	35			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	55			1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
	75			1	1		1	1			1				1	1	1	1	1	1	1	1		1	1							1		
LTKE03 ⁷	1	1	1	1	1		1	1			1	1	1	1	1	1	1	1	1	1	1	1		1	1	1								
	variable ¹	1	1	1	1		1	1			1	1	1	1	1	1	1	1	1	1	1	1		1	1									
LTUM03 ⁷	1	1	1	1	1		1	1			1	1	1	1	1	1	1	1	1	1	1	1		1	1	1								
	variable ¹	1	1	1	1		1	1			1	1	1	1	1	1	1	1	1	1	1	1		1	1									
HNFD01 ⁷	1	1	1	1	1		1	1			1	1	1	1	1	1	1	1	1	1	1	1		1	1	1								
	variable ¹	1	1	1	1		1	1			1	1	1	1	1	1	1	1	1	1	1	1		1	1									
LTXQ01 ^{2,7}	1	1	1	1	1		1				1													1	1	1								
LSEP01	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1	1		1	1	1								
	15			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	25			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	30																																	1
	35			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	55			1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
	100	1	1	1	1	1	1	1			1				1	1	1	1	1	1	1	1		1	1								1	
	180	1	1	1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
LSKQ06	1	1	1	1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1	1								
	15			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	25			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	35	1	1	1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
LSNT01	1	1	1	1	1	1	1	1	1	1	1				1	1	1	1	1	1	1	1		1	1	1								
	15			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	25			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	35			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	55			1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
	100			1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
	180			1	1		1	1			1				1	1	1	1	1	1	1	1		1	1									
LSVV01	1	1	1	1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1	1								
	5	1	1	1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
MSJN02	1	1	1	1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1	1								
	15			1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	25	1	1	1	1		1	1	1	1	1				1	1	1	1	1	1	1	1		1	1									
	35			1	1		1	1	1	1	1				1	1	1	1	1															



2014 Marine Beaches Monitoring Program

Monthly Water Quality Sampling Matrix

Locator	Station Description	Bacteria		Conventionals					Field
		Enterococcus	Fecal Coliform	Ammonia Nitrogen	Nitrite + Nitrate Nitrogen	Total Nitrogen	Orthophosphorus	Salinity	Sample Temperature, Field
JSVW04	Richmond Beach	1	1	1	1	1	1	1	1
ITCARKEEK	Carkeek Park - North	1	1	1	1		1	1	1
KSHZ03	Carkeek Park - Piper's Creek Mouth	1	1	1	1	1	1	1	1
KTHA01	Carkeek Park - Piper's Creek Upstream	1	1	1	1		1		1
KSLU03	Golden Gardens	1	1	1	1		1	1	1
KSSN04	West Point - North	1	1	1	1		1	1	1
KSSN05	West Point - South	1	1	1	1		1	1	1
KSYV02	South Magnolia CSO	1	1	1	1		1	1	1
LTBD27	SAM Sculpture Park Beach	1	1	1	1		1	1	1
LSGY01	Seacrest Park	1	1	1	1		1	1	1
LSHV01	Alki Beach	1	1	1	1		1	1	1
LSKR01	Alki Beach - Alki Plant	1	1	1	1		1	1	1
LSKS01	Richey Viewpoint	1	1	1	1		1	1	1
LSVW01	Fauntleroy Cove	1	1	1	1	1	1	1	1
MTLD03	Normandy Park	1	1	1	1		1	1	1
MTUJ01	Des Moines Creek Park	1	1	1	1		1	1	1
NTFK01	Redondo Beach	1	1	1	1	1	1	1	1
NSJY01	Dumas Bay Park	1	1	1	1	1	1	1	1
MSJL01	Vashon Island - Gorsuch Road	1	1	1	1		1	1	1
MSSM05	Vashon Island - Tramp Harbor	1	1	1	1		1	1	1
MSXK01	Vashon Island - Burton Acres Park	1	1	1	1	1	1	1	1

Total Samples/Records per Month	21	21	21	21	6	21	20	21
Total Samples/Records for 2014	252	252	252	252	72	252	240	252