Case Study Investigating Elevated Levels of PCBs in Storm Drain Sediments in San Mateo County

San Mateo Countywide Stormwater Pollution Prevention Program

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April 15, 2002

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1.0 BACKGROUND

California Regional Water Quality Control Board, San Francisco Bay Region (Regional Board) staff is currently gathering data needed to prepare TMDLs for pollutants on the 303(d) list for San Francisco Bay. To assist the Regional Board with the PCBs TMDL, the San Mateo Countywide Stormwater Pollution Prevention Program (STOPPP) has performed a case study for selected areas potentially having elevated concentration of PCBs in storm drain sediments, based on a field survey conducted in the fall of 2000 (KLI 2001).[1] The case study work also contributes to the fulfillment of provision C.2 of STOPPP's National Pollutant Discharge Elimination System permit adopted by the Regional Board in 1999.

This report presents the results of the case study. The objective of the investigation was to gather data useful for identifying PCBs sources to urban runoff and developing control measures.

The investigation consisted of the following tasks:

- Collecting and testing storm drain sediment samples from three pump station drainages in San Mateo County.
- Researching storm drain system maintenance in the areas investigated.
- Researching current and historical land use at one property where elevated PCBs were found during the field-sampling program.

The areas investigated were the Bradford and Broadway pump stations in Redwood City and the South Maple pump station in South San Francisco (Figures 1 through 3). Sediment samples collected from the sumps of these three pump stations during the fall 2000 survey had elevated levels of PCBs.

2.0 FIELD SAMPLING PROGRAM

The general strategy of the field program was to 1) resample the sumps of each of the case study pump stations and 2) collect sediment samples from each storm drain line feeding each pump station to try to narrow potential source areas.

Sediment samples were collected in each of the three pump station drainages (Figures 1 through 3) in October 2001. The fieldwork was performed by Kinnetic Laboratories, Inc. (KLI) of Santa Cruz, California. KLI was unable to obtain any samples from the storm drain line southeast of the Bradford pump station due to a lack of an accessible area with accumulated

[1]KLI (2002) documents the results of a follow-up second year survey performed during the fall of 2001.

sediment. Sediment samples were obtained in all other storm drain lines feeding the three case study pump stations. The samples were shipped to Columbia Analytical Services, Inc. of Kelso, Washington and analyzed for PCB congeners, organochlorine pesticides, particle size (Puget Sound Protocol with hydrogen peroxide digestion), percent moisture and total organic carbon. The Appendix contains a report prepared by KLI documenting the fieldwork and chemical analytical results.

Table 1 summarizes the chemical analytical results, including the samples taken from the pump station sumps during the fall 2000 survey.[2] PCBs concentrations were generally lower than the fall 2000 samples, with the exception of sample SMC-040 from the South Maple pump station drainage (Figure 3). This composite sample was taken from a large grated vault and manhole positioned next to each other and had the highest total PCBs level (2,719 ppb) of any of the samples taken from the three drainages. It appears that the grated vault associated with SMC-040 and the upstream storm drain lines primarily drain the property at 245 Spruce Avenue. It should be noted, however, that drainage patterns in relatively flat urban areas such as the South Maple pump station area may vary depending on the rate of precipitation and resulting quantity of overland flow.

The distribution of PCB homologs in each sediment sample, including the samples taken from the pump station sumps during the fall 2000 survey, is summarized in the Appendix, Figures 4 and 5. The homolog distributions are highly variable. For most samples, this variability was expected since low concentrations of PCBs preclude reliable information on the distribution of homologs. High concentrations of PCBs in sample SMC-040 from 245 Spruce Avenue were an exception. The PCBs formulation contributing to the elevated concentrations in this sample is most comparable to Arochlor 1260 with little weathering.

3.0 PUMP STATION AND STORM DRAIN LINE MAINTENANCE

City of Redwood City public works staff annually removes sediment from the sumps of Redwood City's pump stations. This routine maintenance typically is performed in the summer or fall, before the rainy season. During the past three years, sediment was removed from the Bradford and Broadway pump station sumps in June 1999, October 2000 and August 2001. Sediment is not routinely removed from storm drain lines in Redwood City.

Public works staff for the City of South San Francisco also removes sediment from the city's pump station sumps annually as part of a routine maintenance program. During the past three years, sediment was removed from the South Maple pump station sump in May 1999, December 2000 and November 2001. Sediment is not routinely removed from storm drain lines. It should also be noted that a water main break occurred on the eastern portion of the 245 Spruce Avenue property during spring 2000. The break was caused by construction work. City of South San Francisco public works staff believe that a significant amount of sediment and other debris may have been washed into the storm drain inlets on the eastern portion of the property during the break, including the grated vault associated with sample SMC-040 and upstream inlets.

[2]Sample SMC-041 (see the Appendix) is not included in Table 1 or Figure 3 because it was determined after the field program was complete that it was taken from an area outside of the South Maple pump station drainage.

4.0 LAND USE RESEARCH

The generalized land use in the three pump station drainage areas is as follows, based on 1995 land use data from the Association of Bay Area Governments (ABAG 1996) and estimated drainage areas:

- Bradford pump station: mainly commercial with a small percentage residential.
- Broadway pump station: mixed industrial, commercial and residential.
- South Maple pump station: mainly industrial with a small percentage commercial and open area.

Additional current and historical land use research was performed for the 245 Spruce Avenue property, since the sediment sample from this property had higher concentrations of PCBs than the other samples collected during this investigation. This property is currently leased by the San Francisco International Airport and used for offices and warehousing. A large warehouse type building with several loading docks covers most of the property; the remaining area is paved. A railroad track runs along the western property boundary (Figures 3).

Environmental Data Resources, Inc. (EDR) of Southport, Connecticut was retained to provide historical information on 245 Spruce Avenue using its database of aerial photographs, Sanborn fire insurance maps and city directories. In addition, records regarding hazardous material use and waste generation were obtained from San Mateo County Environmental Health.

4.1 Aerial Photographs

The following descriptions of the 245 Spruce Avenue property are based on examination of aerial photographs provided by EDR:

- 1943 – The property appears to be part of a trailer park with paved and unpaved areas.

- 1956 – The property appears similar to the above description for the 1943 photograph.

- 1965 – A building about half the size of the present day building but similar in appearance covers most of the northern portion of the property. The southern part of the property appears unpaved and possibly under construction.

- 1982 – A building that appears to be the present day building covers most of the property. The area surrounding the building appears paved.

- 1994 – The property appears similar to the above description for the 1982 photograph.

4.2 Sanborn Fire Insurance Map

EDR found one Sanborn fire insurance map for 245 Spruce Avenue in its database. The map is dated 1970 and shows what appears to be the same building observed in the above 1982 and 1994 aerial photographs. The building is labeled Zellerbach Paper Co. and office, paper cutting and shipping dock areas are labeled.

4.3 City Directory Search

EDR searched its database of business directories, including city, cross-reference and telephone directories, at approximately five-year intervals for the years spanning 1976 through 2001. Zellerbach Paper Company, the only listing found for 245 Spruce Avenue, was listed in 1976, 1989 and 1995.

