Cruise Report

2014 RMP Sediment Cruise

Contract No. 1084

September 12, 2014

Submitted to:

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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) sediment cruise. The Regional Monitoring Program through the Status and Trends conducts routine monitoring of water, sediment and biological tissue. The current study design calls for monitoring of water and bivalves every two years and sediment every four years. Bird egg monitoring (cormorant and terns) is conducted triennially, while sport fish are monitored on a five-year rotation. For 2014, sampling operations entailed dry season collections at 27 RMP sediment sampling sites.

2. Cruise Report

2.1. Objectives

All sampling was conducted from the *RV Turning Tide.* The objectives of the sampling effort were to collect the following:

1. Measure field parameters at 27 sites.
2. Collect sediment samples from 27 sites for analysis of:
    - Sediment Quality Parameters (% solids, CHN, total organic carbon) by ALS Environmental (ALS)
    - Sediment Grain Size by ALS
    - Trace Elements (Al, Cd, Cu, Fe, Pb, Mn, Ni, Ag, and Zn) by the City and County of San Francisco (CCSF)
    - Trace Elements (As, Hg, MeHg, Se) and % solids by Brooks Rand Labs (BRL)
    - Trace Organics (Polycyclic Aromatic Hydrocarbons, Pesticides, Polychlorinated Biphenyls, and Polybrominated Diphenyl Ethers) and %solids by East Bay Municipal Utility District (EBMUD).
    - Perfluorinated compounds (at 27 sites) and precursors (at 10 sites) by AXYS Analytical Services (AXYS)
    - Total Organic Fluorine (at 10 sites) by the California Department of Toxic Substances Control (DTSC)
    - Hindered phenols (at 12 sites) by Environment Canada (Env. Canada)
    - Alternative flame retardants (at 10 sites) by Southern Illinois University (SIU)
    - Microplastics (at 10 sites) by SUNY Fredonia
    - Triclosan and hydroxylated polybrominated diphenyl ethers (at 24 sites) by the University of Minnesota (UMN)
    - Quaternary ammonium compounds (South and Lower South Bay, 10 sites) by Stony Brook University (SBU)
3. Collect sediment samples from 27 sites for trace metals archive.
4. Collect sediment samples from 27 sites for trace organics archive.
5. Collect sediment samples from 7 sites for PFC archive.
6. Collect sediment samples from 7 sites for NIST archive.

7. Collect a water column profile at each of the 27 sediment sites for analysis of temperature, salinity, electrical conductivity, optical back scatter, dissolved oxygen, density, and pressure by Applied Marine Sciences (AMS).
8. Collect cores for on-board analysis of Eh at 27 sites by San Francisco Estuary Institute (SFEI).
9. Collect direct pH measurements from the interstitial water found in the undisturbed sediment in the grab at 27 sites by AMS.
10. Collect water samples from 12 sites for hindered phenols analysis by Environment Canada.

2.2. Personnel

The personnel and work assignments for this cruise are shown in Table 1.

Table 1. Personnel for 2014 RMP Sediment Cruise

Name	Affiliation	Duties
Don Yee	SFEI	Field Sampling, 8/5-8/6
Becky Sutton	SFEI	Field Sampling, 8/5
Ellen Willis-Norton	SFEI	Field Sampling, 8/4-8/5, 8/7
Phil Trowbridge	SFEI	Field Sampling, 8/6-8/7, 8/11
Thomas Jabusch	SFEI	Photodocumentation, 8/7
Emily Novick	SFEI	Field Sampling, 8/11, 8/13
Amy Franz	SFEI	Field Sampling, 8/12-8/13
Adam Wong	SFEI	Field Sampling, 8/12
Paul Salop	AMS	Cruise Manager (8/4-8/7, 8/11-8/13)
Rebecca Isquith	AMS	Field Sampling, 8/4-8/7
Doug George	AMS	Field Sampling, 8/11-8/12
Traci Linder	AMS	Field Sampling, 8/13
Jay Johnson	AMS	Logistics and Demob, 8/13
Chris Vallee	USGS	Vessel Skipper
Trevor Violette	USGS	First Mate

2.3. Sampling Activities

Sampling activities for the 2014 RMP Water Cruise are shown in Table 2.

