DRAFT

Appendix F
Site-specific Dive Safety and Work Plan

Site-Specific Dive Safety and Work Plan

Under-pier Investigations and Sampling

Lower Duwamish Waterway, Middle Reach

Seattle, Washington

FINAL

October 2022

Prepared for:

Lower Duwamish Waterway Group

Port of Seattle / City of Seattle / King County / The Boeing Company

For submittal to:

The US Environmental Protection Agency
Region 10
Seattle, WA

Prepared by:

Research Support Services

This page intentionally left blank

Table of Contents

List of Figures

List of Tables

1 Introduction and Objectives

This document is the Dive Safety and Work Plan for diver assistance with under-pier observations and sediment sampling in the middle reach of the Lower Duwamish Waterway (LDW). The diving tasks are in support of the middle reach Pre-Design Investigation for remedial design.

The project area is shown in Figure 1 and is located between Terminal 115 (river mile [RM] 1.6) and Boeing Plant 2 (RM 3). The ultimate objective of the work is to perform sediment probing and collect sediment samples in areas inaccessible to sampling vessels.

1.1 Description of Activities

Research Support Services, Inc. (RSS) personnel will be conducting tethered diving operations to evaluate conditions, ascertain depth of soft sediment, and collect sediment samples. The estimated number of dives will be between five and eight per day at depths ranging from approximately 3 to 45 ft salt water (fsw).

The tethered diving operation normally involves a dive supervisor and three divers. The dive team for each sample site will consist of a diver, a fully suited standby diver ready to assist if necessary, and a diver tender. This allows for safe and efficient diving by rotating the three-diver crew through the roles of diver, standby diver, and tender, allowing multiple dives for each diver per day.

Work activities will be coordinated closely with the Consultant (Anchor QEA), per the steps outlined in Standard Operating Procedure (SOP) E17.

- **Initial reconnaissance**

  Prior to conducting any diving, an above-water, pre-project reconnaissance inspection will be made with the Dive Supervisor and members of the engineering team, including a structural engineer. The purpose of this inspection is to verify the safety of conducting dive work under the overwater structures. All understructure diving locations will be observed from the *Carolyn Dow* for the presence of in-water debris, and/or any structural damage that could potentially endanger a diver working at that location due to collapse or falling structural debris. Any potentially dangerous locations will be discussed with the structural engineer and project team and, if warranted due to the presence of entanglement or debris hazards, the transect location will be adjusted to a safe nearby location.

- **Reconnaissance inspections—transect surveys from the pier face toward shore**

  At each dive location the diver will descend along a down line at the face of the pier and place a fiberglass measuring tape between two pile bents. The diver will descend slowly, while observing the surrounding site conditions for potential entanglement or obstruction hazards, carefully avoiding any debris. The diver will communicate potentially hazardous conditions to the dive supervisor and tender. A nearby alternative transect will be selected in consultation with Anchor QEA if the site is found to be too hazardous for descent.

- **Sediment probing to determine if soft sediment is present in the interstitial spaces of large riprap or other shoreline armoring at sufficient quantities to collect samples**

  The diver will insert a 3/8-in. stainless steel probe into the sediment to determine if and to what depth a sample will be obtained. The work will follow SOP E27, with the exception that station control will be based on positioning between pile bents as handheld differential global positioning system receivers are not likely to work under structures. The results of the sediment probing will be discussed with Anchor QEA prior to finalizing the final locations of sediment samples. SOP E17 describes the decision-making process for final selection of under structure sample locations based on field conditions.

  Sediment probing may increase turbidity and cause blackout conditions. Divers are trained to work in blackout conditions. The diver will note the location of the transect line before disturbing sediment that could impact visibility and will stay in contact with the transect line at all times to maintain position and accomplish the required tasks.

- **Collection of 10-cm, 45-cm, and 60-cm samples**

  After setting the transect and conducting reconnaissance and probing, the diver will return to the pier face to exchange the camera and probing equipment for the sediment sampling equipment. The exchange of equipment will be conducted using a tending line haulback technique. The diver will remain on the bottom and gear will be transferred using a loop of line tied to the tending line by the tender.

  10-cm samples will be collected with an eight-inch diameter stainless steel hand core.

  Deeper samples will be collected by inserting a 3.75-in. diameter butyrate tube to the desired depth by hand or by using a slide hammer device. The diver will plug the top of the tube, extricate the core, and cap the bottom. The tools and measuring tape will be attached to the down line, and the diver will return to the surface with the sample.

  Samples brought to the surface will be processed in accordance with SOPs E18 and E19.

Table 1. Target Sample Location Coordinates

Structure	Location ID	RM	Expected Tidal Category[1]	Target Coordinates			
				X	Y	Longitude	Latitude
Northland North Wharf (Terminal 115)	1800	1.6	subtidal	1268399	203288	-122.339787	47.547323
	1801	1.6	subtidal	1268456	203083	-122.339539	47.546762
	1802	1.7	subtidal	1268516	202906	-122.339283	47.546282
	1803	1.7	subtidal	1268589	202719	-122.338972	47.545773
	1804	1.7	subtidal	1268652	202529	-122.338699	47.545257
Certainteed Wharf	1805	1.7	intertidal	1268997	203168	-122.337356	47.547024
Samson Tug	1806	1.8	intertidal	1269258	202625	-122.336253	47.545551
Muckleshoot Tribes Marina	1807	2.0	intertidal	1270049	201579	-122.332972	47.542725
SeaTac Marine	1808	2.1	subtidal	1270183	201232	-122.332402	47.541781
	1809	2.1	subtidal	1270306	201101	-122.331891	47.541430
	1810	2.2	subtidal	1270431	200967	-122.331375	47.541068
Alaska Marine Lines Yard No 2	1811	2.1	subtidal	1269893	200813	-122.333540	47.540618
Seattle Iron & Metals Wharves	1812	2.4	subtidal	1271224	200119	-122.328101	47.538787
	1813	2.4	subtidal	1271284	200051	-122.327851	47.538603
Boyer Alaska Barge Line Seattle Main Wharf	1814	2.5	subtidal	1271090	199548	-122.328598	47.537214
Pacific Pile and Marine Wharf	1815	2.7	subtidal	1271990	198568	-122.324878	47.534575
8th Avenue Terminal Wharf	1816	2.8	subtidal	1272814	198631	-122.321547	47.534792
	1817	2.8	subtidal	1272940	198669	-122.321040	47.534903
	1818	2.8	subtidal	1273060	198777	-122.320564	47.535207
	1819	2.8	subtidal	1273160	198867	-122.320165	47.535458
Silver Bay Logging Wharf	1820	2.9	intertidal	1272673	198057	-122.322071	47.533212