4.4 County Health Records

San Mateo County Environmental Health regulates hazardous materials use and hazardous waste generation by businesses in South San Francisco. Available records for 245 Spruce Avenue in South San Francisco document three facilities permitted for hazardous materials. San Mateo County Environmental Health provided the following summaries of these records:

- Zellerbach Paper Company - Business: Paper distributor. Records indicate this facility had a pump island and three underground tanks: a 6,000-gallon unleaded gasoline tank, a 500-gallon waste oil tank and an 8,000-gallon diesel tank. The tanks were installed in 1969 and removed in 1991 after it was determined they were leaking. Site cleanup and soil remediation was completed to the satisfaction of San Mateo County Environmental Health. Records indicate that Crown Zellerbach purchased the property from the Mead Corporation in 1986. There is no documentation in the records since June 1991, when the tanks were removed.

- R. Ford Trucking - Business: Trucking company. A chemical inventory form included engine oil only. Hazardous waste was not generated. The business opened at this location January 1992 and closed March 1994.

- Bean Bag Storage Company - Business: Warehouse storage of coffee beans. A chemical inventory form included propane, hydraulic oil and engine oil. Hazardous waste was not generated. The business opened at this location January 1992 and closed February 1994.

Currently, 245 Spruce Avenue is not regulated by San Mateo County Environmental Health. Unregulated properties report that hazardous wastes are not generated and hazardous materials are stored only in small quantities (less than 55 gallons liquid, 500 pounds solid or 200 cubic feet gas).

5.0 DISCUSSION

The chemical analysis results (Table 1) suggest that the 245 Spruce Avenue property is the area of highest concern in the three pump station drainages. This conclusion, however, is based on a very limited field-sampling program.

During the late 1970s, the U.S. EPA banned the manufacture and tightly restricted the use of PCBs. Prior to that time, PCBs were widely used by many industries because of their low electrical conductivity, high boiling point, chemical stability and flame retardant properties (Binational Toxics Strategy, 1999). Applications included electrical transformers and capacitors, hydraulic fluids, flame retardants, lubricants, paints, inks, dyes, sealants and plasticizers. The use of hydraulic fluids containing PCBs may have resulted in relatively large releases to the

environment, since hydraulic systems were designed to leak slowly to provide lubrication (Binational Toxics Strategy, 1998).

Historic businesses at 245 Spruce Avenue (Section 4.0) could have used PCBs in the above applications, potentially resulting in releases of PCBs to surface soils and/or storm drains. Since PCBs are highly persistent in the environment, surface soils or accumulated storm drain sediments could potentially contain PCBs released many years ago. Historic spills in outdoor areas and illicit connections from inside the property's building are possible direct pathways for PCBs to have entered storm drains. Ongoing release of potentially contaminated surface soils to storm drains appear less likely, since this property has apparently been paved for many years. However, past construction activities and incidents such as the spring 2000 water main break may have transported site soils to the storm drains. It is also possible that PCBs releases (if any) from neighboring properties could have reached the storm drains on 245 Spruce Avenue.

STOPPP has researched known PCBs use and/or release sites in San Mateo County (STOPPP 2002). This research did not reveal any known sites within the three pump station drainages. However, because of the widespread and unregulated historic use of PCBs, the identity and location of most PCBs sites is probably unknown.

6.0 FUTURE WORK

STOPPP and other Bay area stormwater agencies are participating in a regional storm drain sediment watershed characterization study. In accordance with the recommendations from the second year of the study (KLI 2002), STOPPP will perform additional PCBs case study work. The objectives will include continuing to develop a better understanding of PCBs sources, developing and costing controls, and estimating the impact of such controls on reducing loads of urban runoff PCBs to San Francisco Bay. During FY 02/03, STOPPP will work with Regional Board staff to develop and implement a work plan for performing additional investigation in areas with elevated storm drain sediment PCBs in San Mateo County.

References

Association of Bay Area Governments (ABAG), 1996. *Existing Land Use in 1995: Data for Bay Area Counties and Cities.* Publication Number P96007EQK.

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Kinnetic Laboratories, Inc. (KLI), 2001. *Final Report, Joint Stormwater Agency Project to Study Urban Sources of Mercury and PCBs.* April 2001

Kinnetic Laboratories, Inc. (KLI), 2002. *Final Report, Joint Stormwater Agency Project to Study Urban Sources of Mercury, PCBs, and Organochlorine Pesticides.* April 2002.

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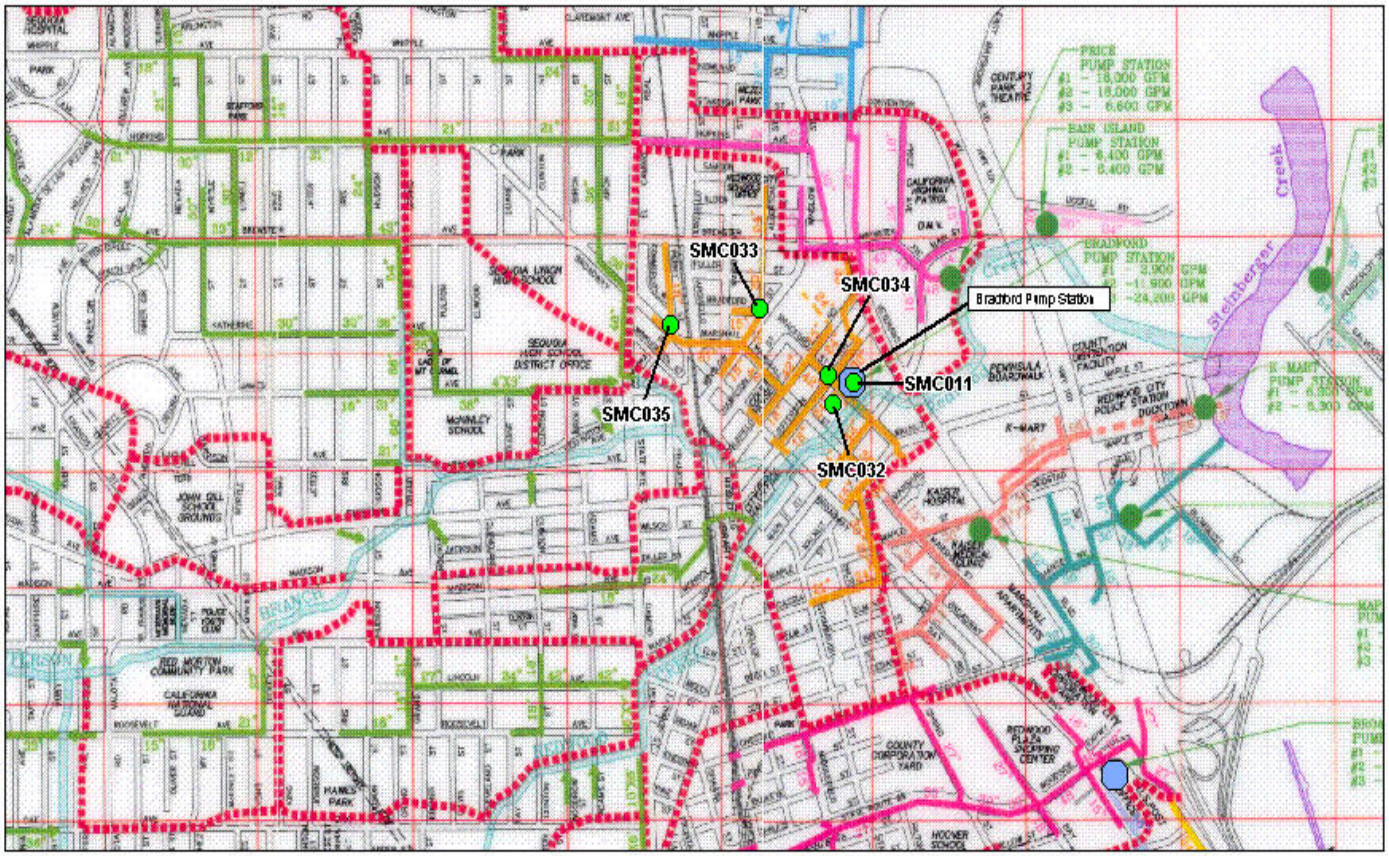
Table 1 – Chemical Analysis Results Summary