Table 2. Sampling Activities for 2014 RMP Sediment Cruise

Date	Time	Activity
August 4, 2014	1100-1600	AMS and SFEI personnel mobilized all sampling gear aboard vessel *R/V Turning Tide* at Redwood City Marina.
August 5, 2014	0645-0715	SFEI and AMS personnel mobilized all remaining sampling gear aboard vessel at Redwood City Marina. Conducted safety briefing and departed for LSB058S.
	0815-0922	Sampled LSB058S, departed for LSB046S.
	0938-1042	Sampled LSB046S, departed for BA10.
	1052-1144	Sampled BA10, departed for LSB002S.
	1209-1307	Sampled LSB002S, departed for LSB004S.
	1323-1405	Sampled LSB004S, departed for SB110S.

Date	Time	Activity
	1511-1551	Sampled SB110S, departed for Redwood City Marina.
	1632-1649	Arrived Redwood City Marina and demobilized vessel. Aloha Transportation retrieved all samples for transport to AMS.
August 6, 2014	0700-0730	SFEI and AMS personnel mobilized all sampling gear aboard vessel at Redwood City Marina. Conducted safety briefing and departed for BA41.
	0808-0847	Sampled BA41, departed for SB002S.
	0922-0957	Sampled SB002S, departed for SB004S.
	1044-1114	Sampled SB004S, departed for SB111S.
	1205-1240	Sampled SB111S, departed for CB100S.
	1330-1427	Sampled CB100S, departed for Redwood City Marina.
	1520-1615	Arrived Emeryville Marina and demobilized vessel. Aloha Transportation retrieved all samples for transport to AMS and transferred sampling personnel to personal vehicles in Redwood City.
August 7, 2014	0800-0846	SFEI and AMS personnel mobilized all sampling gear aboard vessel at Emeryville Marina. Conducted safety briefing and departed for CB133S.
	0859-0924	Sampled CB133S, departed for BC11.
	0955-1030	Sampled BC11, departed for CB073S.
	1052-1138	Sampled CB073S, departed for CB001S.
	1204-1252	Sampled CB001S, departed for Emeryville Marine
	1330-1345	Arrived Emeryville Marina and demobilized vessel. Aloha Transportation retrieved all samples for delivery to AMS.
August 8, 2014	-	Non-scheduled vessel maintenance day
August 11, 2014	0715-0734	SFEI and AMS personnel mobilized all sampling gear aboard vessel at Emeryville Marina. Conducted safety briefing and departed for BD31.
	0858-1000	Sampled BD31, departed for SPB63S.
	1017-1116	Sampled SPB063S, departed for SPB002S.
	1135-1215	Sampled SPB002S, departed for SPB098S.
	1251-1348	Sampled SPB002S, departed for SPB110S.
	1408-1508	Sampled SPB098S, departed for SPB046S.
	1408-1508	Sampled SPB046S, departed for Benicia Marina.
	1533-1548	Arrived Benicia Marina and demobilized vessel. Aloha Transportation retrieved all samples for delivery to AMS, and transported sampling personnel to personal vehicles in Emeryville.
August 12, 2014	0830-0845	Mobilized sampling gear aboard vessel at Benicia Marina. Conducted safety briefing and departed for SU003S.
	0912-0958	Sampled SU003S, departed for SU095S.
	1010-1052	Sampled SU095S, departed for SU071S.
	1102-1150	Sampled SU071S, departed for SU073S.
	1207-1300	Sampled SU073S, departed for BF21.
	1305-1355	Sampled BF21, departed for Driftwood Marina, Oakley.
	1510-1520	Arrived Driftwood Marina, and demobilized vessel. Aloha Transportation retrieved all samples for delivery to AMS and transported sampling personnel to personal vehicles in Benicia.

Date	Time	Activity
August 13, 2014	0800-0831	Mobilized sampling gear aboard vessel at Driftwood Marina. Conducted safety briefing and departed for BG20.
	0907-0955	Sampled BG20, departed for BG30.
	1019-1119	Sampled BG30, departed for Driftwood Marina.
	1140-1202	Arrived Driftwood Marina and demobilized vessel of all samples and sampling equipment. AMS personnel retrieved all samples and sampling equipment for transport to AMS.

2.4. Discussion

All cruise objectives were met. There was a one-day deviation from planned cruise schedule due to vessel maintenance issues.