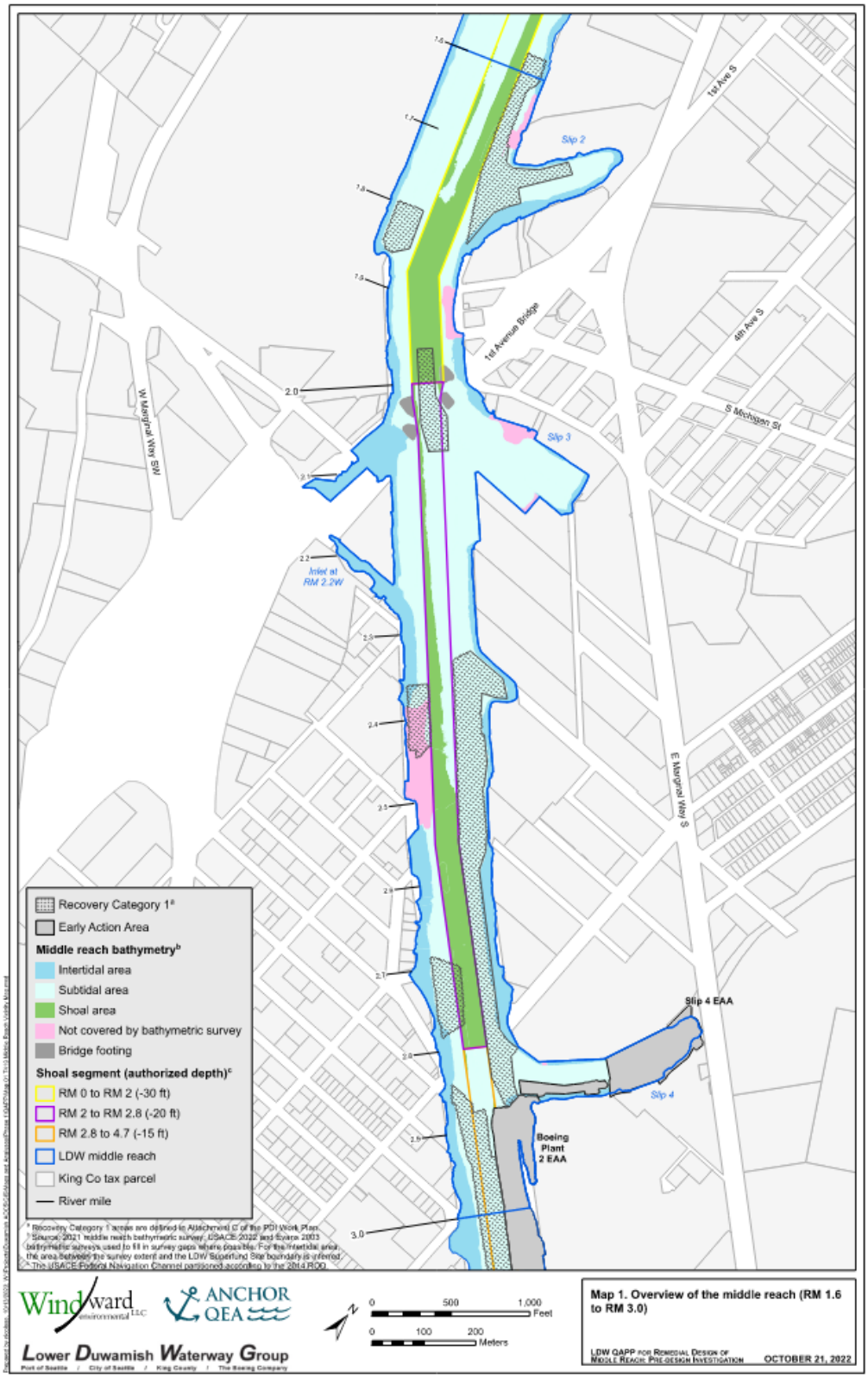

Figure 1. Project Area

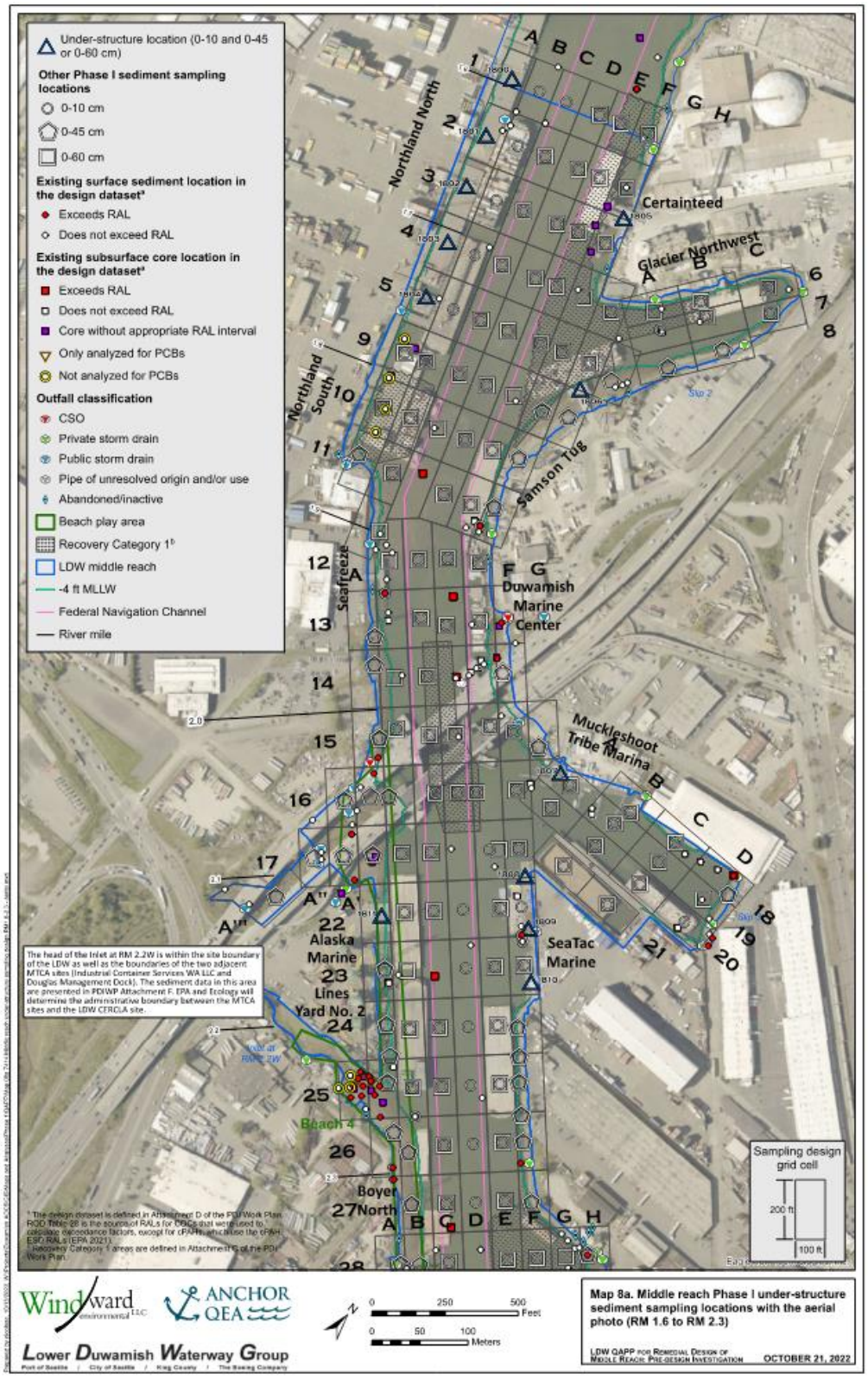

Figure 2. Proposed Sample Locations, RM 1.6 to RM 2.3

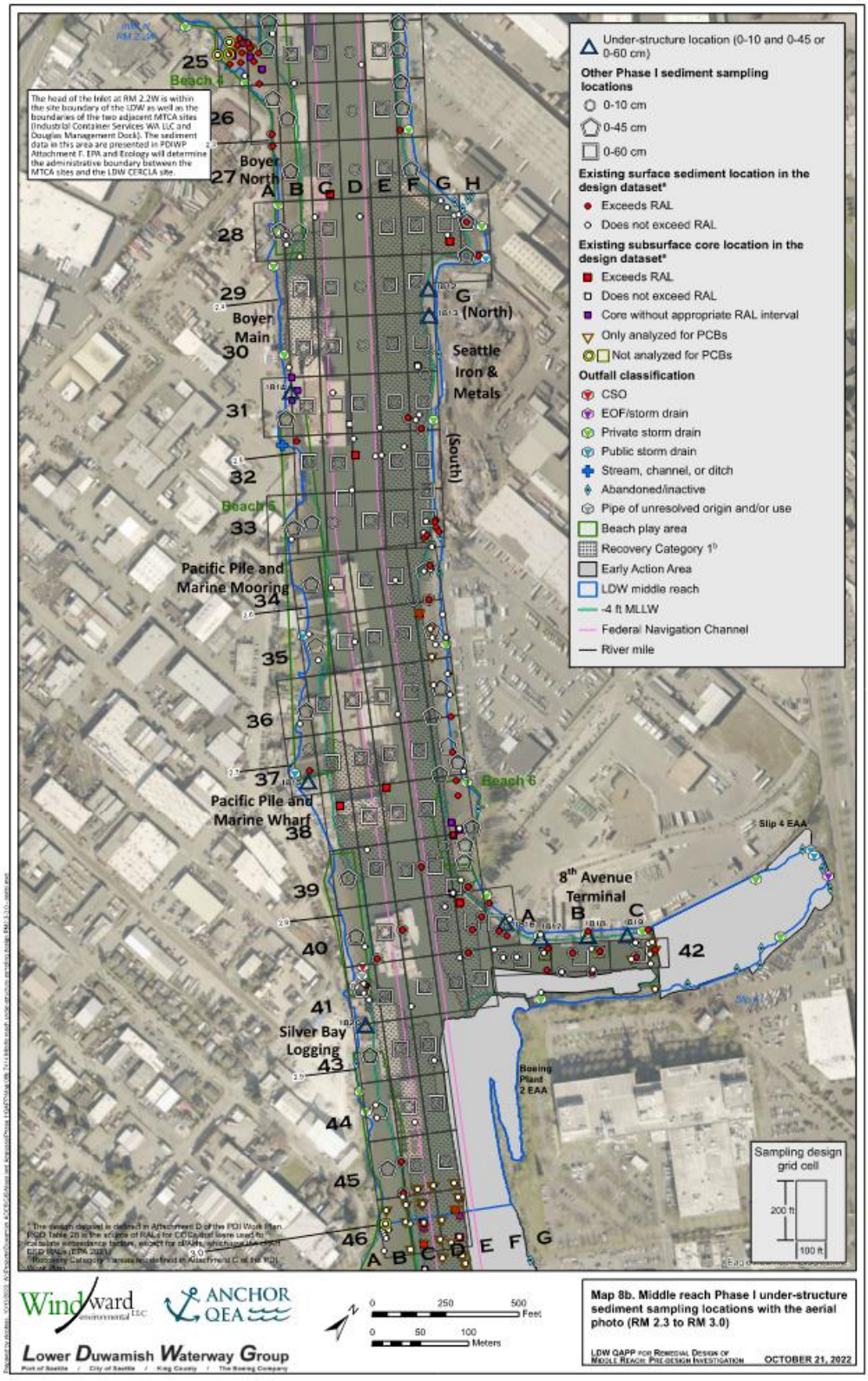

Figure 3. Proposed Sample Locations, RM 2.3 to RM 3.0

1.2 Known Physical Site Hazards

This site has a long history of industrial and municipal use, which brings with it the possibility of unmarked structures and debris. Tide cycles and changes in river flow and currents can also bring debris to the site. These factors present an entanglement risk to divers and deployed equipment. All work in industrial areas must be conducted slowly and methodically, with special care taken in low visibility and in areas with structures or a high likelihood of debris. Low visibility and entanglement are addressed in **Section 10, Diving Emergency and Problem Management.**