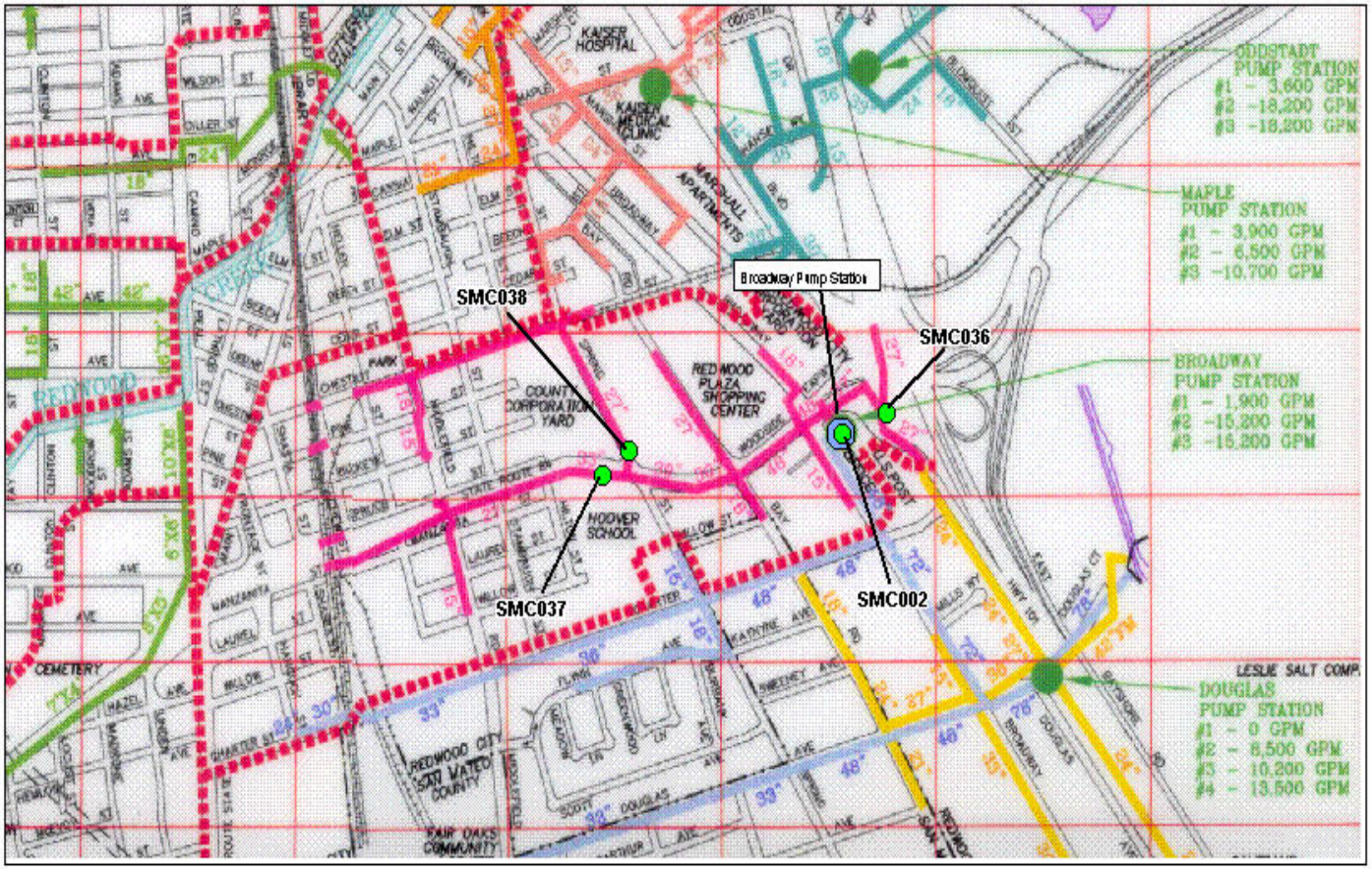
Sample Number	Description[1]	Date Collected	Total PCBs[2]	Total PCBs normalized to fines[2]
Bradford pump station drainage in Redwood City:				
SMC-011	Pump station sump	10-24-2000	339	360
SMC-011	Pump station sump	10-4-2001	124	159
SMC-032	Drop inlet	10-4-2001	22	117
SMC-032FR[3]	Drop inlet	10-4-2001	44	180
SMC-033	Manhole	10-4-2001	2	3
SMC-034	Manhole	10-4-2001	80	145
SMC-035	Manhole	10-4-2001	75	841
Broadway pump station drainage in Redwood City:				
SMC-002	Pump station sump	10-24-2000	116	2,371
SMC-002	Pump station sump	10-4-2001	61	560
SMC-036	Grated vault	10-4-2001	72	713
SMC-037	Vault	10-4-2001	14	473
SMC-038	Grated vault	10-4-2001	93	2,525
South Maple pump station drainage in South San Francisco:				
SMC-009	Pump station sump	10-25-2000	477	2,110
SMC-009FR	Pump station sump	10-25-2000	227	1,187
SMC-009	Pump station sump	10-2-2001	70	1,735
SMC-039	Drop inlet	10-2-2001	72	1,206
SMC-040	Composite - adjacent grated vault and manhole	10-2-2001	2,719	13,842

[1]See Figures 1 – 3 for sample locations.
[2]All concentrations in parts-per-billion.
[3]FR – indicates sample was a field replicate.



Base Map Source: City of Redwood City, Redwood City Storm Drain System, September 28, 1998

Figure 1 - Bradford Pump Station Case Study



Base Map Source: City of Redwood City, Redwood City Storm Drain System, September 28, 1998