No sites were abandoned during the cruise itself. Several sites, however, were pre-abandoned during the cruise planning stage:

- Site SU002S, a site sampled on an annual basis prior to 2008, was permanently replaced in 2008 with site SU073S, which is now an annual site for the Suisun Bay region. SU002S was traditionally sandy in nature, and has recently been experiencing active dredging that changed the bottom profile significantly.

- LSB059S is located in the shipping channel between the Dumbarton Bridge and an adjacent railroad bridge, a location that that is constrained by the exclusion zones around the bridges and no anchoring areas around submerged pipelines. It was replaced with oversample site LSB046S.

- SPB003S is located on a wide shoal in an area north of China Camp that has multiple hazards identified on nautical charts (e.g., duck blinds, ruins, submerged stakes). It was replaced with oversample site SPB046S.

At one location, SB111S, the actual sampling location was located outside of the 100m radius around the target coordinates due to presence of a pipeline area that prevented anchoring at the target location. At this site, the determination was made to anchor outside of the 100m radius and conduct sampling in lieu of dropping the site entirely. While measurements made on-board the vessel put the actual location approximately 120m away from target, a post-hoc comparison of target and final recorded coordinates suggests that the final vessel anchoring location was approximately 150m north of target coordinates.

Several samples were compromised to some extent during the collection or shipping and handling phase of the project. Actions taken to address specific issues are listed below:

- Collection of the BRL trace metals sample at station SB111S was inadvertently not collected while on station. This omission was noted shortly after leaving the site, and the corrective action taken was to allocate one of the two trace metals archive samples for this analysis. Therefore, only a single trace metals archive container remains for the site.
- Water and sediment samples shipped to Environment Canada (EC) were held up in customs for approximately one week due to inability of the broker to obtain release of the shipment in a timely fashion. As the broker is contracted to Environment Canada, the RMP or AMS have no ability to affect a more timely release of materials. Follow-up discussions with the Environment Canada representative, Xiowa Wang, suggested that samples arrived in acceptable condition to support analyses.

2.5. Sample Labeling

The sample ID labeling system used for the 2014 cruise is as follows:

RMP-14SC-XXXX

Where:

RMP	=	Project
14	=	Cruise Year
SC	=	Matrix (Sediment Cruise)
XXXX	=	Unique ID number

2.6. Sampling Sites

2014 RMP Sediment Cruise sampling sites are listed in Table 3. All samples collected are listed in Table 4. Sample containers and sample handling procedures are summarized in Table 5. Weather conditions encountered at time of sampling are shown in Table 6.

Table 3. 2014 RMP Water Cruise Site Coordinates and Water Depth. Sample depths are not corrected for tidal action.

Site Code	Latitude		Longitude		Depth (m)	Sediment Character and Comments
	Target	Actual	Target	Actual		
BA10	37.46824	37.46818	-122.06397	-122.06444	2.3	Moderately consolidated fines; meHg not collected within 20 min.
BA41	37.55904	37.55905	-122.21058	-122.21070	3	Shells, fines, sand
BC11	37.82233	37.82219	-122.34928	-122.34961	7.4	Moderately consolidated fines with abundant macroalgae at surface
BD31	38.02412	38.02415	-122.36368	-122.36372	6.2	Consolidated fines, shell, some anoxia
BF21	38.11552	38.11533	-122.04048	-122.04073	2.3	Lightly consolidated fines
BG20	38.05895	38.05907	-121.81437	-121.81435	9.4	Sand, fines, clay at depth (4-5cm); meHg not collected within 20 min
BG30	38.02282	38.02288	-121.80837	-121.80834	6.4	Clay
CB001S	37.87631	37.87655	-122.36150	-122.36150	3.8	Consolidated fines
CB073S	37.84293	37.84318	-122.39761	-122.39795	13.1	Moderately consolidated fines, fine sand
CB100S	37.77595	37.77725	-122.32960	-122.32939	7.9	Sand over consolidated fines
CB133S	37.83939	37.83953	-122.31587	-122.31670	3	Unconsolidated fines, *Ampelisca*, anoxic layer reached at approx 4cm
LSB002S	37.47913	37.47918	-122.07798	-122.07781	8.7	Consolidated fines, shell hash; anoxic layer close to surface
LSB004S	37.49443	37.49313	-122.08520	-122.08549	2.4	Unconsolidated fines, *Ampelisca*
LSB046S	37.47332	37.47322	-122.07771	-122.07744	2	Unconsolidated over consolidated fines, *Ampelisca*
LSB058S	37.48138	37.48130	-122.08476	-122.08480	2.3	Consolidated fines with light shell
SB002S	37.61019	37.61039	-122.16738	-122.16700	2.2	Consolidated fines, *Ampelisca*
SB004S	37.60066	37.60085	-122.21851	-122.21859	3.5	Shell, fines, sand
SB110S	37.54745	37.54753	-122.17317	-122.17277	3.7	Unconsolidated fines, *Ampelisca*
SB111S	37.69478	37.69587	-122.22802	-122.22957	2.7	Shell hash over fines; moved outside of 100m radius to avoid pipeline area
SPB002S	38.01641	38.01672	-122.34128	-122.34073	2.9	Unconsolidated fines
SPB046S	38.06121	38.06184	-122.29736	-122.29739	9	Fine sand over clay
SPB063S	38.08527	38.08596	-122.44020	-122.44070	2.1	Consolidated fines, light shell
SPB098S	38.03669	38.03675	-122.32638	-122.32614	6.6	Consolidated fines, shell, fine sand
SU003S	38.06552	38.06542	-122.09704	-122.09664	8.7	Consolidated fines, fine sand
SU071S	38.09317	38.09327	-122.06359	-122.06348	6.7	Thin sandy layer over clay and peat
SU073S	38.11075	38.11052	-122.04873	-122.04891	2.2	Lightly consolidated fines
SU095S	38.07339	38.07392	-122.08813	-122.08728	5.5	Consolidated fines, fine sand