The project is in an active harbor area, and vessel traffic can pose a hazard. It is important to maintain communication with facility operators and vessel operators in the area. Contact information and procedures for addressing vessel traffic issues are outlined in **Sections 3, 4 and 5.**

2 Emergency Response Information

NOTE: Call local 911 first in case of any medical emergency before traveling to the emergency medical facility. Call DAN (Divers Alert Network) with questions regarding treatment of diving emergencies.

2.1 Emergency Contact Information

EMS Rendezvous Points:	Harbor Island Marina, Gate C 1001 SW Klickitat Way, Seattle, WA 98134 Duwamish River boat ramp under First Ave S Bridge 108 S River Street, Seattle, WA 98108 Boat ramp next to South Park Marina, upriver of the 16th St. Bridge 8500 Dallas Ave. S, Seattle, WA 98108
Telephone Emergency:	911
U.S. Coast Guard VTS:	VHF channel 14 or (206) 217-6152
Divers Alert Network (DAN):	(919) 684-9111
Poison Control Center:	(800) 222-1222
Dive Emergency Gear:	First aid kit, emergency oxygen kit, backboard/litter, eyewash kit, fire extinguisher, AED, VHF radio, and cellular phone
Contacting Vessels:	VHF channel 13 for commercial traffic VHF channel 16 to raise Coast Guard or hail recreational vessels
Uplands Facility:	None
Staff Emergency Info:	Emergency information for all RSS staff will be located in the beige file box in the wheelhouse.

2.2 Nearest Dive Emergency Medical Facility

Virginia Mason Hospital
Center for Hyperbaric Medicine
1100 Ninth Ave.
Seattle, Washington 98104
Hours: 0730-1600
(206) 583-6543

Double-lock, Tables 4 and 6 capable
Intake through any ER

NOTE: Call to confirm operational status of decompression chambers before the start of operations.

2.3 Nearest Non-dive Emergency Medical Facility

Harborview Medical Center
325 9th Ave., Seattle WA 98104
(206) 744-3000

2.4 Nearest Non-urgent Care Facility

NeighborCare at Columbia City
4400 37th Street South, Seattle, WA 98118
(206) 461-6957
Open: Monday - Friday, 8 a.m. - 5 p.m.

Maps from the EMS rendezvous points to hospitals are at located in Section 15.3, along with a signature page indicating that all the divers have read and understand the dive plan. Signatures will be obtained following the initial project safety meeting and orientation.

3 Dive Plan Overview

Project:	LDW Middle Reach Sediments
Daily Work Window:	0700-1700
Uplands Contact:	NA
Field Managers:	Eric Parker, RSS: (206) 550-5202
	Rebecca Gardner: (206) 669-7333
Dates of Operation:	5 dive days (anticipated)
Location of Dives:	RM 1.6 to RM 3
Dive Supervisor:	Eric Parker
Divers/Tenders:	River Brown**,** Savanah Brewer, Michael Janson,
	Alex Hasselbring, Chase Kingsford
Purpose of Work:	Underpier reconnaissance and sediment sampling
Est. # of Dives:	27
Est. Max Depth:	50 feet salt water (fsw)
Est. Max Bottom Time:	20-30 minutes/dive
Depth for Majority:	45 fsw and shallower
Visibility:	2 to 5 ft expected
Tidal Influence:	Tides range from approximately -4 to 13 feet over the year.
Current:	Less than 1 knot expected. Tide can reverse river flow depending on river stage
Diving Mode:	SCUBA/contaminated environment gear
Breathing Gas:	Air (80 ft^3 minimum tank capacity, CGA grade E air minimum) Octopus Gardens Diving, Port Townsend, WA
	Latest test date to be added (will be within six months of project)
Backup Air Supply:	30 ft^3 bailout tank to manifold block; second stage regulators from primary and bailout
Communications:	Hardwire comms to full-face mask

4 Pre-dive Safety Procedures and Notifications

- The U.S. Coast Guard Vessel Traffic System will be notified on VHF channel 14 before diving operations begin and again when work is finished for the day. The vessel operator will monitor VHF channel 14 throughout the day.

- VHF channels 13 and 16 will also be used to establish contact with vessels working in the project area and will be monitored throughout the day.
- The on-board AIS will be monitored throughout the day.
- All personnel will be instructed to keep watch for boat wakes and vessel traffic and to communicate them to the rest of the crew.
- This document will be read and discussed prior to the start of operations and reviewed during a pre-dive safety briefing to familiarize divers and surface personnel of site-specific hazards and to ensure readiness to work.
- Site specific conditions will be assessed the day of the dive and discussed as part of the pre-dive safety briefing. This will include potential hazards related to weather conditions (e.g. heat stress, hypothermia, sunburn), water conditions (e.g. waves, currents, visibility), and site conditions (e.g. structures, debris, vessel traffic).
- All equipment will be checked on deck to ensure it is in proper working order, including the emergency oxygen supply and the functionality of the equipment.
- At least one vehicle will be staged at the EMS rendezvous site closest to the dive locations for that day.

5 General Work Plan

- Diving operations will be conducted from the *Carolyn Dow,* a 36-foot aluminum landing craft anchored or tied to pilings adjacent to the dive location.
- A weighted down line will be secured to the vessel to provide a reference for the diver's descent and ascent in an environment with low visibility and the potential for debris.
- A single, line-tended diver will conduct the work at each location. A total of three crew per day will be rotated through the positions of diver, safety diver, and diver tender.
- A safety diver will stand by on the vessel, suited and ready to assist.
- Divers, tender, and dive supervisor will communicate via a round-robin hardwire communication system with 12v supply and battery backup. Line pull signals will be reviewed as part of the safety briefing as a means of back up communication. Back up line-pull signals are presented in **Section 14** of this plan.

6 Compliance with Agency and Industry Standards

RSS is committed to performing services in accordance with the standard of care of our profession, including maintaining safe work conditions during operations. All work conducted under this plan strives to meet or exceed U.S. Coast Guard and Occupational Safety and

Health Administration (OSHA) regulations, and the Association of Diving Contractors International, Inc. In addition, procedures from the 2022 EPA Dive Safety Manual will be followed.

If for any reason the dive plan is altered in mission, depth, personnel, or equipment, the Client will be contacted to review and accept the alteration before actual operation.

6.1 Diver Certification and Training

Divers conducting the work on this project are experienced and qualified. Documentation is provided in Section 15.1 showing each team member's commercial or government training, physical fitness-to-dive, training in first aid, CPR, AED and medical oxygen administration, 40-hour 1910.120 initial Hazardous Waste Operations and Emergency Response training, and current 8-hour refresher.

6.2 Medical Monitoring

Workers involved in field activities subject to OSHA HAZWOPER 29 CFR 1910.120 for more than 30 days per year will be required to participate in a medical surveillance program covered under 29 CFR 1910.120(f), or equivalent regulations based on the jurisdiction in which the project is performed. Based on the activities of this project's team members, chemical/biological medical surveillance does not apply to this work. Documentation to that effect is included at the end of Section 15.1.