Figure 2 - Broadway Pump Station Case Study

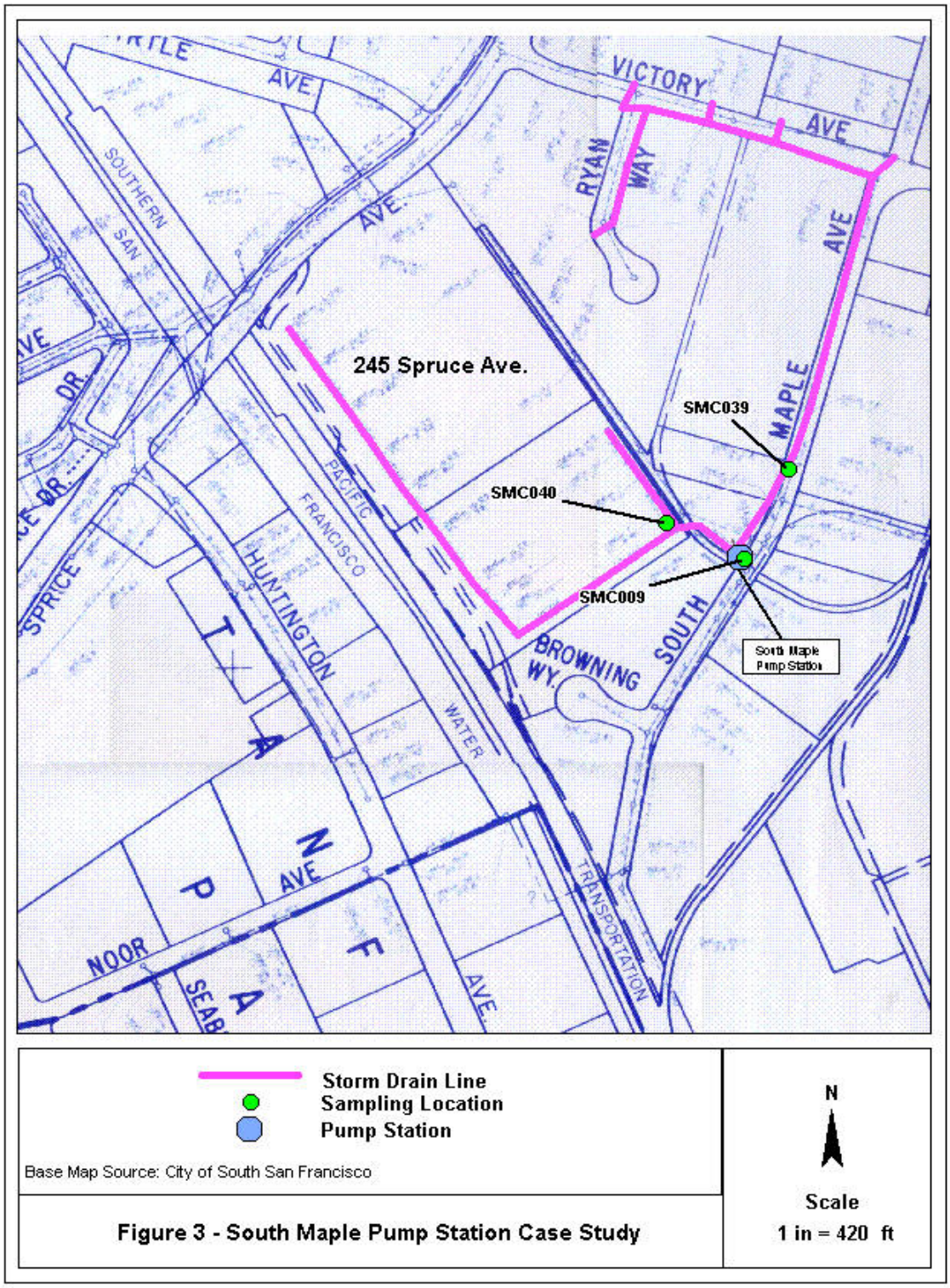


Figure 3 - South Maple Pump Station Case Study

APPENDIX

KINNETIC LABORATORIES INCORPORATED

OCEANOGRAPHIC & ENVIRONMENTAL CONSULTING

307 Washington Street, Santa Cruz, CA 95060
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March 18, 2002

Mr. Jon Konnan
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Re: San Mateo County PCBs Case Studies

Sediments were sampled from storm drainages associated with three pump stations in San Mateo County. On 2 October 2001, four samples were collected in association with the South Maple Pump Station located in South San Francisco. On 4 October 2001, five samples were collected in association with Bradford Pump Station and four samples in association with the Broadway Pump Station. Descriptions of the sampling locations, sampling site designations, and qualitative descriptions of the sediments are included in Attachment 1. Locations of each site are shown on Figures 1 through 5. Figure 1 shows the generalized location of the South Maple Pump Station case study area. Figure 2 shows the sampling site locations for the South Maple Pump Station case study. Figure 3 shows the generalized location of the both the Bradford and Broadway Pump Station case study areas. Figure 4 shows the sampling site locations for the Bradford Pump Station case study. Figure 5 shows the sampling site locations for the Broadway Pump Station case study.

Data from this survey are summarized in Tables 1 through 3. Data tables include field replicates and laboratory duplicates. Triplicate samples are reported for sediment particle size data in Table 3. All QA/QC data were reviewed and found to meet overall program data quality objectives.

PCB levels were measured at 70 ug/Kg at the South Maple Pump Station (SMC009). PCB concentrations measured in October 2000 at this site were 477 ug/Kg for the original sample and 227 ug/Kg for the field duplicate. Three different source directions were investigated for the South Maple Pump Station. The first source investigated drains the area north of the pump station along South Maple Avenue and west along Victory Avenue and Ryan Way. The second catchbasin (SMC039) north of the pump station dropped straight into the storm drain line and displayed PCB levels (72 ug/Kg) similar to

those measured at the pump station. The second source investigated drains the area south/southwest of the pump station along South Maple Avenue and Noor Avenue. PCB levels were measured at 39 ug/Kg from a manhole (SMC041) sampled just east of the pump station. This storm drain line flows to a slough to the east, eventually drains into Colma Creek and to San Francisco Bay. There is a side branch at this location that could possibly flow to the South Maple Pump Station when the water level is high. The third source investigated drains the property west of the pump station between the railroad tracks and Spruce Avenue. A composite sample was taken just west of the pump station from a large grated vault and manhole positioned next to each other (SMC040). This sampling location displayed the highest measured PCB levels (2719 ug/Kg) of any case study site for San Mateo County. It should be noted that an asphalt like roofing material was observed at three of the locations (Refer toAttachment 1).

PCB levels were measured 124 ug/Kg at the Bradford Pump Station (SMC011). Three different source directions were investigated for the Bradford Pump Station. Storm drainage lines directed from Main Street (east/southeast) were investigated but insufficient or no embedded sediment were observed at four locations on Main Street, one location at the intersection of Walnut Street and Marshall Street, and one location at the intersection of Walnut Street and Spring Street. The second source direction investigated, a catchbasin (SMC032) located in a parking lot directly south of the Bradford Pump Station, was sampled and measured 22 to 44 ug/Kg (sample and field replicate respectively). The third source direction drains a large area west of the Bradford Pump Station flowing east along Bradford Street to the pump station. Slightly higher levels (80 ug/Kg) were measured from a sample collected directly west of the pump station at the intersection of Bradford Street and Jefferson Avenue (SMC034). Similar levels (75 ug/K) were measured at the intersection of Perry Street and Broadway (SMC035). A side branch to this third source displayed very low levels (2 ug/Kg) in a sample collected at the intersections of Bradford, Allerton, and Winslow Streets (SMC033).

PCB levels were measured at 61 ug/Kg at the Broadway Pump Station (SMC002). Testing conducted during the previous year indicated PCB levels of 116 ug/Kg at this location. Two different source directions were investigated for the Broadway Pump Station. The first source investigated drains the area around the Highway 101 interchange to the east. A catchbasin (SMC036) located on an island between the southbound on ramps had slightly higher PCB levels (72 ug/Kg) than measured at the pump station. The second drainage area investigated flows from the west toward the pump house along Highway 84 (Woodside Expressway). Samples were collected from two locations near the intersection of Spring Street and Highway 84 where this drainage area splits into its' two major subdrainage areas. The highest PCB levels (93 ug/Kg) were measured from the northwestern subdrainage area in a catchbasin at the intersection of Spring Street and westbound Highway 84 (SMC038). The southwestern subdrainage area was sampled from a vault between Spring Street and Middlefield Road on the south shoulder of eastbound Highway 84 (SMC037). PCB levels at this site were the lowest (14 ug/Kg) measured values for the Broadway Pump Station case study.

Generally lower concentration of total PCBs measured during the three San Mateo case studies make interpretation of the homolog data (Figures 6-8) difficult. High concentrations of PCBs at SMC040 in the South Maple study area provide an exception. The PCB formulation contributing to the high concentrations in this sample is most comparable to Arochlor 1260 and shows very little evidence of weathering.

