2019 RMP Water Cruise Plan

Prepared by:

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1. Introduction

This report details plans associated with the annual Regional Monitoring Program for Water Quality in the San Francisco Estuary (RMP) water cruise. The RMP water sampling program was redesigned in 2002 to adopt a randomized sampling design at thirty-one sites in place of the twenty-six base program stations sampled previously. In 2007, the number of sites was decreased to twenty-two stations, and it remains as such for 2019.

2. Key Personnel and Approvals

Oversight of the 2019 Water Cruise is by AMS and SFEI senior managers shown in Table 1. These key personnel have indicated their approval of the Cruise Plan by adding their initials and date in the far right column.

Personnel participating in the cruises are shown on Table 2. AMS staff will be responsible for oversight of sampling operations, compliance with cruise plan and quality assurance guidelines, maintenance of the sample field log, chain-of-custody procedures, and CTD profiling. Captain Vallee will be responsible for vessel operation and safety. SFEI staff will alternate trace metals and ancillary sampling. Other representatives of program sponsors may be aboard the *RV Turning Tide* during portions of the cruise to observe sampling operations.

Contact information for participating laboratories are shown in Table 3.

Table 1. Approvals of Cruise Plan

Name	Affiliation	Duties	Cell	Initial and Date to Indicate Approval of Plan
Paul Salop	AMS	Cruise Manager	510-323-6523	
Melissa Foley	SFEI	RMP Program Manager	831-566-7816	
Jay Davis	SFEI	RMP Lead Scientist	530-304-2308	
Don Yee	SFEI	RMP QA Officer	510-508-2995	
Amy Franz	SFEI	RMP Data Manager	510-282-5012	
Diana Lin	SFEI	RMP Scientist (CECs)	714-932-8085	

Table 2. Personnel for Water Cruise

Name	Affiliation	Duties	Cell
Paul Salop	AMS	Cruise Manager (7/30)	[redacted]
Winn McEnery	AMS	Cruise Manager (7/30 - 8/1)	[redacted]
Clifton Herrmann	AMS	Cruise Manager (8/1-8/5)	[redacted]
Don Yee	SFEI	Field Sampling (7/30-7/31)	[redacted]
Amy Franz	SFEI	Field Sampling (7/31-8/2)	[redacted]
Diana Lin	SFEI	Field Sampling (7/30)	[redacted]
Ila Shimabuku	SFEI	Field Sampling (7/30-8/2)	[redacted]
Nina Buzby	SFEI	Field Sampling (7/30-8/1, 8/5)	[redacted]
Liz Miller	SFEI	Field Sampling (7/30, 8/1)	[redacted]
Melissa Foley	SFEI	Field Sampling (8/2, 8/5)	[redacted]
Adam Wong	SFEI	Field Sampling (8/2, 8/5)	[redacted]
Lawrence Sim	SFEI	Field Sampling Back-up	[redacted]
Emily Clark	SFEI	Field Sampling Back-up	[redacted]
Chris Vallee	USGS	Captain, RV Turning Tide	[redacted]
Norbert VandenBranden	USGS	1st Mate, RV Turning Tide	
Jerry Eldorado	Aloha Trans	Logistics	[redacted]

Table 3. Laboratory Contact Information

Lab / Company	Name	Phone	email	Shipping Address
BAL	Lauren Blaiwes	(206) 632-6206	lauren@brooksapplied.com	18804 North Creek Parkway, Suite 100 Bothell, WA 98011
Caltest	Todd Albertson	(707) 258-4000	Todd_Albertson@CaltestLabs.com	1885 North Kelly Road Napa, California 94558
Duke	Lee Ferguson	(919) 886-0692	lee.ferguson@duke.edu	140 Science Dr. Gross Hall, Room 380 Duke University Durham, NC 27708
ALS	Wendy Hyatt / Ralph Poulsen	(520) 573-1061	wendy.hyatt@alsglobal.com ralph.poulsen@alsglobal.com	ALS 4208 S Santa Rita Avenue Tucson, Arizona 85714
PER	Natalie Lynch	(707) 207-7786	nlynch@pacificecorisk.com	2250 Cordelia Rd. Fairfield, CA 94534

Table 4. SFEI Staffing Schedule

Table 5. Combined Site-Parameter List and Handling Instructions

3. Cruise Plan

3.1. Sample Process Design

All sampling will be conducted from the *RV Turning Tide*. The objectives of the sampling effort are to collect the following:

Collect Real-time Data on Field Parameters

1. Real-time data over the duration of sampling for conductivity, temperature, optical back scatter (OBS), and dissolved oxygen (DO) by AMS (1 meter CTD cast for duration of sampling, plus a full water column profile where water depth allows).
2. Water samples from 22 sites for on-board (field meter) measurement of DO, pH, salinity, conductivity, and temperature by SFEI.
3. Document current and recent weather conditions at each site.

Collect Water Samples - Total Fraction (Unfiltered water samples)

4. 22 sites (and 2 replicates and 1 blank) for analysis of Weak Acid Dissociable (WAD) Cyanide (BAL)
5. 22 sites (and 2 replicates and 1 blank) for analysis of SSC (BAL)
6. 22 sites (and 2 replicates and 1 blank) for analysis of Chla (Caltest)
7. 9 sites (and 0 replicates and 0 blanks) for analysis of aquatic toxicity by Pacific EcoRisk (PER).
8. 19 sites (and 2 replicates and 2 blanks) for Ethoxylated surfactants (Duke)

Collect Water Samples - Particulate Fraction (Filters)

9. 22 sites (and 2 replicates and 1 blank) for Particulate Organic Carbon (POC) (ALS)
10. 22 sites (and 2 replicates and 1 blank) for analysis of Cu (BAL)
11. 22 sites (and 2 replicates and 1 blank) for analysis of Se (BAL)
12. 22 sites (and 2 replicates and 1 blank) for analysis of MeHg (BAL)

Collect Water Samples - Dissolved Fraction (Filtrate)

13. 22 sites (and 2 replicates and 1 blank) for analysis of Dissolved Organic Carbon (DOC) (ALS)
14. 22 sites (and 2 replicates and 1 blank) for analysis of hardness (BAL)
15. 22 sites (and 2 replicates and 1 blank) for analysis of MeHg (BAL)
16. 22 sites (and 2 replicates and 1 blank) for analysis of Cu - column chelation (BAL)
17. 22 sites (and 2 replicates and 1 blank) for analysis of Cu - reductive precipitation (BAL)
18. 22 sites (and 2 replicate and 1 blank) for analysis of Se - column separation (BAL)

3.2. Sampling Methods

Field Parameters

CTD Profiler

The following steps describe the CTD deployment and data management process:

1. Initialize CTD via laptop.
2. Disconnect communication cord from CTD and replace rubber cap.
3. Ensure that rope is securely fastened to vessel and to CTD containment cage.
4. Ensure that DI syringe is disconnected from CTD input.
5. Turn CTD on by moving switch completely to on position (fully up).
6. Place CTD into the water, with intake approximately 1 meter below water surface (typically a bit lower in the column to allow for any seas).
7. Leave CTD deployed for duration of sampling.
8. When sampling is completed, slowly lower CTD to the bottom (at a rate less than 1' per second) until rope goes slack or the end of the rope is reached. With strong currents, the rope may extend at a severe angle precluding its reaching the bottom. As soon as the CTD reaches the bottom, immediately begin moving to surface so as to minimize the amount of sediment pulled into the intake. The CTD can be moved to the surface at any rate as data is only collected on the downcast.
9. When CTD is at the surface, return to the vessel deck and place the switch in the off position (fully down).
10. Download the data between stations.
11. At day's end (or after stations where CTD intake may have become fouled with sediment or vegetation) rinse the CTD with distilled water, flush the intake with a minimum of three syringes full of distilled water, and store the CTD with a full syringe of DI inserted onto the intake and partially emptied into the CTD.
12. Replace batteries when the battery level drops below 7 volts.

YSI Hand-Held Field Meter

Field parameters (DO, conductivity, salinity, and pH) will be collected using a YSI water quality meter provided by SFEI. The YSI meter should be calibrated for conductivity, pH, and DO at the start of each day, and calibration results recorded on the station field sheet and laptop access form. When recording field readings, the sampler should ensure that the YSI electrode is fully submerged and not surrounded by any bubbles.

The following steps describe the YSI deployment and data management process:

Programming the YSI

1. Hit 'Esc' to go to menu
2. Arrow down to "Logging Setup"
3. Go to 'edit site list' – delete old sites or just add in new sites
4. Enter sites then press enter to store the site
5. Hit 'esc' to get out of the menu

Calibrating the YSI

- Calibrate the YSI for conductivity, pH and DO once per day at the beginning of the day prior to sampling
    - Conductivity
        - fill the calibration cup 1/3 full with 12,800 uS/cm standard (enough to submerge both the metal tip probe with no trapped air pocket in the side port – note that the port assembly has substantial volume and may overflow the cup if it is overfilled)
        - submerge the probe in the calibration cup, and allow the meter reading to equilibrate
        - hit 'esc' to go to menu, go to 'calibrate,' and choose 'Specific Conductance' (NOT 'Conductivity')
        - set the calibration standard to 12.8 mS/cm, and press enter to calibrate
    - pH
        - fill the calibration cup 1/4 full with pH 7 buffer (probe is near the tip)
        - submerge the probe in the calibration cup, and allow the meter reading to equilibrate
        - hit 'esc' to go to menu, go to 'calibrate,' choose 'pH', and choose '2 point'
        - set the calibration standard to 7, and press enter to calibrate
        - pour out the pH 7 buffer, rinse the cup and probe, and repeat with pH 10 buffer
    - DO
        - fill the calibration cup about 1/8 full with DI water, screw on to the probe, and shake vigorously to wet the DO probe
        - unscrew the cup and pour out the water
        - loosely screw the cap back onto the probe, and allow the meter reading to equilibrate
        - hit 'esc' to go to menu, go to 'calibration,' choose 'DO 2 mil PE (Blue),' choose 'DO %,' and set the barometric pressure to 760 mmHg (sea level)
        - press enter to calibrate
- Rinse the probe and calibration cup with DI water in between calibrations. Make sure the calibration cup is dry before adding new calibration solution.

- No calibration is needed for salinity or temperature

Running the YSI

1. hit ‘esc’ to go to the menu
2. go to logging setup menu and set the logging interval to 5 minutes
3. go to ‘start logging’ and press enter
4. select site from site list and press enter
5. screw the metal cage onto the probe sensor assembly
6. lower the probe sensor assembly to 1 m below the water surface, and fix cable to the boat railing to keep the probe at that depth for the duration of the time on station
7. to stop logging – go to ‘stop logging’ and hit enter
8. record DO, pH, salinity, conductivity, temperature, site code, and sampling date/time on the YSI field sheet, usually requested near start or middle of time on station

Lab Parameters

Sample labeling

AMS field staff will print out and provide sample labels to sampling personnel prior to arrival on station. The sample ID naming convention is as follows:

RMP-19WC-xxxx

where xxxx is a four-digit number assigned by the sample tracking and labeling application.

For double bagged samples, printed labels are dropped inside the outer bag, and a sharpie is used to write the site code and fraction (T or D) on the label on the outer bag. Labels should be attached directly to bottles without bags, and the site code, analyte, and fraction should be written on the bottle lid.

POC filters should be individually wrapped in foil provided by BAL, which will be placed inside ziplock bags. The ziplock bag should be labeled with the filtered volume.

Blank sample collection

Blanks will be taken at the beginning of the day, before any other sample collection, to ensure the sample is collected using a clean sampler (ie. no site water contamination). Prior to field blank sample collection, sample tubing is rinsed with lab blank water for at least 30 seconds (may vary depending on how much water is provided by labs and how much is required for analyses - pump rate is about 1L per minute).

A field blank will be collected in the morning before sampling beings for ethoxylated surfactant on 7/30/19 and 7/31/19.

A field blank will be collected in the morning before sampling begins on 08/02/2019 for trace metals and ancillary parameters.

- LCMS grade water will be provided by SFEI for ethoxylated surfactant.

- One 10 L carboy of ultra pure reagent water will be provided by BAL for metals and ancillary parameter blanks.
- DOC/POC - use blank water provided by the lab
- Chla - use the leftover BAL water

Sample Collection

Sample tubing must be rinsed with site water prior to any sample collection for at least a minute (total fraction) and for only one minute (dissolved fraction, to not clog the filter). The overflow sink drains to a 5 gallon bucket or water jug to avoid contaminating the site with water flowing off the boat deck. If a blank sample will be collected that day, do not attach the float and weight or flush the sampler until after the blank sample has been collected.

The "clean hands" sampler will rinse all bottles without preservative with site water before filling - for ancillary and trace metal samples, all non-preserved sample containers should be rinsed at least twice. To rinse, partially fill a bottle (5-10 seconds, enough to rinse the interior surface), close the cap, shake/swirl thoroughly, and dispose of the rinsate. Bottles with preservative are filled directly, without overflowing. Bottles that will be frozen are filled to 3/4 of the total bottle volume (none on this cruise). See Table 8 for a list of sample bottles by parameter and bottle handling instructions.