7 Dive Safety Procedures

- Diving operations will be conducted in accordance with federal and state health and safety regulations for commercial scuba diving. The RSS Dive Safety Manual is crafted to address equipment, training and procedures relevant to the sampling and instrument installation conducted by RSS divers. The Client's Site-Specific Health and Safety Plan will apply to non-diving components of this operation and will be reviewed and signed by all participants.
- A dive log will be maintained showing depth, bottom time, surface interval, and repetitive group designation. Allowable bottom time will be calculated using tables. No-decompression limits will be calculated using NDL and RNT tables from the U.S. Navy Diving Manual, version 7 provided in **Section 13**.
- A blue-and-white alpha flag and a red-and-white recreational dive flag will be flown above the working surface during dive operations. Flags will be each be a minimum of 1 meter by 1 meter per USCG Collision Regulations, State and municipal requirements, and to enhance overall visibility and safety of the operation.
- An automated external defibrillator (AED) will be on the dive platform. At least two people on the vessel will be trained in its use in the event of potentially life threatening cardiac arrhythmia.
- 636 liters of emergency oxygen, and equipment with a manual trigger valve (MTV) capable of ventilating non-breathing diver, will be available on the dive platform in case of a

pressure-related injury. A second manually operated bag valve mask ("ambu bag") will also be on board for circumstances involving two non-breathing divers. In addition to administration of oxygen to an injured diver, basic first aid and activation of EMS will apply. All RSS staff on board are trained in the administration of oxygen and first aid.

- All divers will carry at a minimum a 30 ft^3 auxiliary bailout bottle should a malfunction occur with the primary air supply.
- Contamination precautions will include a drysuit comprised of slick, easily cleaned material, attached latex dry hood and dry gloves, and a full-face mask that seats upon the dry hood. Leakage of the full-face mask or suit will trigger a safe abort of the dive and procedures listed in the Activity Hazard Analysis under Underwater Activities, **Section 11**.
- Divers will wear a safety harness capable of lifting them aboard the vessel via the davit or a-frame. A rescue stretcher (litter) will be on site during dive operations and used for transport if necessary.
- The standby diver will be tethered with a longer line than the primary diver to ensure that the standby diver is capable of reaching the primary diver in the event of an emergency.
- Personnel will wear personal flotation devices (PFDs). Hydrostatic inflation vests will be checked daily for operational status and to ensure that cartridges are not expired.
- As a safety precaution, divers will be rinsed with potable water upon re-boarding the vessel and before removing any of their gear or opening the ambient breathing valve on their full-face mask. As they remove their gear, any sediment held by straps or wrinkles in clothing will be rinsed away.
- Dive tenders will wear personal protective gear slightly less protective than that worn by the divers. This will include waterproof coats, pants, boots, protective gloves and, when spraying down the diver, a face shield. Tenders and will be subject to the same decontamination procedures as the divers (to the extent applicable). The diver decontamination procedure is discussed in more detail in **Section 9.4**

8 COVID-19 Precautions

The work will be performed in accordance with Centers for Disease Control (CDC) guidelines and requirements regarding COVID-19 at the time the work is performed. This may include rapid antigen testing, masking with N-95 face coverings, social distancing, self-quarantine, and restrictions on returning to work.

COVID-19 screening questions and temperature checks will take place each morning at the safety briefing. Workers who feel sick are instructed to stay home. Workers who report feeling sick at the briefing or are found to have a fever will be sent home to follow guidance in place at the time. The Anchor QEA project manager will be made aware of positive cases.

Except for the tending activities related to assisting the diver, personnel will endeavor to maintain a six-foot separation from one another. Divers will be provided with safety glasses and the tender will wear a face shield during diver decontamination processes.

Soap and water will be available for hand washing, and hand sanitizer will be available and used frequently.

Wheelhouse occupancy will be limited to two, and ventilation will be maintained to avoid the possible accumulation of exhaled aerosols.

9 Prevention of Chemical Exposure

9.1 Contaminants of Concern

Potential contaminants in surface water at the site may be encountered during dive operations, including bacteria from stormwater runoff and oils on the surface of the water. Contact with and ingestion of river water is to be avoided.

Other potential contaminants may be present in sediment on the diver's suit, equipment or tending line. These chemicals will typically be bound in the wet solid matrix of the sediment.

Although sediments in the Duwamish Waterway may contain contaminants, concentration levels in the water and sediment are expected to be below levels that will produce significant exposures when prescribed personal protective equipment (PPE) such as gloves and rubber boots are used. Limiting contact with sediments and water will further minimize any contact exposures.

Known or suspected substances at the site are provided in **Section 15.2**.

Surface personnel will be working in an open-air environment, and these chemicals pose a low risk for inhalation. Care should be taken, however, to avoid breathing water mist associated with diver decontamination procedures. The decontamination zone for divers will be positioned downwind of the tender and vessel crew to reduce this risk. The vessel position will be monitored during decontamination processes and maneuvered via the anchor windlasses and motors to maintain the downwind position of the decontamination zone if the wind direction shifts. All PPE will be removed in the decontamination zone at the vessel bow as shown on Figure 4.

The primary routes of exposure in this marine environment are dermal exposure and ingestion of sediment. Contact should be minimized through proper use of protective equipment and safety protocols as described in the following sections.

9.2 Work Zones

A small boat presents challenges to the textbook contamination management model because of the limited space available for transitioning from dirty to cleaner environments. Aboard the *Carolyn Dow* there will be four areas delineated by tape or physical barriers:

1. An *Exclusion Zone* represented by the surrounding water.
2. *A Decontamination Zone,* comprised of the bow door and the area around the processing tray, for rinsing sediment and site water from divers and storing re-useable equipment. (The bow door is lowered to a horizontal position at the water surface for diver entry, exit, and decontamination.) This zone will be delineated by tape applied to the deck. PPE will be removed from the diver in this zone. The tender's PPE and gloves will be cleaned following the diver decontamination and will be left in the decontamination zone.
3. A *Contamination Reduction Zone* that includes the rest of the deck, but not the wheelhouse, where care will be taken to keep the deck clean of sediment through frequent rinsing. This zone is delineated by the decontamination zones and the wheelhouse.

4. A *Support Zone* in the wheelhouse, where everyone entering will have been through the potable-water rinsing process on deck and rinsed their boots again before entering. The diagram below shows the boat in plan view and the locations of these zones.

Additionally, the operator will orient the vessel with stern anchors into the wind or otherwise orient the boat in order to avoid splashes or spray aft of the decontamination zone during diver decontamination, as previously noted.

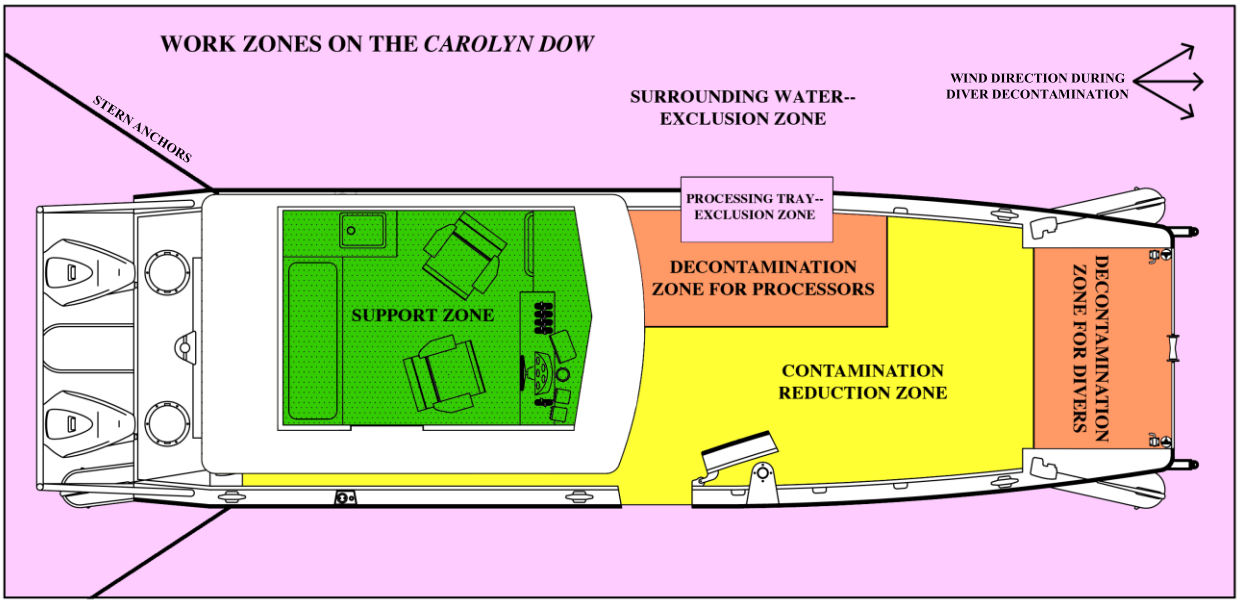

Figure 4. Work Zones on the Carolyn Dow

9.3 PPE

Personal protective equipment (PPE) for on-deck personnel consists of Level-D PPE (gloves, rubber boots, eye protection, and hard hat when overhead or head injury conditions exist). Inadvertent contact with sediment or site water is to be mitigated by rinsing and washing the affected skin. Ingestion of site water and sediment is to be avoided.