Chlordane was highest (177 ug/Kg) in sediments from SMC040, the composite sample taken from the large grated vault and manhole just west of the South Maple Pump Station. Chlordane was also measured at 104 ug/Kg for site SMC035 of the Bradford Pump Station case study. All other measured chlordane values were 36 ug/Kg or less.

The highest levels of DDT compounds were found at two sites sampled for the South Maple Pump Station and one site sampled for the Bradford Pump Station. DDT compounds were measured at 103 and 102 ug/Kg near the South Maple Pump Station at SMC040 and SMC039, respectively. DDT compounds were measured at 101 ug/Kg from the manhole (SMC035) at the intersection of Perry Street and Broadway sampled for the Bradford Pump Station case study. All other measured values of DDT were 47 ug/Kg or less.

Elevated levels of chloropyrifos were measured at the catchbasin (SMC032) sampled for the Bradford Pump Station case study. Both the sample (470 ug/Kg) and field replicate (490 ug/Kg) displayed similar high values. All other measurements of chloropyrifos were 28 ug/Kg or less. Mirex was undetected at all sampling locations for all case studies.

Please give me a call (808 661-1110 or 831 901-7019) if you have any questions or need further information.

Sincerely,

Marty L Stevenson

Marty L. Stevenson

Attachments

Table 1. Summary of PCB Concentrations (ug/Kg-dry weight) in sediments from San Mateo County Case Study Sites

		Bradford						Broadway				South Maple			
Component	**Units**	**SMC011**	**SMC032**	**SMC032FR**	**SMC033**	**SMC034**	**SMC035**	**SMC002**	**SMC036**	**SMC037**	**SMC038**	**SMC009**	**SMC039**	**SMC040**	**SMC041**
PCB 8	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.4	ND
PCB 18	ug/Kg	3.2	ND	ND	ND	ND	ND	ND	2.9	ND	ND	1.3	ND	1.2	ND
PCB 28	ug/Kg	4.6	ND	1.7	ND	4	1.8	ND	3.3	ND	ND	ND	2.3	ND	ND
PCB 31	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	40	ND	ND	5.2
PCB 33	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 44	ug/Kg	2.9	1.4	1.9	ND	2.5	2.4	1.7	3.7	0.76	2.3	ND	1.1	6	2.7
PCB 49	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 52	ug/Kg	2.6	ND	10	ND	ND	ND	ND	6.9	4.7	8.3	ND	ND	21	6.4
PCB 56	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 60	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 66	ug/Kg	2.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	4.2	ND
PCB 70	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.5	ND
PCB 74	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 77	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 81	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 87	ug/Kg	4.8	ND	ND	ND	8.8	ND	2.4	4	ND	ND	ND	2.2	32	1.6
PCB 90	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.87	ND	ND	1.5	2.9
PCB 95	ug/Kg	5	ND	ND	ND	ND	ND	5.2	ND	ND	5.4	ND	ND	50	ND
PCB 97	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	20	ND
PCB 99	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	22	ND
PCB 101	ug/Kg	6.1	3.3	4.2	ND	12	4.6	6.1	3.4	1.2	5.4	2	3.9	72	2.9
PCB 105	ug/Kg	ND	ND	5.1	ND	ND	ND	ND	15	ND	ND	ND	ND	ND	ND
PCB 110	ug/Kg	8.8	ND	6.2	ND	11	6.6	9.4	7.5	ND	9.3	ND	4.9	120	3.9
PCB 114	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 118	ug/Kg	5.8	3.7	4.1	ND	7.8	5.7	5.3	4	1.2	5.8	2.1	3.5	110	2.8
PCB 123	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 126	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 128	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	38	ND
PCB 132	ug/Kg	6.3	ND	ND	ND	ND	7.5	ND	ND	ND	4.6	ND	4.1	82	ND
PCB 138	ug/Kg	12	3.5	3.3	1.3	10	7.7	8	5.5	2.2	8.2	3.7	8.1	280	4

FR = Field Replicate (submitted blind to laboratory)

Table 1. Summary of PCB Concentrations (ug/Kg-dry weight) in sediments from San Mateo County Case Study Sites. (continued)

		Bradford						Broadway				South Maple			
Component	**Units**	**SMC011**	**SMC032**	**SMC032FR**	**SMC033**	**SMC034**	**SMC035**	**SMC002**	**SMC036**	**SMC037**	**SMC038**	**SMC009**	**SMC039**	**SMC040**	**SMC041**
PCB 141	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	79	ND
PCB 149	ug/Kg	11	ND	ND	ND	ND	ND	5.6	ND	ND	7.6	ND	6.7	160	ND
PCB 151	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	62	ND
PCB 153	ug/Kg	12	4.2	3.7	ND	8	6.9	6.4	4.7	1.9	8.6	3.9	8.1	220	2.9
PCB 156	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	1.4	ND	ND	62	ND
PCB 157	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 158	ug/Kg	ND	1.2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 166	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 167	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	27	ND
PCB 169	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 170	ug/Kg	6.9	1.4	ND	ND	4.2	5	2.9	3.3	ND	4.4	2.8	4.8	180	ND
PCB 174	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	140	ND
PCB 177	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	81	ND
PCB 180	ug/Kg	14	3.7	3.4	0.8	7.5	9	5.3	4.5	2.1	8.8	5	9.1	330	1.3
PCB 183	ug/Kg	4.7	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	120	1.9
PCB 184	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
PCB 187	ug/Kg	8.3	ND	ND	ND	4.4	5.8	3.1	3	ND	5.8	3.8	5.8	140	ND
PCB 189	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	6.5	ND
PCB 194	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	89	ND
PCB 195	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	39	ND
PCB 201	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	14	ND
PCB 203	ug/Kg	ND	ND	ND	ND	ND	4.7	ND	ND	ND	3.8	ND	4.1	74	ND
PCB 206	ug/Kg	2.5	ND	ND	ND	ND	4.2	ND	ND	ND	2.1	4.9	3.4	21	ND
PCB 209	ug/Kg	ND	ND	ND	ND	ND	3.2	ND	ND	ND	ND	0.95	ND	2.3	ND
Total PCB's:	ug/Kg	**124**	**22**	**44**	**2**	**80**	**75**	**61**	**72**	**14**	**93**	**70**	**72**	**2719**	**39**
Normalized to Fines	**ug/FineFraction**	**159**	**117**	**180**	**3**	**145**	**841**	**560**	**713**	**473**	**2525**	**1735**	**1206**	**13842**	**1447**
Normalized to TOC	**ug/TOCFraction**	**5471**	**319**	**714**	**84**	**1138**	**1788**	**2843**	**2988**	**1162**	**7184**	**9393**	**4266**	**135254**	**5580**

FR = Field Replicate (submitted blind to laboratory)

Table 2. Summary of sediment particle size distributions, percent solids and TOC in sediments from San Mateo County Case Study Sites