Sampling Stations

Samples will be collected at two pump and tubing set-ups, each corresponding to a pump and pre-cleaned sampling tubing assembly. Metals and ancillary parameters will be collected at station 1; and toxicity samples will be collected using a high-volume pump at station 2.

DOC/POC samples will be collected as whole water samples at the metals sampling station, and will be filtered using a vacuum pump and pre-ashed filters inside the boat cabin.

Staff will be roughly assigned to sampling stations in the following order:

- Staff 1 (Team 1) - Station 1 "clean hands"
- Staff 2 (Team 1) - Station 1 "dirty hands"
- Staff 3 (Team 2) - Station 1 "super dirty hands", help setting up toxicity station and with CEC sampling, POC/DOC filtering, metals particulates filtering
- Staff 4 (Team 2) - CTD sampling, CEC sampling, toxicity sampling,

Additional staff will assist with sample labeling, organization, and equipment cleaning.

Station 1: Metals & Ancillary parameters

A low-volume peristaltic pump will be provided by SFEI and 9 sampling tube assemblies (one each for 5 sampling dates and 4 backups) will be provided by SFEI and pre-cleaned by BAL. Each tubing assembly consists of 16 ft of PVDF and 3 ft of silicone tubing attached with zip ties.

Samples should be collected using clean hands-dirty hands technique in the order listed below. Bagged samples should be collected before unbagged samples within each group (unfiltered samples, and later for in-line filtered samples).

A. DOC/POC

Wear nitrile gloves and filter samples inside the boat cabin to protect bottles from the sun. DOC/POC filtering will serve as rinsing between trace particulate metals filtering, so avoid contamination.

Particulate organic carbon:

1. Rinse with site water and collect samples into clean 2 L sample bottles (metals sampling station)
2. Rinse filter apparatus with squirts of ~100 mL of lab DI water, rinse funnel (potentially with carryover particulates from prev station/cabin environment, especially on the shoulder and/or bottom edge in contact with filter) separate from fritted glass support-keep funnel from touching support unless there is a filter in between.
3. Place pre-ashed filter on the filter apparatus with the grid side facing down. The grid side will have a faint imprint or cross-hatching from resting on a screen during manufacture. That side should stay down in sampling.
   Remove filters from packaging using forceps only
   i. Be sure not to knock filter off center when placing funnel on
   ii. If filter repeatedly moves off center, briefly turn on vacuum to suck it into position while attaching funnel
4. Swirl sample and pour out measured volume of water using graduated cylinders. Record volume and pour all contents into funnel. If filtering fast, quickly prepare for next addition.
5. Swirl sample holding bottle, and add water in 20-100 mL increments to graduated cylinder (add less each time as filter slows), record volume, and dump entire grad cylinder contents to funnel, repeat until filter clogs. Drip rate of around 1 drop per second is enough, move onto next filter.
   i. As fluid level approaches the shoulder of the funnel, check for settled material, and especially if filter nearly clogged/last addition, swirl to knock material off.
   ii. **Do not let filter run dry between additions, and turn off pump well in advance as residual vacuum continues to pull quickly especially when filter is not clogged. Do not add water too quickly or in large volumes: water may become trapped on top of clogged filter. On final addition for a given filter, filter can run dry.**
6. Keep track of total amount of water filtered and record this amount on the field sheet. Also record the pre-assigned number of the filter on the field sheet

i. A contingency if you messed up the volume recording, if there is a balance on board, weigh the filtration flask when done with filter, and after emptying to determine volume of water by difference (convert weight to volume based on station salinity). Worry about getting the filter packed away first though.

7. Carefully lift filter funnel/funnel straight up to avoid knocking off filtered material. Leaving filter pump on can help prevent filter lifting with funnel.
8. Fold filter in half carefully to not expose any filtered material, and taking care not to touch filtered material with forceps. Use a second pair of forceps or the filter funnel if necessary to flatten/fold filter. Try and observe dominant grain of fibers, filter will fold more easily along that direction
9. Individually wrap filters in foil pouches provided by ALS using forceps, and place these pouches inside ziplock bags along with pre-printed label.
10. Label the ziplock bags with the filtered volume and immediately freeze the sample on dry ice.
11. At end of day rinse off collection bottles with DI. Close collection bottles to avoid collecting dust overnight.

Dissolved organic carbon

1. Pour some of the filtrate (water in the bottom of the flask after the POC sample has been collected on the filter) into 250-mL bottles (this will be the DOC fraction).
   *Make sure there is no head space, but do not overfill to keep preservative intact.
2. Refrigerate the DOC, do not freeze.
3. *(skip if particulate metals to be done)* Rinse filtration apparatus with DI between stations, and wipe off and rinse with DI any material accidentally left on forceps when done.

B. Particulate (MeHg, Cu, Se)

1. Rinse filter apparatus with 10% HCl on the boat deck (or into the boat sink) at the beginning of each sampling day. Thoroughly rinse with DI after.
2. Collect samples into cleaned (1x DI rinsed and drained between stations, then 3x rinsed in site water at current site) 1 L HDPE bottles from BAL for metals.
3. *(skip if DOC/POC done immediately prior)* Rinse filter apparatus with squirts of ~100 mL of lab DI water, rinse funnel (potentially with carryover particulates from prev station/cabin environment) separate from fritted glass support- keep funnel from touching support unless there is a filter in between.
4. Place polycarbonate plankton filter on the filter apparatus.
   Remove filters from packaging using forceps only
   i. Be careful to not knock the filter off center placing funnel on
   ii. If filter repeatedly moves off center, briefly turn on vacuum to suck it into position while attaching funnel
5. *(skip if DOC/POC done immediately prior)* Pour 100 mL of lab DI water through filter. Discard that water.
6. Swirl sample and fill graduated cylinder with ~250 mL sample (we will filter as much water as reasonable through each filter. Collect one filter per sample. Based on experience with POC sample, guess the amount that will easily filter, the polycarbonate filters usually have ~25% less capacity, so add less based on best judgement if the POC was already clogged at 250ml.
   i. Rather than refill the grad cylinder and add to filter from the cylinder in increments, because we can mix the holding bottle much more easily, swirl sample holding bottle, and add to graduated cylinder in 20-100 mL increments (amount based on how slow filter already is) record amount, and dump entire grad cylinder content into funnel, and repeat until filter clogs. Drip rate of around 1 drop per second, move onto next filter.
   ii. As fluid level approaches the shoulder of the funnel, check for settled material, and especially if filter nearly clogged/last addition, swirl to knock material off.
   iii. **Do not let filter run dry between additions, and turn off pump/release sidearm clamp well in advance as residual vacuum continues to pull quickly especially when filter is not clogged. Do not add water too quickly or in large volumes: water may become trapped on top of clogged filter. On final addition for a given filter, filter can run dry.**
7. Keep track of amount of water filtered and record this amount on the field sheet. You should have been recording volume added to grad cylinder each time before dumping into funnel. Also record the pre-assigned number of the filter on the field sheet IF there is one (more likely for POC than metals filters)..
   i. A contingency if you messed up the volume recording, if there is a balance on board, weigh the filtration flask when done with filter, and after emptying to determine volume of water by difference (convert weight to volume based on station salinity).Worry about getting the filter packed away first though.
8. Remove filter and carefully fold and place filter in 50 mL centrifuge tubes.