While rinsing the diver in the Decontamination Zone, the dive tender will additionally wear splash protection in the form of rain gear and a face shield. The rain jacket and face shield will be removed after the diver enters the Contamination Reduction Zone.

Protection from in-water contaminant exposure for divers will be accomplished through use of a drysuit composed of slick, easily cleaned material, attached latex dry hood and dry gloves, and a full-face mask that seats upon the dry hood.

Leakage of the full-face mask or suit will trigger a safe abort of the dive and procedures listed in the Activity Hazard Analysis under Underwater Activities, (**Section 11**), and the diver and equipment will be decontaminated as appropriate in accordance with the procedures described below.

9.4 Diver Decontamination Procedures

Although the dilute underwater environment works in the diver's favor in terms of exposure to contaminants, the diver will have direct contact with the sediment. It is important to rinse free whatever sediment might remain on their gear upon their return to the surface. This is most likely where their gloves meet their suits, on their knees and fins, and in folds and crevices on the suit.

Diver decontamination will be conducted in the Decontamination Zone shown in the drawing above. The following procedure will be followed as divers exit the water:

1. The bow door will be lowered to allow the diver to sit on it, and then it will be raised to provide a horizontal seating surface at the waterline. The vessel will be positioned to keep the bow area in a downwind position from the vessel crew during decontamination. The diver's primary gas tank will be inspected to verify that 500 psi remains.
2. The tender will be positioned upwind of the diver during decontamination.
3. The tender will sanitize their gloves and the hose nozzle prior to approaching the diver.
4. With the diver still seated, the tender will carefully hose down the diver's head, mask, and hands with potable municipal water supplied from a hose at the front of the wheelhouse. Care will be taken to avoid excessive spray that might drive contaminants inside the mask.
5. Still seated, the diver will remove their mask, taking care to avoid dripping water onto their face. The tender will wipe the diver's forehead and hood skirt with a paper towel as the mask is removed.
6. If the diver or tender's skin comes into contact with sediment or water, the exposed area will be washed with soapy water. The soapy water will be collected as practicable in a bucket for disposal by the client.
7. The tender will assist the diver out of their scuba rig and weight belt. The diver then will stand on the door and remove their fins. The tender will rinse the diver once again with potable municipal water to remove any sediment and river water from the diver's suit.
8. The divers will wash their gloved hands with water and then remove the gloves and dry hood if they are not returning to the water directly. When removing the gloves, the diver will invert the cuffs below the wrist rings so the tender can rinse away any sediment that collected there during the dive. Soapy water will be used if needed to remove sediment from gloves and/or hands if needed. The soapy water will be collected as practicable in a bucket for disposal by the client.
9. The diver is now clear to leave the bow door decontamination zone and enter the foredeck contamination reduction zone (CRZ), avoiding the sediment processing exclusion zone on the port side against the wheelhouse.
10. If they are not visibly contaminated after washing and rinsing, the drysuit gloves may be reused on subsequent dives. They will be stored in a small plastic bin in the CRZ.
11. The rinsed SCUBA rig, weight belt, harness and fins will be stored in the CRZ away from masks, gloves and other accessories since they may contain materials that are difficult to fully decontaminate during the field day. If they cannot be re-used, they will be replaced.

12. Following decontamination, the tender will rinse the bow door and decontamination zone with potable water.
13. The outside of the diver's mask and the inside of the mask skirt will be cleaned with soapy water, taking care to avoid the inside of the mask. The soapy water will be collected as practicable in a bucket for disposal by the client.
14. The mask will be stored in a plastic bin in the CRZ.
15. Before assisting the diver in donning gear for the next dive, the tender will wash and rinse their reusable gloves or don new disposable gloves.

10 Diving Emergency and Problem Management

First aid supplies will be provided and kept readily accessible at the work site, including an American Red Cross standard first aid handbook or equivalent. Medical oxygen as specified above will be available on the vessel.

The primary means of activating emergency services will be through cellular telephone. **A list of primary emergency contact numbers is provided on Page 3 of this plan**. In the event of the need for emergency transport, 911 operators will coordinate the EMS response.

Table 2. Emergency situations and actions. The following table provides a list of potential emergency situations that may arise and suggested actions to be taken in the event of an occurrence:

EMERGENCY OR PROBLEM SITUATION	RECOMMENDED ACTION
Entangled or fouled diver	Provide the diver a reasonable amount of time to clear the entanglement. The second diver will enter the water to assist if necessary. Once the diver is free, if anxious or if a second diver was required to go to their assistance, terminate the dive. The dive supervisor will determine if further dives will be performed that day.

EMERGENCY OR PROBLEM SITUATION	RECOMMENDED ACTION
Loss of breathing medium	Check the fill of each cylinder for primary and emergency air supply before and after each dive. Open the manifold block to start flow from the emergency air supply, and surface at a safe ascent rate. Standby diver will make ready to assist the out-of-air diver as required. If two divers are in the water and the out-of-air diver is not receiving gas from their primary or emergency air supply, that diver will go to the secondary regulator (octopus) of the second diver and both divers will surface immediately. The diver will be appropriately decontaminated after surfacing.
Full-face mask malfunction	On removal of the full-face mask, the diver will switch to the second stage regulator, don the scuba mask they carry with them, and make a safe ascent to the surface. The diver will be appropriately decontaminated after surfacing.
Diver glove, mask or suit leak	Equipment shall be checked prior to entering the water. Discontinue dive and undress the diver to the point of exposure. Wash and rinse any point of skin contact. Diving may continue at the discretion of the Dive Supervisor if: the leak can be repaired; clean undergarments are available; and the diver feels fit to continue.
Loss of communication	Plan the dive and position the boat so communications can be maintained between the diver and the boat/tender. If communications cannot be maintained, resort to pull signals and terminate dive. (See Section 14 for signals.) Reestablish hardwire or wireless communications before resuming operations. Two divers may work as a team without voice communication if they remain in visual contact or are connected via a short “buddy line”.

EMERGENCY OR PROBLEM SITUATION	RECOMMENDED ACTION
Injured diver	Divers shall inform topside of the nature and extent of injury. If necessary, the safety diver shall enter the water to assist, monitoring the injured diver's condition and breathing during ascent. Proper safety stops and ascent rates should be observed except when the severity of the injury indicates a greater risk than omitting a safety stop or accelerating the ascent. Administer appropriate first aid, including emergency oxygen if there is any likelihood of a pressure-related injury. Request medical assistance and emergency evacuation as required.
Dry suit or BCD blow-up/rapid ascent to the surface Obvious signs of pressure-related injury including decompression sickness	Evaluate the diver for symptoms of decompression sickness, air embolism, and lung-overexpansion injury. If no symptoms are present, advise diver to be aware that symptoms may occur up to 24 to 48 hours later and to seek medical help if they do. If symptoms are present, administer medical oxygen, notify emergency services, and arrange for transport to the appropriate medical facility as directed by emergency services.
Injury/illness of a member of surface crew with diver in the water	Notify divers of the injury/illness. Abort the dive. Request medical assistance and emergency evacuation as required.
Diver loss of consciousness	If two divers are in the water, the second diver will bring the unconscious diver to the surface at a safe ascent rate. If only one diver is in the water, launch the standby diver to bring the unconscious diver safely to the surface. Contact emergency services. Administer First Aid/Rescue Breaths/CPR/oxygen as appropriate and transport the diver to the EMS rendezvous point or nearest medical facility.

11 Activity Hazard Analysis

Table 3. Activity hazards and controls. The following table identifies potential hazards associated with this job and lists controls, or behaviors that will be instituted to help prevent or manage safety incidents.

Job Steps	Hazards	Controls
Transporting personnel and general boat safety	Vehicle collision	Seat belts shall be worn at all times by driver and passengers, and there shall be no cell phone use by driver.
	Drowning	All personnel shall wear personal flotation devices (PFD) when in boats or over water unless they are in a zipped drysuit.
	Slips, trips and falls	An orientation to the vessel will point out potential hazards such as slippery surfaces and protruding objects.
	Boat wakes	All personnel shall keep watch for wakes from passing vessels and make others aware.
	Windlass injury	All personnel shall be instructed in windlass safety and will remain clear when in operation.
	A-frame	Pinch points will be pointed out, and hardhats will be required when a-frame is in use or suspended loads are present.
	Diver egress and ingress	Divers will enter and exit the water via the a seated position on the bow door to avoid the potential for jumping into shallow water or onto an obstruction. Divers will remove their fins and hang them from their wrists when coming aboard via the bow door.
	Vessel anchoring	The vessel will be anchored fore and aft adjacent to the dive location. If the vessel must be moved when divers are in the water, windlasses, not the boats motors, will be used.
Using high pressure cylinders	Catastrophic failure of HP cylinders	All cylinders shall be in good condition with current VIP and hydro inspections, and cylinders shall be securely positioned unless they are in use. Dressed tanks will be laid down or strapped in an upright position unless attended.