		Bradford									Broadway				
Component	**Units**	**SMC011**	**SMC011 LD**	**SMC011 LT**	**SMC032**	**SMC032 FR**	**SMC033**	**SMC033 LD**	**SMC033 LT**	**SMC034**	**SMC035**	**SMC002**	**SMC002 LD**	**SMC036**	**SMC037**	**SMC038**
Solids, Total	%	55			57.3	61.1	56.7			44.2	67.8	74.1	73.8	79.1	80.7	77.6
Carbon, Total Organic (TOC)	%	2.27			7.02	6.11	2.49			7.05	4.2	2.16	2.1	2.4	1.21	1.29
Gravel	%	0.12	0.09	0.02	0.56	1.1	0.04	0.04	0.06	0.37	3.8	0.18		0.11	0.15	1.34
Sand, Very Coarse	%	0.43	0.65	0.39	14.7	11.4	1	0.88	1.1	5.15	10	4.68		18.8	24.6	20.3
Sand, Coarse	%	1.13	0.126	1.26	27.7	24	3.39	3.34	3.45	8.02	16.5	17.6		27.6	38.1	23.1
Sand, Medium	%	3.92	3.33	4.12	20.7	20.7	14.9	15	15	6.22	33.6	38.3		25.4	27.6	30.5
Sand, Fine	%	7.42	7.53	7.76	9.79	11.1	8.57	8.86	8.69	7.07	23	24.7		14.8	5.78	19.4
Sand, Very Fine	%	7.71	8.15	8.71	6.55	7.12	3.73	3.73	3.77	14.6	3.7	3.16		2.72	1.13	1.67
62.5 µm	%	11.1	14.1	12.7	9.24	10.1	4.31	5.16	5.11	16	2.26	7.39		5.01	0.61	0.88
31.3 µm	%	37.8	32.2	30	7.54	11.8	24.2	24.6	21.9	35.8	3.46	2.12		3.11	0.56	1.23
15.6 µm	%	13.5	14.9	17.2	0.67	0.49	16.1	16	18.9	0.71	0.98	0.53		0.46	1.2	0.78
7.8 µm	%	7.36	8.69	9.28	0.43	0.35	11.1	11.3	11.3	0.5	0.87	0.103		0.8	0	0
3.9 µm	%	4.57	4.63	5.31	0.34	0.43	6.81	6.76	6.23	0.17	0.5	0.25		0	0.25	0.31
1.95 µm	%	2.16	2.65	2.16	0.19	0.16	3.82	3.76	3.57	0.15	0.2	0.13		0.26	0.17	0.13
0.98 µm	%	1.55	1.96	2.01	0.73	0.88	2.24	1.94	1.83	1.86	0.66	0.44		0.41	0.18	0.34
Total Fines	%	**78.0**	**79.1**	**78.7**	**19.1**	**24.2**	**68.6**	**69.5**	**68.8**	**55.2**	**8.9**	**11.0**		**10.1**	**3.0**	**3.7**

LD = Laboratory Duplicate
LT = Laboratory Triplicate
FR = Field Replicate (submitted blind to laboratory)

Table 2. Summary of sediment particle size distributions, percent solids and TOC in sediments from San Mateo County Case Study Sites. (continued)

Component	Units	South Maple				
		SMC009	SMC039	SMC039 LD	SMC040	SMC041
Solids, Total	%	83.1	75.4	73.4	66.5	82.8
Carbon, Total Organic (TOC)	%	0.75	1.69		2.01	0.69
Gravel	%	0.3	2.61		0.14	0.23
Sand, Very Coarse	%	42.8	20.1		25.1	14.5
Sand, Coarse	%	25	28.3		21.9	16.9
Sand, Medium	%	8.5	23.4		16.8	38.3
Sand, Fine	%	3.93	8.54		12.4	25.1
Sand, Very Fine	%	14.5	10.9		4.69	2.24
62.5 µm	%	1.71	2.21		3.46	0.54
31.3 µm	%	0.92	1.61		8.42	0.59
15.6 µm	%	0.63	1.04		1.87	0.35
7.8 µm	%	0.06	0.03		2.96	0.3
3.9 µm	%	0.24	0.2		1.89	0.32
1.95 µm	%	0.05	0.18		0.6	0.18
0.98 µm	%	0.45	0.71		0.44	0.38
Total Fines	%	**4.1**	**6.0**		**19.6**	**2.7**

LD = Laboratory Duplicate

Table 3. Summary of organochlorine concentrations measured in sediments from each San Mateo County Case Study Site.

		Bradford						Broadway				South Maple			
Component	**Units**	**SMC011**	**SMC032**	**SMC032 FD**	**SMC033**	**SMC034**	**SMC035**	**SMC002**	**SMC036**	**SMC037**	**SMC038**	**SMC009**	**SMC039**	**SMC040**	**SMC041**
alpha-Chlordane	ug/Kg	5.2	ND	ND	2.5	12	25	5.7	6.2	2.6	13	ND	ND	ND	ND
gamma-Chlordane	ug/Kg	14	ND	ND	4.9	ND	41	ND	15	6.6	ND	9.4	14	47	5.5
cis-Nonachlor	ug/Kg	6.1	1.2	1.4	1.1	3.9	11	4.5	11	2.8	5.1	1.5	2.6	130	1.1
trans-Nonachlor	ug/Kg	2.8	1.4	2.1	2.3	14	20	3.3	4.1	2.2	8.8	ND	0.93	ND	0.61
Heptachlor	ug/Kg	ND	ND	ND	ND	ND	7	ND	ND	ND	ND	ND	ND	ND	ND
Heptachlor Epoxide	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Oxychlordane	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Total Chlordane:	ug/Kg	**28**	**3**	**4**	**11**	**30**	**104**	**14**	**36**	**14**	**27**	**11**	**18**	**177**	**7**
Aldrin	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Dieldrin	ug/Kg	ND	ND	ND	ND	ND	16	ND	5.4	ND	ND	ND	ND	ND	ND
Endrin	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
alpha-BHC	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
beta-BHC	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
delta-BHC	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
gamma-BHC (Lindane)	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan I	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan II	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Endosulfan Sulfate	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
2,4'-DDD	ug/Kg	7.4	13	13	3.7	ND	19	20	8.5	4.3	29	7.7	13	ND	ND
2,4'-DDE	ug/Kg	ND	ND	ND	ND	ND	2.1	ND	0.77	ND	ND	ND	ND	17	ND
2,4'-DDT	ug/Kg	3.6	ND	ND	ND	5.7	6.3	4.7	12	ND	4.4	ND	6.4	76	ND
4,4'-DDD	ug/Kg	ND	3.9	3.7	ND	3.7	33	16	7	4.3	8.5	5.1	44	10	ND
4,4'-DDE	ug/Kg	ND	9.9	9.1	ND	ND	25	6.1	11	ND	4.5	ND	6	ND	ND
4,4'-DDT	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	17	33	ND	3.9
Total DDTs:	ug/Kg	**11**	**27**	**26**	**4**	**9**	**101**	**47**	**45**	**9**	**46**	**30**	**102**	**103**	**4**
Chlorpyrifos	ug/Kg	25	470	490	ND	ND	28	4.7	ND	6.9	2.1	ND	ND	ND	ND
Mirex	ug/Kg	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND

FR = Field Replicate (submitted blind to laboratory)