9. Repeat steps 4-9 for second and third filter. BAL is fine with all filters in one tube, final volume for all filters combined recorded.
10. For dupe or Se intercomparison sites, set up 2 filtration stations with Y connector attached to two filtration flasks with pinch locks on each set up tubing to allow independent control*. Be careful to keep track of volume filtered through each filter.
    i. The pinch lock may be counterintuitive as one of the filters get clogged. When filter clogged, the pinch traps the vacuum in the sidearm flask. If in doubt, vacuum off, all pinch locks open will (eventually) get to ambient pressure. When running 2 stations simultaneously, really focus on the faster flowing station until it's kind of slow. It may be wise to just do one (other pinched closed) until slow enough to not need to do panic speed refills.
11. For Se intercomparison sites, combine up to 3 filters, from up to 2L volume, for each lab into one vial. The order for the combinations should be somewhat randomized using the following procedure in case there is a general trend (partitioning, settling) over time:
    i. Prepare 3 vials, one for each lab, hypothetically called A, B, C;
    ii. Put first completed filter (filter 1) into Vial A, 2 in B, 3 in C;
        1. If there is leftover volume in a holding bottle after filter 3 save for CCSF particulate sample. Start with new holding bottle for filter 4
    iii. Put filter 4 into B, 5 into C, and 6 into A;
        1. If there is leftover volume in a holding bottle after filter 6 save for CCSF sample. Start with new holding bottle for filter 7
    iv. Put filter 7 into C, 8 into A, and 9 into B. (If 2L got through 2 filters this step moot)
        1. Save leftover volume for CCSF particulate composite
    v. CCSF intercomp sample is done as time allows, combine leftover unfiltered water bits from bottles for 3 other labs as a composite, and filter as much as time allows. (other labs get composite by including filters from multiple holding bottles, CCSF composite is from combining leftover volumes in the partial used bottles for other labs)

12. Once completed all filters go into freezer/on dry ice
13. At end of day rinse off collection bottles, filter units, and filter flasks with DI. Close collection bottles to avoid collecting dust overnight.

C. Unfiltered Water Samples

1. CN-WAD

   Bottles are pre-loaded with NaOH pellet, and should be preserved to a pH > 12. After sample collection, check pH with pH strip. If additional NaOH is necessary, then need to obtain NaOH pellets for the following cruise dates since the lab did not provide additional NaOH.

2. SSC
   Because ALS only sent 1L bottles, guesstimate the sample volume to collect for each station. As a rule of thumb: at any stations deeper than 20 ft with only a hint of color in POC water bottle (Central Bay, Golden Gate), collect 1L. If the sample is slightly cloudy, collect around 500 mL or a bit less (½ full). If the water is cloudy (brownish around the boat, less than 6 ft depth, rocked by wind/waves) collect around 250ml (¼ full). Most sites should be in the slightly cloudy category.
3. Chlorophyll a collect 3 - 1000 ml amber HPDE bottles per site plus a lab duplicate sample each day (30 samples total: 22 sites, 1 field blank, 1 field duplicate, 1 lab duplicate per day of sampling)

Completed water samples are kept refrigerated or chilled in coolers with wet ice or ice packs (0 to 5 C)

D. Dissolved (or Filtered) Water Samples

After collecting whole water samples, the "clean hands" sampler should attach a pre-cleaned filter provided by BAL to the end of the tubing. The "dirty hands" sampler should use a clamp to hold the filter in place. The filter should be flushed for at least 1 minute before collecting the first dissolved sample.

Fill the containers for the parameters listed above. Bagged samples should be collected before unbagged samples.

1. Trace metals (Cu, Se)
2. MeHg (bottles pre-loaded with HCl preservative - no rinse)
3. Hardness

Completed water samples are kept refrigerated or chilled in coolers with wet ice or ice packs (1 to 5 C)

Station 2: Toxicity

A high-volume peristaltic pump will be provided by AMS and 9 sampling tube assemblies (one per toxicity station) will be pre-cleaned by Pacific Eco Risk. Collect samples into a 5 gallon carboy and place the bottle label directly on the bottle. Sampling personnel should use gloves (nitrile or vinyl OK) while handling the pump and tubing. Bottles should be left with no headspace after filling, surrounded by wet ice, and transported to the laboratory as soon as possible, but well within maximum hold time of 36 hours.

For sites where extra water is collected for TIE analysis (sites BG20 and BG30), two additional carboys will be collected.

Station 3: CECs: Ethoxylated surfactants

Prior to sampling, rinse the outside of bottles in site water before opening the cap. Only remove cap with clean hands in nitrile gloves. Bottles have been pre-cleaned with methanol.

Ethoxylated surfactant samples will be collected by submerging the sample bottle using a steel sampling pole. Prior to filling containers, rinse sample container three times with site water before filling. Fill containers with about 2L of water (half-way up neck). Slowly pull the sampling pole directly out of the water and into the boat with the non-sampling end angled upwards until the bottle can be reached. Pour off any volume required to reach optimal level and cap as soon as possible.

Blanks should be collected by filling sampling container with 1.5 L LCMS grade reagent water provided by SFEI.

Completed water samples are kept refrigerated or chilled in coolers with wet ice or ice packs (1 to 5 C)

3.3. Cruise Schedule

Sampling activities for the 2019 RMP Water Cruise are shown in Table 6. The tentative schedule assumes that an average of forty-five minutes will be required for sampling at each station. Sampling times may also vary depending upon suspended sediment loads, number and type of samples collected, and other factors. The schedule is for planning purposes only, and may be revised during sampling operations to reflect weather conditions, equipment performance, or other factors. Any sites unable to be sampled at the scheduled time will be rescheduled later in the cruise if possible, or will be replaced with the first available site within the segment from the current 2019 sampling schedule (see Appendix A for site locations). A record of all sites not able to be sampled and why will be maintained as part of the cruise recordkeeping.