Table 4. 2014 RMP Sediment Samples Collected by Site.

SITE CODE	REGION	pH / Eh / CTD	TE- CCSF	TE- BRL	Org- anics	PSD, TOC	CHN	PFC / Precursors1	TOF	FR	BDE	QAC	HP (water)	HP (sediment)	Microplastics	TE Archive	ORG Archive	NIST Archive	PFC Archive	pH (avg.)
BC11	CB	x	x	x	x	x	x	x	x	x	x		x	x		x	x	x	x	7.0
CB001S	CB	x	x	x	x	x	x	x			x				x	x	x			7.1
CB073S	CB	x	x	x	x	x	x	x			x				x	x	x			7.0
CB100S	CB	x	x	x	x	x	x	x	x	x	x				x	x	x			7.3
CB133S	CB	x	x	x	x	x	x	x			x		x	x	x	x	x			7.5
BA10	LSB	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	6.5
LSB002S	LSB	x	x	x	x	x	x	x			x	x	x	x	x	x	x			6.9
LSB004S	LSB	x	x	x	x	x	x	x			x	x			x	x	x			7.0
LSB058S	LSB	x	x	x	x	x	x	x	x	x		x				x	x			7.2
LSB046S	LSB	x	x	x	x	x	x	x	x	x		x				x	x			7.0
BG20	RIV	x	x	x	x	x	x	x			x		x	x		x	x	x	x	7.3
BG30	RIV	x	X	x	x	x	x	x			x		x	x		x	x	x	x	6.7
BA41	SB	x	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	7.1
SB002S	SB	x	x	x	x	x	x	x			x	x	x	x	x	x	x			7.3
SB004S	SB	x	x	x	x	x	x	x	x	x	x	x			x	x	x			7.3
SB110S	SB	x	x	x	x	x	x	x	x	x	x	x			x	x	x			7.1
SB111S	SB	x	x	x	x	x	x	x			x	x			x	x	x			7.6
BD31	SPB	x	x	x	x	x	x	x			x		x	x		x	x	x	x	7.3
SPB002S	SPB	x	x	x	x	x	x	x			x					x	x			6.9
SPB046S	SPB	x	x	x	x	x	x	x			x					x	x			7.4
SPB063S	SPB	x	x	x	x	x	x	x	x	x	x		x	x		x	x			7.3
SPB098S	SPB	x	x	x	x	x	x	x			x					x	x			7.3
BF21	SU	x	x	x	x	x	x	x			x		x	x		x	x	x	x	7.2
SU003S	SU	x	x	x	x	x	x	x	x	x	x					x	x			7.2
SU071S	SU	x	x	x	x	x	x	x			x		x	x		x	x			7.2
SU073S	SU	x	x	x	x	x	x	x			x					x	x			7.1
SU095S	SU	x	x	x	x	x	x	x								x	x			7.5
TOTAL		27	27	27	27	27	27	27	10	10	24	10	12	12	10	27	27	7	7	-

Table 5. Containers and Sample Handling for 2014 RMP Sediment Cruise.