Job Steps	Hazards	Controls
Using high pressure cylinders (cont.)	Cylinder valve failure	All cylinders and valves shall be in good condition with current VIP and hydro inspections on the cylinders.
	Freezing of valves or regulators on HP cylinders	Monitor valves and regulators during low temperatures for signs of icing.
Conducting underwater operations	Vessel traffic	Dive flag shall be posted at dive site prior to divers entering the water. Approaching vessels shall be contacted by VHF and flagged by the topside crew. In areas with vessel traffic systems, VTS should be made aware of the dive operations and may request participation in the traffic system or notification of diver entries and exits.
	Adverse sea-state	Diving supervisor shall determine if it is possible for a diver to safely enter and exit the water routinely and in an emergency.
	Poor visibility	Dive lights and mandatory communications will be used in low visibility environments. Divers are trained to work in low visibility and blackout conditions. Divers will be tethered and will maintain contact with the transect line at all times.
	Diver entanglement or trapped diver	Review dive plan and observe the physical environment before diving, noting possible obstructions the divers or entanglement risks. The boat shall be positioned as close as possible to the area being inspected and moved as necessary, without power, while the divers are in the water. If possible, the boat shall be positioned so that the diver's objective requires a straight swim out and a straight return along the tending line. If the tending line does not lead directly to the diver's bubbles, it could be an indication that an obstruction has been encountered. The diver shall make their way back to the obstruction and clear the line.

Job Steps	Hazards	Controls
Conducting underwater operations (con.t)	Loss of air to diver	Check the fill of each cylinder for primary and emergency air supply before and after each dive. The diver will open the manifold block to start flow from the emergency air supply, and surface at a safe ascent rate. Standby diver will make ready to assist the out-of-air diver as required. If two divers are in the water and the out-of-air diver is not receiving gas from their primary or emergency air supply, that diver will go to the secondary regulator (octopus) of the second diver and both divers will surface immediately.
	Loss of voice communications when divers are using audio communications.	The audio communications will be hardwired to the diver via the tether. Handpull signals will be used to return the diver to the surface in the event of a communications loss.
	Hypothermia	Divers shall be dressed appropriately for the conditions and communicate if they are cold. Dive team duties can be rotated as necessary. The tender and dive supervisor shall monitor the diver's comfort and readiness throughout the day. The wheelhouse can be heated if necessary to warm a cold diver.
	Hyperthermia	The tender and dive supervisor shall monitor the diver's comfort level throughout the day. Air conditioning is available in the wheelhouse to help avoid overheating. Dressed divers can be sprayed with potable water to help with overheating.
	Diver glove, mask or suit leak	Equipment shall be checked prior to entering the water. The diver will return to the surface in the event of a glove, mask, or drysuit leak. Spare gloves, suit repair materials and spare undergarments shall be available. Leaky equipment will be decontaminated per standard protocol.
	Decompression sickness	All dives shall follow the diver's computer or US Navy decompression tables and stay within no-decompression limits. Any signs of decompression sickness will be treated according to standard dive emergency management protocols including administration of oxygen and activation of EMS.

12 Equipment Considerations

Table 4. Equipment Considerations

Equipment to be Used	Training Requirements	Inspection Requirements
Boats	Boaters safety training for smaller vessels, USCG Master for *Carolyn Dow*. First aid, CPR, AED, O2 admin for all crew	Daily inspection for functionality, worn hoses, leaks, etc. Check safety gear.
Navigation and survey electronics	Experienced and familiar with component function and operating procedures	Visual inspection, pre-operations test to ensure proper operation
Sediment samplers	Experienced and familiar with safe operating procedures. Appropriate OSHA training for the expected contaminants per HASP	Visual inspection, pre-operations test to ensure proper operation
Company vehicles and trailers	Licensed appropriately for the vehicle and familiar with towing procedures	Annual DOT inspection Pre-trip inspections and daily fluid checks
High pressure air cylinders	Handling of cylinders	Visual inspection, current VIP and hydrostatic test.
Dive system including hoses, manifolds and regulators, BCD, submersible pressure gauge, quick release weight system, depth gauge, knife, dive timer for diver and dive supervisor	Experienced and familiar with component function and operating procedures	Annual service. Visual inspection, pre-operations test to ensure proper operation.
Dry suit	Experienced and familiar with dry suit operations	Check for leaks and proper inflation/deflation prior to diving. Inspect valves to ensure proper operation.
Full-face mask and acoustic communications	Experienced and familiar with component function and operating procedures	Annual service. Visual inspection and pre-operations safety check.
Tending line and positive-buckling safety harness	Experienced and familiar with component function and operating procedures	Visual inspection and pre-operations safety check.

13 U.S. Navy No-Decompression Dive Tables

Table 5. U.S. Navy No-Decompression

Depth (fsw)	No-Stop Limit	Repetitive Group Designation															
		A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	Z
10	Unlimited	57	101	158	245	426	*										
15	Unlimited	36	60	88	121	163	217	297	449	*							
20	Unlimited	26	43	61	82	106	133	165	205	256	330	461	*				
25	1102	20	33	47	62	78	97	117	140	166	198	236	285	354	469	992	1102
30	371	17	27	38	50	62	76	91	107	125	145	167	193	223	260	307	371
35	232	14	23	32	42	52	63	74	87	100	115	131	148	168	190	215	232
40	163	12	20	27	36	44	53	63	73	84	95	108	121	135	151	163	
45	125	11	17	24	31	39	46	55	63	72	82	92	102	114	125		
50	92	9	15	21	28	34	41	48	56	63	71	80	89	92			
55	74	8	14	19	25	31	37	43	50	56	63	71	74				
60	63	7	12	17	22	28	33	39	45	51	57	63					
70	48	6	10	14	19	23	28	32	37	42	47	48					
80	39	5	9	12	16	20	24	28	32	36	39						
90	33	4	7	11	14	17	21	24	28	31	33						
100	25	4	6	9	12	15	18	21	25								
110	20	3	6	8	11	14	16	19	20								
120	15	3	5	7	10	12	15										
130	12	2	4	6	9	11	12										
140	10	2	4	6	8	10											
150	8		3	5	7	8											
160	7		3	5	6	7											
170	6			4	6												
180	6			4	5	6											
190	5			3	5												

* Highest repetitive group that can be achieved at this depth regardless of bottom time.

Table 6. U.S. Navy Residual Nitrogen Timetable for Repetitive Air Dives.

Locate the diver's repetitive group designation from his previous dive along the diagonal line above the table. Read horizontally to the interval in which the diver's surface interval lies.

Next, read vertically downward to the new repetitive group designation. Continue downward in this same column to the row that represents the depth of the repetitive dive. The time given at the intersection is residual nitrogen time, in minutes, to be applied to the repetitive dive.

* Dives following surface intervals longer than this are not repetitive dives. Use actual bottom times in the Air Decompression Tables to compute decompression for such dives.

Repetitive Group at Beginning of Surface Interval

	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
Z	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:19	11:20 12:13	12:14 13:30	13:31 15:50 *
O	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:27	10:28 11:21	11:22 12:37	12:38 14:58 *	
N	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:34	9:35 10:29	10:30 11:45	11:46 14:05 *		
M	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:50	7:51 8:42	8:43 9:37	9:38 10:53	10:54 13:13 *			
L	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:51	7:51 8:44	8:45 10:01	10:02 12:21 *				
K	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:58	6:59 7:52	7:53 9:09	9:10 11:29 *					
J	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:06	6:07 6:59	7:01 8:16	8:17 10:36 *						
I	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:13	5:14 6:08	6:09 7:24	7:25 9:44 *							
H	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:21	4:22 5:16	5:17 6:32	6:33 8:52 *								
G	:10 :52	:53 1:44	1:45 2:37	2:38 3:29	3:30 4:23	4:24 5:40	5:41 8:00 *									
F	:10 :52	:53 1:44	1:45 2:37	2:38 3:31	3:32 4:48	4:49 7:08 *										
E	:10 :52	:53 1:44	1:45 2:39	2:40 3:55	3:56 6:15 *											
D	:10 :52	:53 1:47	1:48 3:03	3:04 5:23 *												
C	:10 :55	:56 2:11	2:12 4:31 *													
B	:10 1:16	1:17 3:36 *														
A	:10 2:20 *															