There are no target sites for 2019 within close proximity to sensitive areas. AMS personnel have arranged to check in with USCG Command Center **(415-399-3547)** as needed in an attempt to minimize disruptions to sampling. After each sampling effort, any SFEI field staff will record all hours spent on the water in the navigable waters log.

Table 6. Tentative Schedule for 2019 RMP Water Cruise

Date	Time	Activity
July 29	0900-1400	*RV Turning Tide* transits from Oakley to Redwood City Marina (675 Seaport Blvd, 650-363-1390).
	1400-1700	AMS and SFEI personnel mobilize sampling equipment and load aboard vessel *RV Turning Tide* at **Redwood City Marina.**
July 30	0700-1530	Mobilize remaining sampling gear aboard vessel at **Redwood City Marina**. Sample BA30 **(+field blank)**, LSB074W, LSB075W, LSB077W, LSB076W, and LSB078W (high tide 7.5' at 13:08). Return to **Redwood City Marina** and demobilize vessel.
	1500-1730	Aloha retrieves all samples for transfer to AMS (all remaining).
July 31	0700-1430	Mobilize sampling gear aboard vessel at **Redwood City Marina**. Sample SB074W **(+field blank)**, SB075W, SB076W, CB050W, and BC10 (high tide 6.9' at 13:39; low tide 2.7' at 18:51). Transit to **Emeryville Marina** (3310 Powell St, Emeryville, 510-654-3716) and demobilize vessel.
	1100-1300	Aloha Transportation retrieves wet and dry ice for delivery to vessel and 7/30 toxicity samples for delivery to PER.
	1400-1700	Aloha Transportation meets vessel at Emeryville Marina and retrieves all personnel for transfer to personal vehicles in Redwood City and all samples for transport to AMS.

Aug 1	0700-1300 1000-1200 1300-1500	Mobilize sampling gear aboard vessel at **Emeryville Marina**. Sample BC20, CB047W, and CB049W (note: if CB047W unsampleable, sample oversample CB052W in place of CB049W). Transit to **Emeryville Marina** and demobilize vessel. Aloha Transportation retrieves dry ice for delivery to vessel and 7/31 toxicity samples for delivery to PER. Aloha Transportation meets vessel at Emeryville Marina and retrieves all samples; delivers 8/1 toxicity samples to PER and remaining samples to AMS.
Aug 2	0730-1430 1430-1700	Mobilize sampling gear aboard vessel at **Emeryville Marina**. Sample SPB046W **(+field blank)**, SPB047W, and SPB048W (low tide -1.4' at 8:22; high tide 6.0' at 15:00). Transit to **Benicia Marina** (266 East B St., Benicia, 707-745-2628) and demobilize vessel. PER courier meets vessel at Benicia Marina and receives 8/2 toxicity samples (call to confirm timing). Aloha Transportation meets vessel at Benicia Marina and retrieves all personnel for transfer to personal vehicles in Emeryville and all samples for transport to AMS.
Aug 5	0730-1530 1530-1830 1530-1730	Mobilize sampling gear aboard vessel at **Benicia Marina**. Sample SU057W, SU055W, SU056W, BG20, and BG30 (high tide 4.0' at 6:51, low tide 0.1' at 13:45). Transit to **Driftwood Marina** (6338 Bridgehead Rd, Oakley, 925-757-9449) and demobilize vessel. Aloha Transportation meets vessel at Driftwood Marina and retrieves sampling personnel for transit to Benicia Marina and toxicity samples for transfer to PER (also at Benicia Marina). AMS TBD meets vessel at Driftwood Marina and sampling personnel demobilize all samples and sampling equipment. AMS retains all remaining samples and sampling equipment for delivery to AMS.
Aug 6	TBD	Contingency day, as needed.

3.4. Lodging and Vendors

Recommended lodging options for vessel personnel are shown in Table 7 and addresses for local dry ice vendors are shown in Table 8.

Table 7. Contact Information for Suggested RMP Water Cruise Lodging.

Location	Nights	Hotel
Redwood City	July 29, 30	Comfort Inn 1818 El Camino Real Redwood City, CA 650-599-9636
Emeryville	July 31, Aug 1	Extended Stay America 3650 Mandela Pkwy Oakland, CA 510-923-1481
Benicia	N/A	Best Western Heritage Inn 1955 E 2nd St. Benicia, CA 94510 707-746-0401

Table 8. Dry Ice Vendors Proximate to RMP Water Cruise Berthing Locations.

Port City	Vendor	Address / Phone	Hours (M-F)
Redwood City	Albertsons	200 Woodside Place Redwood City 650-873-4212	0700-1600
Emeryville	Arco	889 West Grand Oakland 510-465-4450	24 hrs
Benicia	Concord Airgas	1825 Arnold Industrial Concord 925-825-8822	0700-1700
Oakley	Raley's	2077 Main Street Oakley 925-625-0744	0600-2300

3.5. Sampling Sites

2019 target sampling sites are shown in Figures 1 and 2 and listed in Table 9. All coordinates are in NAD83 datum. The replacement-site pool is shown in Appendix A.