Sample	Container	Handling Requirements
pH / Eh / CTD	None	Measurement on board vessel
Trace Elements (TE-CCSF)	250 ml HDPE	Place on dry ice
Trace Elements (TE-BRL)	250 ml HDPE	Place on dry ice within 20 minutes of first successful grab collection.
Trace Organics (EBMUD)	250 ml glass	Place on dry ice
TOC / PSD (ALS)	16 oz glass	Place on wet ice, ship overnight on wet ice.
CHN (ALS)	4 oz glass	Fill at least 3/4, place on dry ice. Ship overnight on dry ice
PFC and Precursors (AXYS)	250 ml HDPE (collected directly from grab)	Nitrile gloves; avoid Teflon/Goretex materials; place on dry ice.
TOF (DTSC)	250 ml HDPE (collected directly from grab)	Nitrile gloves; avoid Teflon/Goretex materials; place on dry ice.
FR (SIU)	250 mL glass I-Chem jars (2 per site)	Nitrile gloves; aluminum foil (provided) must be placed between sample and the cap of the container (to prevent sample exposure to plastics in the container); place on dry ice.
BDE (UMN)	24-oz glass jars	Fill ¾ full, cover with foil liner; place on dry ice
QACs (SBU)	4 oz glass	Fill ½ full; minimize contact with clothing fibers; place on dry ice
Hindered phenols (water)	Collect in 1-liter amber glass bottles	Use gloves, collect upstream of vessels, place on wet ice.
Hindered phenols (sediment)	Collect 50 grams into plastic 8-oz Whirl-paks	Fill ¾ full, freeze in field on dry ice, ship on blue / wet ice
Microplastics	950 ml glass	Place on wet ice
Archive Org, All sites	60 ml glass (3 per site)	Place on dry ice
Archive TE, All sites	250 ml HDPE (2 per site)	Place on dry ice
Archive PFC, Historic sites	10 ml cryovial (2 per site, collected directly from grab)	Place on dry ice
Archive NIST, Historic sites	22 ml Teflon vial (3 per site)	Place on dry ice

Table 6. Weather Conditions for 2014 RMP Sediment Cruise.

Site	Sea State	Tide Stage & Current (kts)	Wind Speed (kts)	Wind Dir.	Cloud Cover, % Overcast	Comments
BA10	Wavelets	½ kt, ebb	5	NW	90	
BA41	Calm	½ kt, flood	2	SW	70	
BC11	Wavelets	1 kt, flood	5	SW	100	
BD31	Wavelets	Light ebb	2	NNW	90	
BF21	Choppy	1 kt, flood	20	WSW	5	
BG20	Light chop	Light ebb	19	WSW	0	
BG30	Wavelets	Light ebb	4	W	0	
CB001S	Chop	Slack	16	WNW	90	
CB073S	Light chop	Slack	12	SW	90	
CB100S	Light chop	½ kt, ebb	13	NW	50	
CB133S	Wavelets	½ kt, flood	6	SW	100	
LSB002S	Calm	½ kt, ebb	3	NW	70	
LSB004S	Calm	½ kt, ebb	Calm	-	50	
LSB046S	Wavelets	Slack	9	NW	100	
LSB058S	Wavelets	¾ kt, flood	8	NW	100	
SB002S	Calm	Slack	3	SW	30	
SB004S	Calm	Light ebb	3	NW	50	
SB110S	Chop	¼ kt, ebb	20	SE	80	
SB111S	Light ripple	Light ebb	6	NW	30	
SPB002S	Wavelets	1 kt, flood	5	W	10	
SPB046S	Light chop	¾ kt, flood	10	WSW	5	
SPB063S	Calm	Light flood	2	N	40	
SPB098S	Wavelets	1 kt, flood	9	W	10	
SU003S	Light chop	1.5 kt, ebb	14	W	10	
SU071S	Light chop	Light ebb	17	W	5	
SU073S	Choppy	Light flood	22	W	5	
SU095S	Light chop	1.5 kt, ebb	10	W	10	