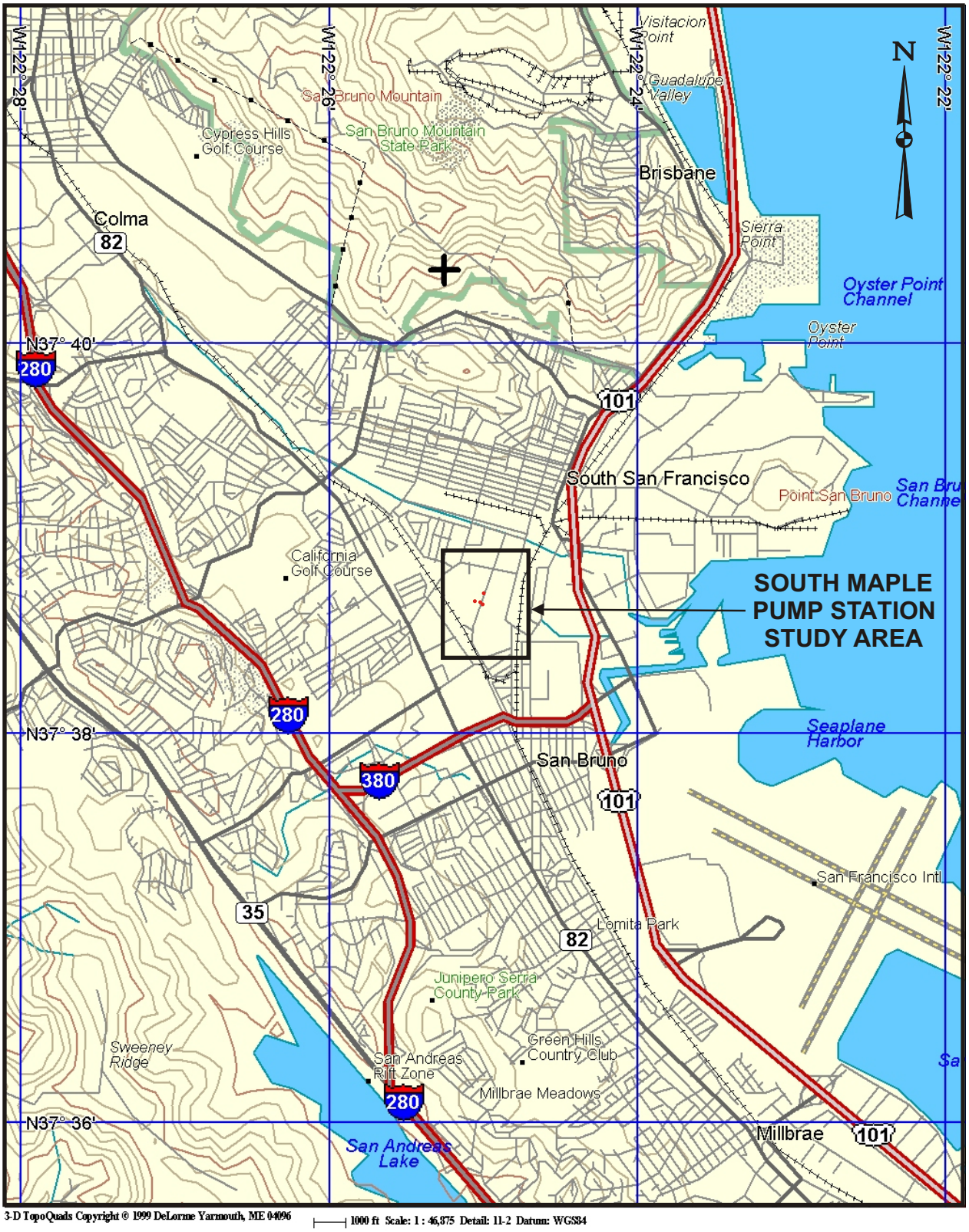


Figure 1 . South Maple Pump Station Case Study Area.

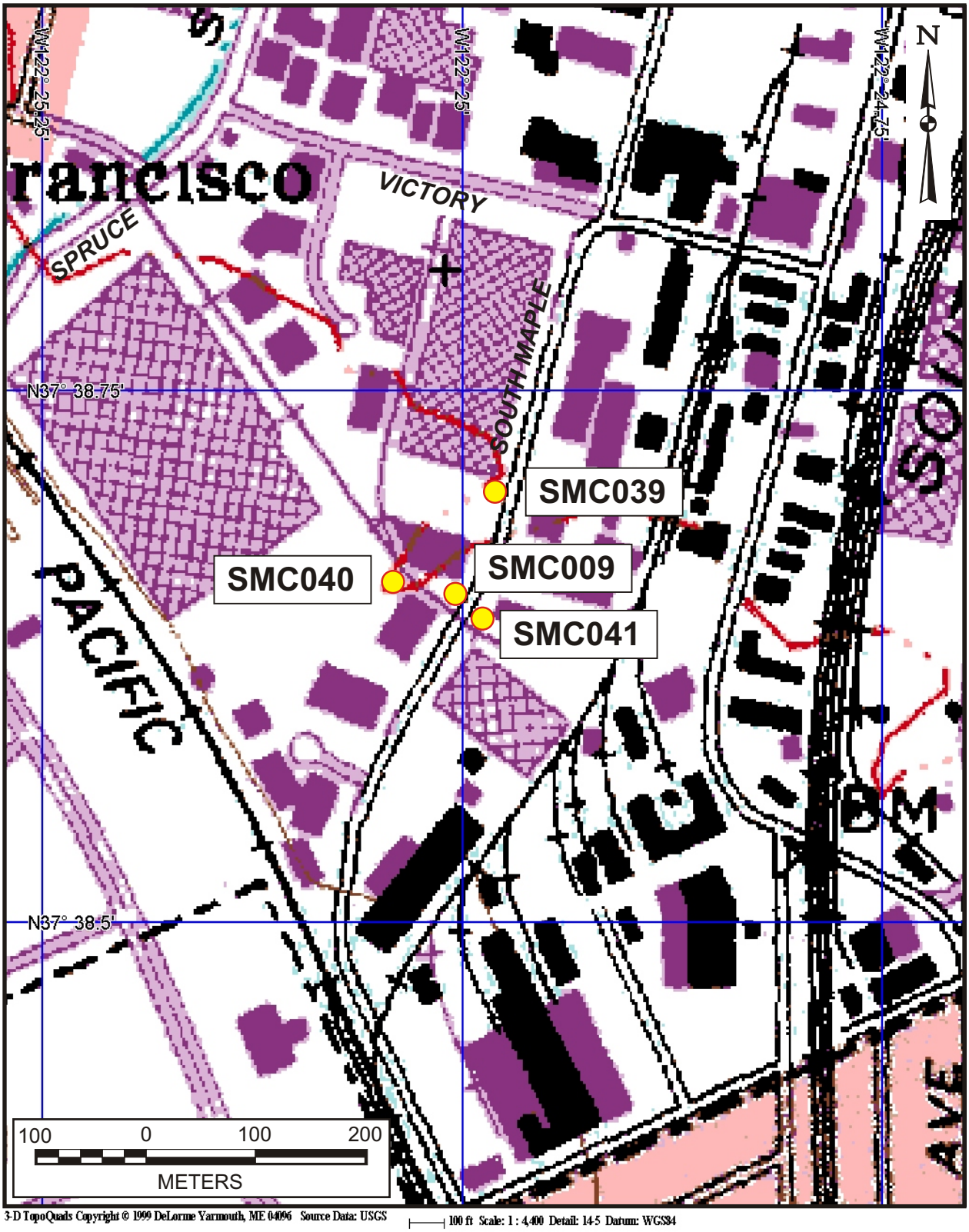


Figure 2. Sampling Sites within the South Maple Pump Station Case Study Area.

Figure 3. Bradford Pump Station and Broadway Pump Station Case Study Areas.