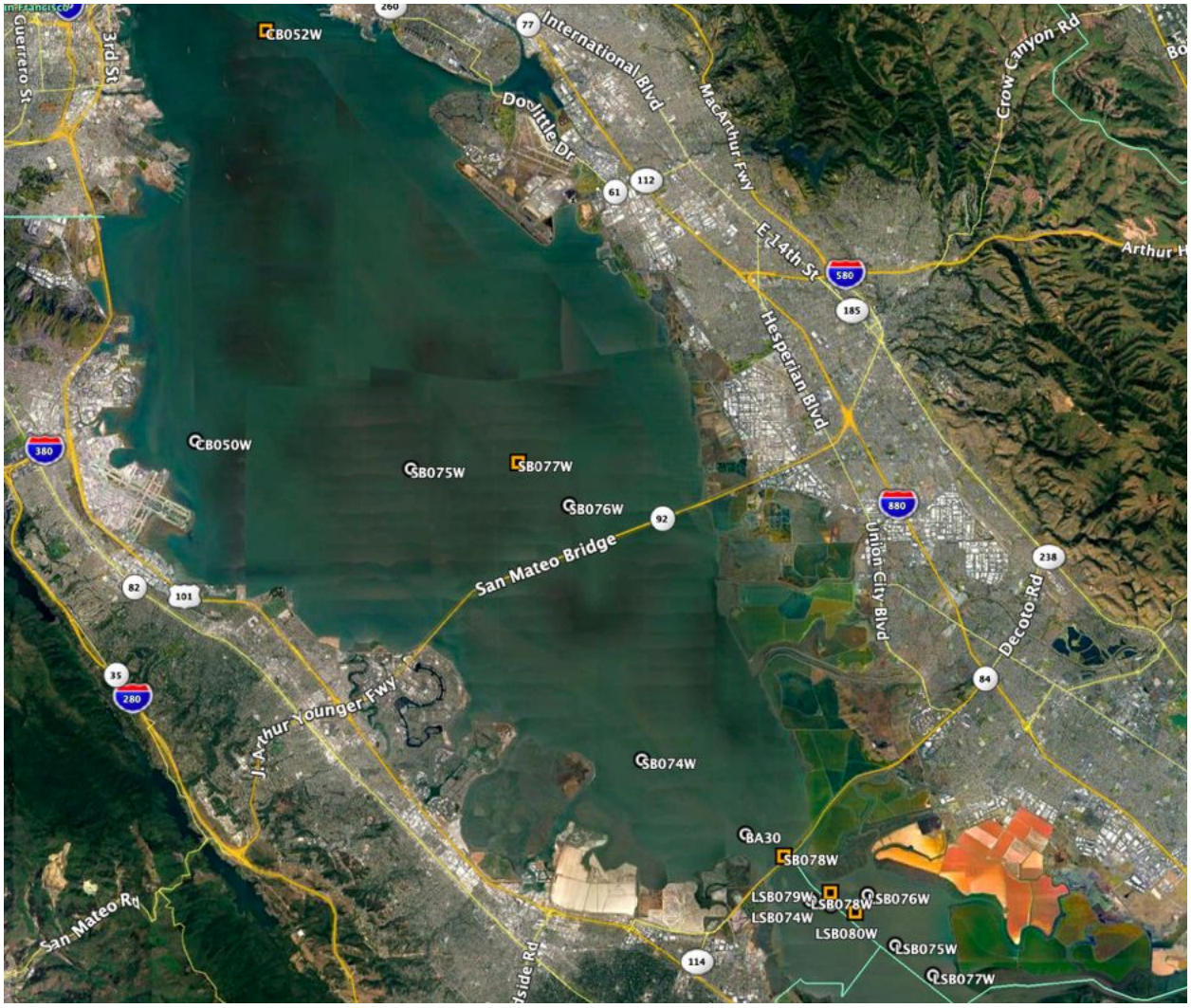

Figure 1. 2019 RMP Water Cruise sites south of Bay Bridge (targets shown as white circles, overample sites as orange squares)

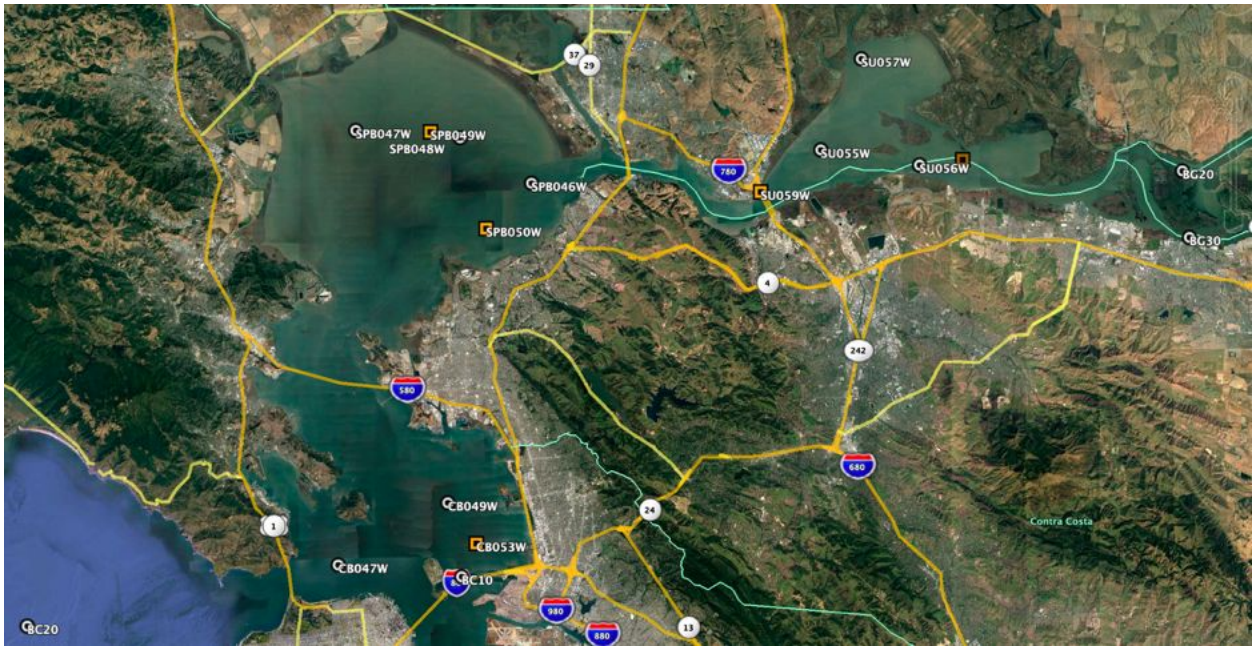

Figure 2. 2019 RMP Water Cruise sites north of Bay Bridge (targets shown as white circles, overample sites as orange squares)

Two target sites for 2019 were removed from the site list during planning for the following reasons:

- SPB045W was removed due to its location that would require approximately 4500m transit across a 4'mudflat (Figure 3), which would allow insufficient time to transit to, sample, and transit from within a high tide window. Its replacement site, SPB048W, is in the same general vicinity, but within slightly deeper water (estimated as 6') and much less transit across the flat (500m).

- CB048W was removed due to its location in Seaplane Lagoon within the former Alameda Naval Air Station (Figure 4). It was replaced with site CB050W.

Coordinates for one additional target site, CB047W, place it in a location that may be difficult to anchor safely (Figure 5). For this site, sampling personnel will confirm with the vessel skipper about possible sampling based upon traffic conditions present and a replacement site (CB052W) may be selected if deemed appropriate, as the next oversample site in line for Central Bay, CB051W, is unsampleable due to its location within Racoon Strait, a deep, narrow channel subject to high velocity current (Figure 6).

.