Dive Depth	Repetitive Group at the End of the Surface Interval															
	Z	O	N	M	L	K	J	I	H	G	F	E	D	C	B	A
10	**	**	**	**	**	**	**	**	**	**	**	427	246	159	101	58
15	**	**	**	**	**	**	**	**	450	298	218	164	122	89	61	37
20	**	**	**	**	**	462	331	257	206	166	134	106	83	62	44	27
25	†	†	470	354	286	237	198	167	141	118	98	79	63	48	34	21
30	372	308	261	224	194	168	146	126	108	92	77	63	51	39	28	18
35	245	216	191	169	149	132	116	101	88	75	64	53	43	33	24	15
40	188	169	152	136	122	109	97	85	74	64	55	45	37	29	21	13
45	154	140	127	115	104	93	83	73	64	56	48	40	32	25	18	12
50	131	120	109	99	90	81	73	65	57	49	42	35	29	23	17	11
55	114	105	96	88	80	72	65	58	51	44	38	32	26	20	15	10
60	101	93	86	79	72	65	58	52	46	40	35	29	24	19	14	9
70	83	77	71	65	59	54	49	44	39	34	29	25	20	16	12	8
80	70	65	60	55	51	46	42	38	33	29	25	22	18	14	10	7
90	61	57	52	48	44	41	37	33	29	26	22	19	16	12	9	6
100	54	50	47	43	40	36	33	30	26	23	20	17	14	11	8	5
110	48	45	42	39	36	33	30	27	24	21	18	16	13	10	8	5
120	44	41	38	35	32	30	27	24	22	19	17	14	12	9	7	5
130	40	37	35	32	30	27	25	22	20	18	15	13	11	9	6	4
140	37	34	32	30	27	25	23	21	19	16	14	12	10	8	6	4
150	34	32	30	28	26	23	21	19	17	15	13	11	9	8	6	4
160	32	30	28	26	24	22	20	18	16	14	13	11	9	7	5	4
170	30	28	26	24	22	21	19	17	15	14	12	10	8	7	5	3
180	28	26	25	23	21	19	18	16	14	13	11	10	8	6	5	3
190	26	25	23	22	20	18	17	15	14	12	11	9	8	6	5	3

Residual Nitrogen Times (Minutes)

** Residual Nitrogen Time cannot be determined using this table (see paragraph 9-9.1 subparagraph 8 for instructions).

† Read vertically downward to the 30 fsw repetitive dive depth. Use the corresponding residual nitrogen times to compute the equivalent single dive time. Decompress using the 30 fsw air decompression table.

14 Line-Pull Signals in Case of Hardwire or Wireless Communication Failure

From Tender to Diver

1 Pull	“Are you all right?” When diver is descending, one pull means “Stop.”
2 Pulls	“Going Down.”
3 Pulls	“Stand by to come up.”
4 Pulls	“Come up.”

From Diver to Tender

1 Pull	“I am all right.” When descending, one pull means “Stop” or “I am on the bottom.”
2 Pulls	“Lower” or “Give me slack.”
3 Pulls	“Take up my slack.”
4 Pulls	“Haul me up.”

Emergency Signals From the Diver

2-2-2 Pulls	“I am fouled and need the assistance of another diver.”
3-3-3 Pulls	“I am fouled but can clear myself.”
4-4-4 Pulls	“Haul me up immediately.”

ALL EMERGENCY SIGNALS SHALL BE ANSWERED AS GIVEN EXCEPT 4-4-4

15 ATTACHMENTS

15.1 Diver Credentials

Diver credentials include as applicable:

- evidence of commercial, government or approved public safety training
- evidence of current commercial diving physical and letter of clearance to dive
- current training certs or equivalent for:
    - First Aid
    - CPR
    - AED operation
    - Emergency Oxygen Administration
- HAZWOPER training (40-hour or equivalent, 8-hour refresher)
- HAZWOPER site exposure over previous 12-month period

Credentials will be furnished separately after the project is scheduled.

15.2 Potential Contaminants

Table 7. Potential Contaminants.

Chemical	Exposure Routes	Symptoms	Target Organs	OEL (STEL)	Odor Threshold (ppm)	LEL (%)	Ionization Potential (eV)
PCBs (Chlorodiphenyls) (42% Cl / 53469-21-9) (54% Cl / 11097-69-1)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, chloracne; liver damage; reproductive effects Potential occupational carcinogen	Skin, eyes, liver, reproductive system	0.001 mg/m^3 TWA_8 Skin IDLH / Ca – 5 mg/m^3	N/A	N/A	?
Polycyclic aromatic hydrocarbons (PAHs) – as coal tar pitch volatiles. (Includes benzo(a)pyrene, chrysene, phenanthrene, fluoranthene, pyrene, acenaphthene, methylnaphthalenes, and anthracene)	Skin, eye, inhalation, and ingestion hazard	Direct contact or exposure to the vapors may be irritating to the eyes. Direct contact can be highly irritating to the skin and can cause dermatitis. Exposure to high vapor concentrations may cause headaches, nausea, vomiting, and other symptoms. Includes human carcinogens. Exposure to all routes should be carefully controlled to levels as low as possible. Confirmed animal carcinogen.	Respiratory system, skin, bladder , kidneys	0.2 mg/m^3 TWA_8 0.1 mg/m^3 TWA_8 (Cyclohexane-extractable fraction) IDLH / Ca – 80 mg/m^3	Varies	N/A	?
Dioxins/Furans (as 2,3,7,8-Tetrachloro-dibenzo-p-dioxin) - TCDD	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes; allergic dermatitis, chloracne; porphyria; gastrointestinal disturbance; possible reproductive, teratogenic effects; In Animals: liver, kidney damage; hemorrhage Potential occupational carcinogen	Eyes, skin, liver, kidneys, reproductive system	Lowest Feasible Concentration (LFC) Proposed OEL of 0.2 ng/m^3 Skin IDLH / Ca - LFC	N/A	?	?
Hydrogen Sulfide (H2S) (7783-06-04) 1 ppm = 1.40 mg/m^3	Inhalation, skin and/or eye contact	Irritation eyes, respiratory system; apnea, coma, convulsions; conjunctivitis, eye pain, lacrimation (discharge of tears), photophobia (abnormal visual intolerance to light), corneal vesiculation; dizziness, headache, lassitude (weakness, exhaustion), irritability, insomnia; gastrointestinal disturbance; liquid: frostbite	Eyes, respiratory system, central nervous system	1 ppm TWA_8 (5 ppm) C – 10 ppm (10-min over an 8-hr shift) IDLH - 100 ppm	0.03 ppm	4.0	10.46
Arsenic, and inorganic compounds as (7440-38-2)	Inhalation, skin absorption, skin and/or eye contact, ingestion	Ulceration of nasal septum, dermatitis, gastrointestinal disturbances, peripheral neuropathy, resp irritation, hyperpigmentation of skin Potential occupational carcinogen	Liver, kidneys, skin, lungs, lymphatic system	Ceiling limit of 0.002 mg/m^3 [15-Minute] IDLH / Ca – 5 mg/m^3	N/A	N/A	N/A
Barium and soluble compounds, as Ba, including Barium chloride (7440-39-3) (10361-37-2)	Inhalation, skin and/or eye contact	irritation eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse, extrasystoles (heart contractions); hypokalemia (deficiency of potassium in the bloodstream).	Eyes, skin, respiratory system, heart, central nervous system	0.5 mg/m^3 TWA_8 IDLH – 50 mg/m^3	N/A	N/A	N/A
Cadmium and compounds, as Cd (7440-43-9)	inhalation, ingestion	Pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia Potential occupational carcinogen	respiratory system, kidneys, prostate, blood, prostatic & lung cancer	0.005 mg/m^3 TWA_8 IDLH / Ca – 9 mg/m^3	N/A	N/A	N/A
Chromium (II) inorganic compounds, as Cr	Inhalation, ingestion, skin and/or eye contact	Irritation eyes; sensitization dermatitis	Eyes, skin	0.5 mg/m^3 TWA_8 IDLH – 250 mg/m^3	N/A	N/A	N/A