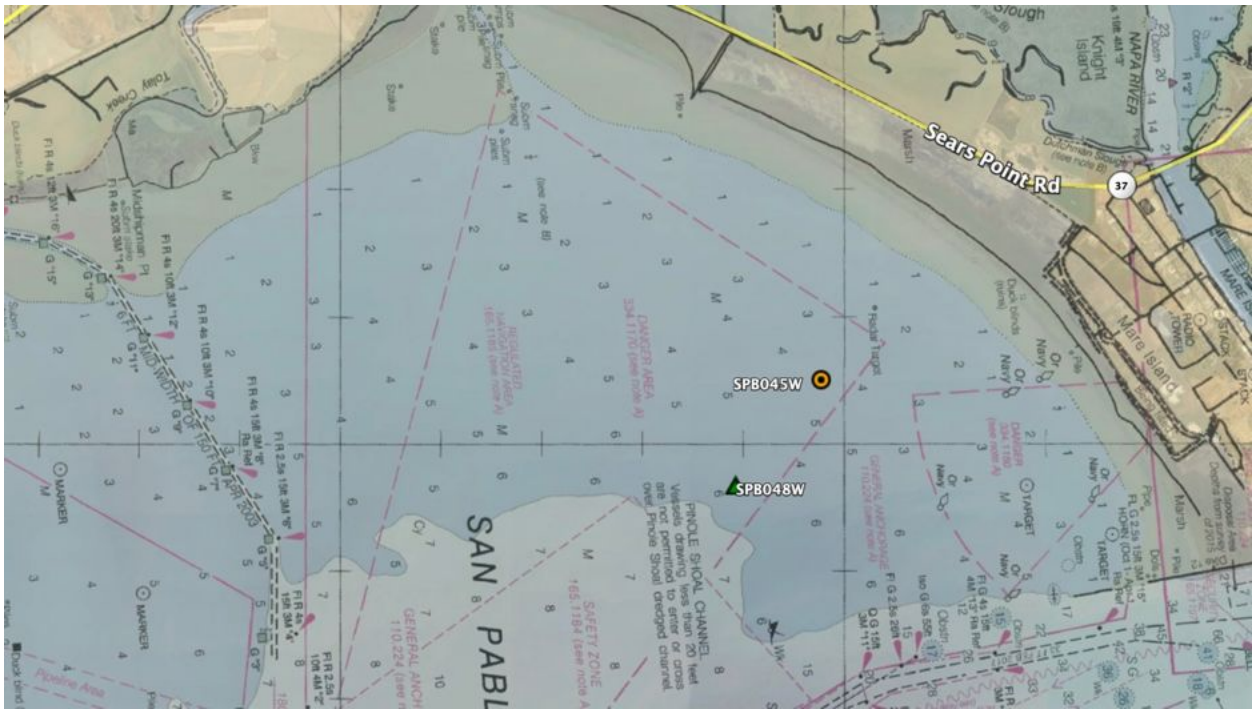

Figure 3. Location of 2019 RMP Target Station SPB045W and its Oversample (SBP048W).