Chemical	Exposure Routes	Symptoms	Target Organs	OEL (STEL)	Odor Threshold (ppm)	LEL (%)	Ionization Potential (eV)
Chromium (III) inorganic compounds, as Cr (7440-47-3)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes; sensitization dermatitis	Eyes, skin	0.5 mg/m^3 TWA_8 (total dust) 0.003 mg/m^3 TWA_8 (inhalable fraction) IDLH – 25 mg/m^3	N/A	N/A	N/A
Chromium (VI) inorganic compounds, as Cr (18540-29-9) (1333-82-0 as CrO_3)	Inhalation, ingestion, skin and/or eye contact	Irritation respiratory system; nasal septum perforation; liver, kidney damage; leukocytosis (increased blood leukocytes), leukopenia (reduced blood leukocytes), eosinophilia; eye injury, conjunctivitis; skin ulcer, sensitization dermatitis Potential occupational carcinogen	Blood, respiratory system, liver, kidneys, eyes, skin, lung cancer	0.0002 mg/m^3 TWA_8 IDLH / Ca – 15 mg/m^3	N/A	N/A	N/A
Lead and inorganic compounds, as Pb (7439-92-1)	Inhalation, ingestion, skin and/or eye contact	Lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation eyes; hypertension	Eyes, gastrointestinal tract, central nervous system, kidneys, blood, gingival (gum) tissue	0.05 mg/m^3 TWA_8 IDLH – 100 mg/m^3	N/A	N/A	N/A
Mercury, elemental and inorganic compounds, as Hg (7439-97-6)	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, headache, lassitude (weakness, exhaustion); stomatitis (inflammation of mucous membranes of the mouth), salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria (abnormal quantities of protein in the urine)	Eyes, skin, respiratory system, central nervous system, kidneys	0.025 mg/m^3 TWA_8 C– 0.1 mg/m^3 Skin IDLH – 10 mg/m^3	N/A	N/A	N/A
Selenium compounds, as Se (7782-49-2)	Inhalation, ingestion, skin and/or eye contact	Irritation eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; In Animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Eyes, skin, respiratory system, liver, kidneys, blood, spleen	0.2 mg/m^3 TWA_8 IDLH – 1 mg/m^3	N/A	N/A	N/A
Silver metal, and soluble compounds, as Ag (7440-22-4)	Inhalation, ingestion, skin and/or eye contact	Blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Nasal septum, skin, eyes	0.01 mg/m^3 TWA_8 IDLH – 10 mg/m^3	N/A	N/A	N/A

TWA_8 – 8-hour time weighted average
Skin – OEL based primarily on skin exposure hazard
C – Ceiling Limit
Ca – potential or confirmed human carcinogen
IDLH – Immediately Dangerous to Life or Health
LFC – Lowest Feasible Concentration
OEL– Occupational Exposure Limit
STEL– Short Term Exposure Limit
LEL– Lower Explosive Limit

15.3 Hospital Route Map and Driving Directions

15.3.1 Hospital Route Map

This map shows directions to both hospitals from each emergency rendezvous point.

Figure 5. Hospital Route Map

15.3.2 Harborview Medical Center

The name, address, and telephone number of the hospital that will be used to provide medical care is as follows:

Harborview Medical Center
325 - 9th Avenue
Seattle, WA
206.323.3074

Directions from the vicinity of the LDW to Harborview Medical Center are as follows (Figure 5):

From the Duwamish River boat ramp (at South River Street, beneath the 1st Avenue South bridge):

- Drive east on South River Street.
- Turn left on Occidental Avenue South.
- Turn left on East Marginal Way South.
- Turn right on South Michigan Street.
- Look for entrance ramps to I-5 Northbound.
- Drive north on I-5.
- Take the James Street exit.
- Drive east on James Street to 9th Avenue.
- Turn right on 9th Avenue.
- Emergency entrance will be two blocks south on the right.

From the Harbor Island Marina (1001 Southwest Klickitat Way):

- Head north toward SW Manning St
- Turn right onto SW Manning St
- Turn slight right onto Southwest Spokane Street
- Turn slight left to take the ramp toward WA-99 N/I-5/Columbian Way.
- Keep left at the fork in the ramp.
- Stay straight to go onto West Seattle Bridge.
- Merge onto I-5 North via the ramp on the left.
- Take the James Street exit.
- Head east on James Street to 9th Avenue.
- Turn right on 9th Avenue.
- Emergency entrance will be two blocks south on the right.

From South Park Marina (8604 Dallas Ave South):

- From marina parking lot, turn right onto Dallas Avenue South.
- Turn right onto 16th Avenue South.
- Turn left on East Marginal Way South.
- Look for entrance ramps to I-5 Northbound.
- Drive north on I-5.
- Take the James Street exit.
- Drive east on James Street to 9th Avenue.
- Turn right on 9th Avenue.
- Emergency entrance will be two blocks south on the right.

15.3.3 Virginia Mason Medical Center

The name, address, and telephone number of the Virginia Mason Medical Center is as follows:

1100 9th Ave,
Seattle, WA 98101
206.223.6600

Directions from the vicinity of the LDW to Virginia Mason Medical Center are as follows:

From the Duwamish River boat ramp (at South River Street, beneath the 1st Avenue South bridge):

- Head northeast on S River St toward Occidental Ave S
- Turn right onto E Marginal Way S
- Turn left onto Corson Ave S
- Turn right onto S Bailey St
- Turn left to merge onto I-5 N
- Take exit 164A for Dearborn St toward James St/Madison St
- Keep left to continue toward 7th Ave
- Use the middle 2 lanes to follow signs for I-5 N/Vancouver/Madison St/Convention Ctr
- Keep right, follow signs for Madison St / Convention Center N and merge onto 7th Ave
- Turn right after Blink Optical at The Polyclinic (on the right)
- Turn left onto 9th Ave
- Turn right onto Seneca St
- Destination will be on the right

From the Harbor Island Marina (1001 Southwest Klickitat Way):

- Head north toward SW Manning St
- Turn right onto SW Manning St
- Slight right onto SW Spokane St Bridge
- Keep left at the fork, follow signs for I-5 N/WA-99 N/Columbian Wy
- Merge onto Spokane St Viaduct/West Seattle Bridge
- Keep left to stay on Spokane St Viaduct/West Seattle Bridge
- Use the left lane to merge onto I-5 N toward Vancouver
- Take exit 164A for Dearborn St toward James St/Madison St
- Keep left to continue toward 7th Ave
- Use the middle 2 lanes to follow signs for I-5 N/Vancouver/Madison St/Convention Ctr
- Merge onto 7th Ave
- Turn right after Blink Optical at The Polyclinic (on the right)
- Turn left onto 9th Ave
- Turn right onto Seneca St
- Destination will be on the right

From South Park Marina (8604 Dallas Ave South):

- Head west on Dallas Ave S toward 16th Ave S
- Turn right onto 14th Ave S
- Continue onto 16th Ave S
- Use the left 2 lanes to turn left onto E Marginal Way S
- Turn right onto Corson Ave S
- Turn right onto S Bailey St
- Turn left to merge onto I-5 N
- Take exit 164A for Dearborn St toward James St/Madison St
- Keep left to continue toward 7th Ave
- Use the middle 2 lanes to follow signs for I-5 N/Vancouver/Madison St/Convention Ctr
- Keep right, follow signs for Madison St / Convention Center N and merge onto 7th Ave
- Turn right after Blink Optical at The Polyclinic (on the right)
- Turn left onto 9th Ave
- Turn right onto Seneca St
- Destination will be on the right

15.3.4 NeighborCare at Columbia City (Non Urgent)

The name, address, and telephone number of the NeighborCare at Columbia City is as follows:

4400 37th Street South
Seattle, WA 98118
(206) 461-6957
Open: Monday - Friday, 8 a.m. - 5 p.m.

From the Duwamish River boat ramp (at South River Street, beneath the 1st Avenue South bridge):

Head east on S River St toward Occidental Ave S

49 s (0.2 mi)

Take Corson Ave S to S Angeline St

7 min (2.0 mi)

Turn right onto S Angeline St

1 min (0.3 mi)

Continue on S Columbian Way. Take S Alaska St to S Oregon St

5 min (1.2 mi)

Continue on S Oregon St. Drive to 37th Ave S

2 min (0.1 mi)

Neighborcare Health at Columbia City
4400 37th Ave S, Seattle, WA 98118

From the Harbor Island Marina (1001 Southwest Klickitat Way):

- Take SW Manning St to SW Spokane St Bridge
  2 min (0.2 mi)
- Take Spokane St Viaduct/West Seattle Bridge, S Columbian Way, 15th Ave S, S Columbian Way and S Alaska St to S Oregon St
  10 min (3.7 mi)
- Continue on S Oregon St. Drive to 37th Ave S
  2 min (0.1 mi)

Neighborcare Health at Columbia City
4400 37th Ave S, Seattle, WA 98118

From South Park Marina (8604 Dallas Avenue South):

- Take Dallas Ave S to 14th Ave S
  57 s (0.1 mi)
- Take E Marginal Way S, Ellis Ave S, S Albro Pl and 15th Ave S to S Angeline St
  7 min (2.7 mi)
- Turn right onto S Angeline St
  1 min (0.3 mi)
- Continue on S Columbian Way. Take S Alaska St to S Oregon St
  5 min (1.2 mi)
- Continue on S Oregon St. Drive to 37th Ave S
  2 min (0.1 mi)

Neighborcare Health at Columbia City
4400 37th Ave S, Seattle, WA 98118

15.4 Dive Safety and Work Plan Acknowledgement Form

Underpier Investigations and Sampling
Lower Duwamish Waterway, Middle Reach
Seattle, Washington

As a dive team member, my signature below certifies that I have read and understand the policies and procedures specified in this Dive Safety and Work Plan.

Date	Name (print)	Signature	Company