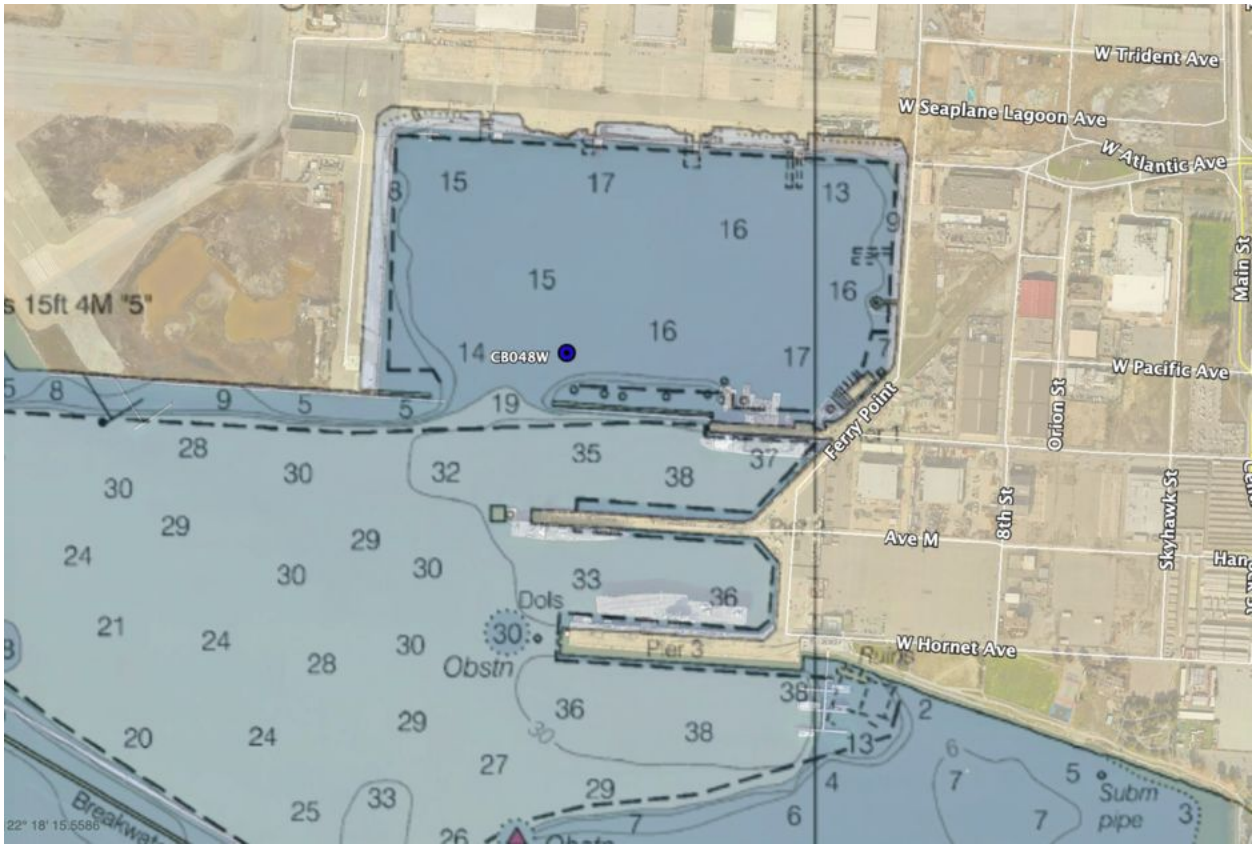

Figure 4. Location of 2019 RMP Target Stations CB048W Within Seaplane Lagoon

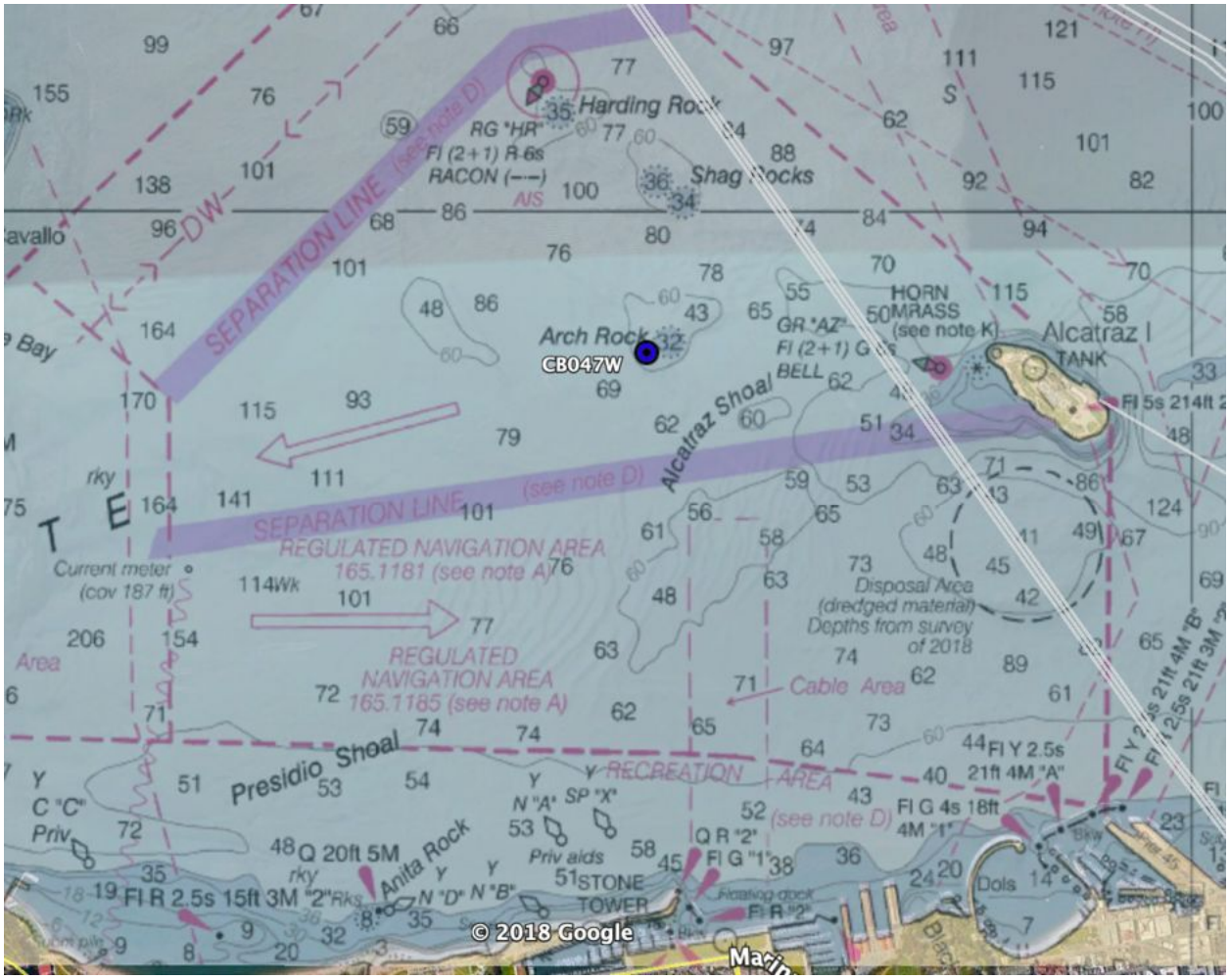

Figure 5. Location of 2019 RMP Target Station CB047W.

Figure 6. Location of 2019 RMP Oversample Site CB051W within Raccoon Strait.

Table 9. Location of 2019 RMP Water Cruise Target Sampling Sites. Coordinates are in the NAD83 datum. The goal is to navigate to within 100 meters of these coordinates. If not possible, the lead scientist on the boat can make the call to accept a larger offset if it is "close enough" and the costs of rejecting the site and taking a replacement site are "too high". If the offset is greater than 200 meters, the station is rejected and replaced with a replacement site.

Region	Site Code	Site Type	Target Latitude	Target Longitude	Depth (ft)
SB	BA30	Historic	37.513750	-122.134620	NULL
CB	BC10	Historic	37.821580	-122.349500	NULL
CB	BC20	Historic	37.791500	-122.673330	12+
RIV	BG20	Historic	38.059700	-121.811270	12+
RIV	BG30	Historic	38.020540	-121.806270	12+
CB	CB047W	Random	37.828310	-122.441480	12+
CB	CB049W	Random	37.865030	-122.359890	6 to 12
CB	CB050W	Random	37.637930	-122.354130	12+
LSB	LSB074W	Random	37.491310	-122.100770	12+
LSB	LSB075W	Random	37.478560	-122.075080	12+
LSB	LSB076W	Random	37.494500	-122.086020	3 to 6
LSB	LSB077W	Random	37.469040	-122.060050	3 to 6
LSB	LSB078W	Random	37.492770	-122.108710	6 to 12
SB	SB074W	Random	37.537230	-122.175940	12+
SB	SB075W	Random	37.629200	-122.268080	6 to 12
SB	SB076W	Random	37.617650	-122.204860	3 to 6
SPB	SPB046W	Random	38.053080	-122.297740	12+
SPB	SPB047W	Random	38.084040	-122.429010	3 to 6
SPB	SPB048W	Random	38.079820	-122.351040	6 to 12
SU	SU055W	Random	38.072630	-122.081680	6 to 12
SU	SU056W	Random	38.063620	-122.007970	12+
SU	SU057W	Random	38.126220	-122.051300	3 to 6

APPENDIX A

2019 Replacement Sites. All coordinates are in the NAD83 datum.

Region	Site Code	Target Latitude	Target Longitude	Depth (ft)
LSB	LSB079W	37.495180	-122.100880	12+
LSB	LSB080W	37.489050	-122.091010	12+
LSB	LSB081W	37.471680	-122.068870	3 to 6
SB	SB077W	37.631170	-122.225240	6 to 12
SB	SB078W	37.506790	-122.119350	12+
SB	SB079W	37.651380	-122.237330	6 to 12
CB	CB052W	37.767690	-122.326220	12+
CB	CB053W	37.841090	-122.338601	6 to 12
CB	CB054W	37.668866	-122.258750	12+
SPB	SPB049W	38.083220	-122.373210	6 to 12
SPB	SPB050W	38.026350	-122.331540	6 to 12
SPB	SPB051W	38.093696	-122.423986	3 to 6
SU	SU058W	38.066740	-121.975780	12+
SU	SU059W	38.047920	-122.126700	6 to 12
SU	SU060W	38.079550	-122.041710	6 to 12