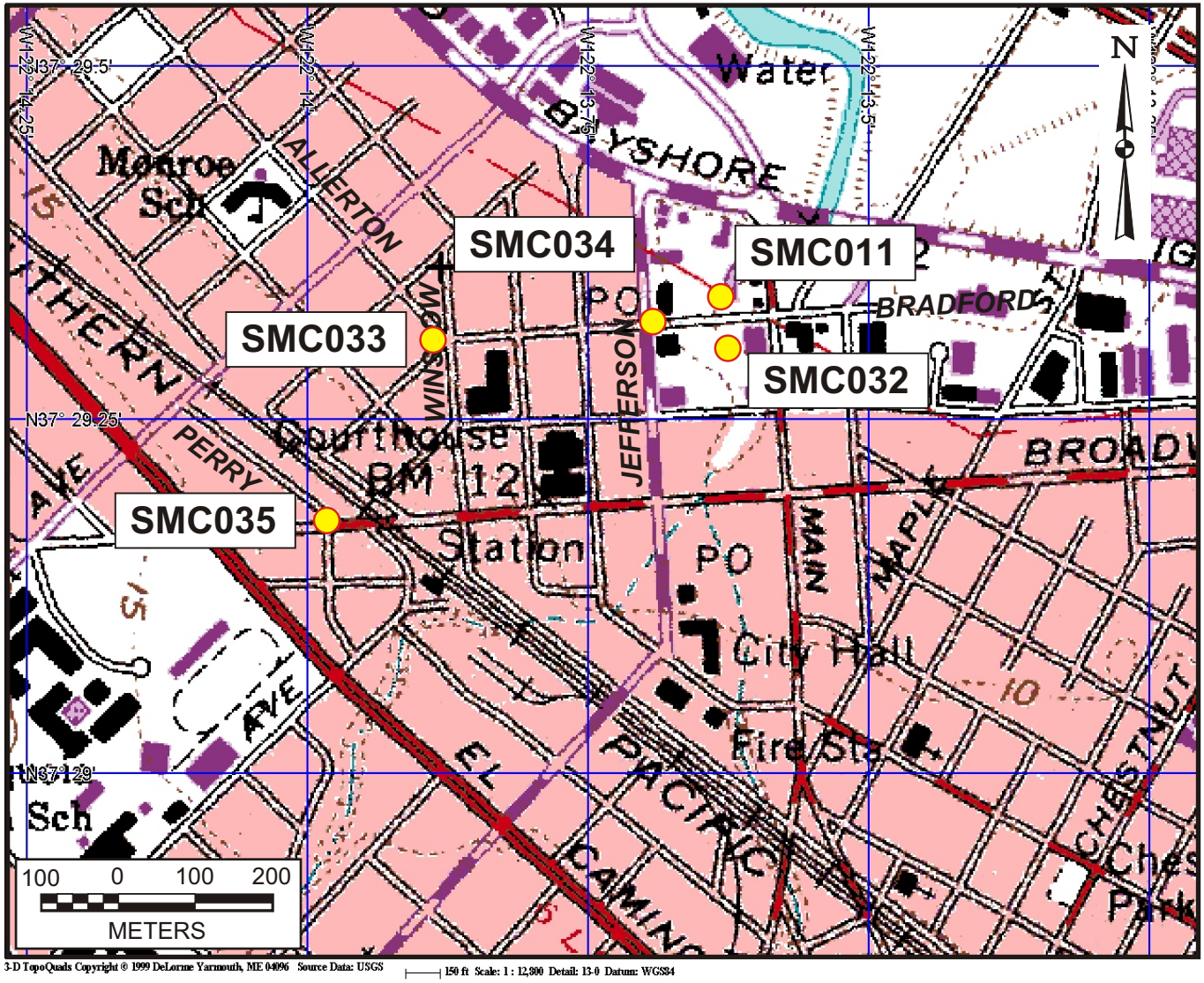


Figure 4. Sampling Sites within the Bradford Pump Station Case Study Area.

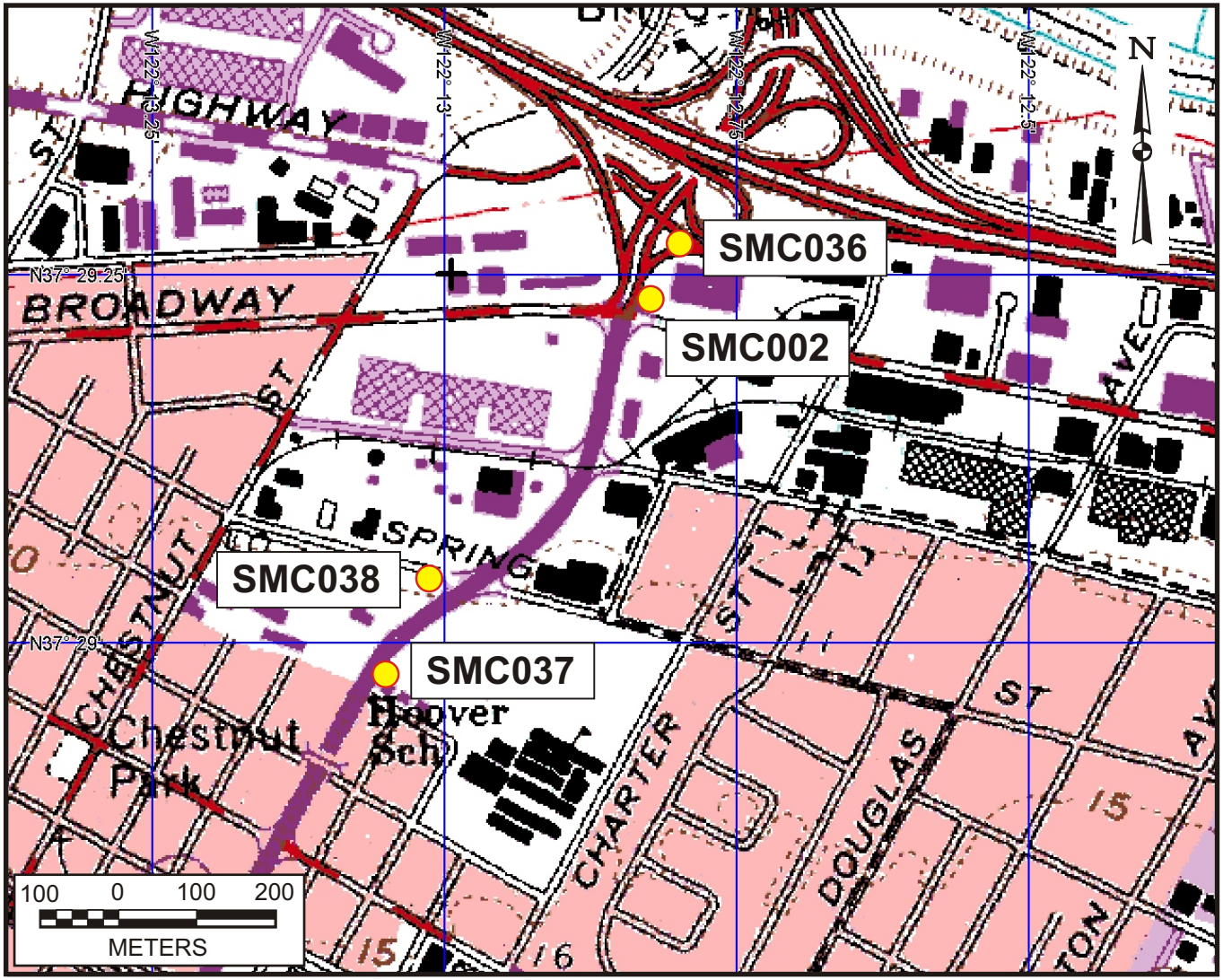
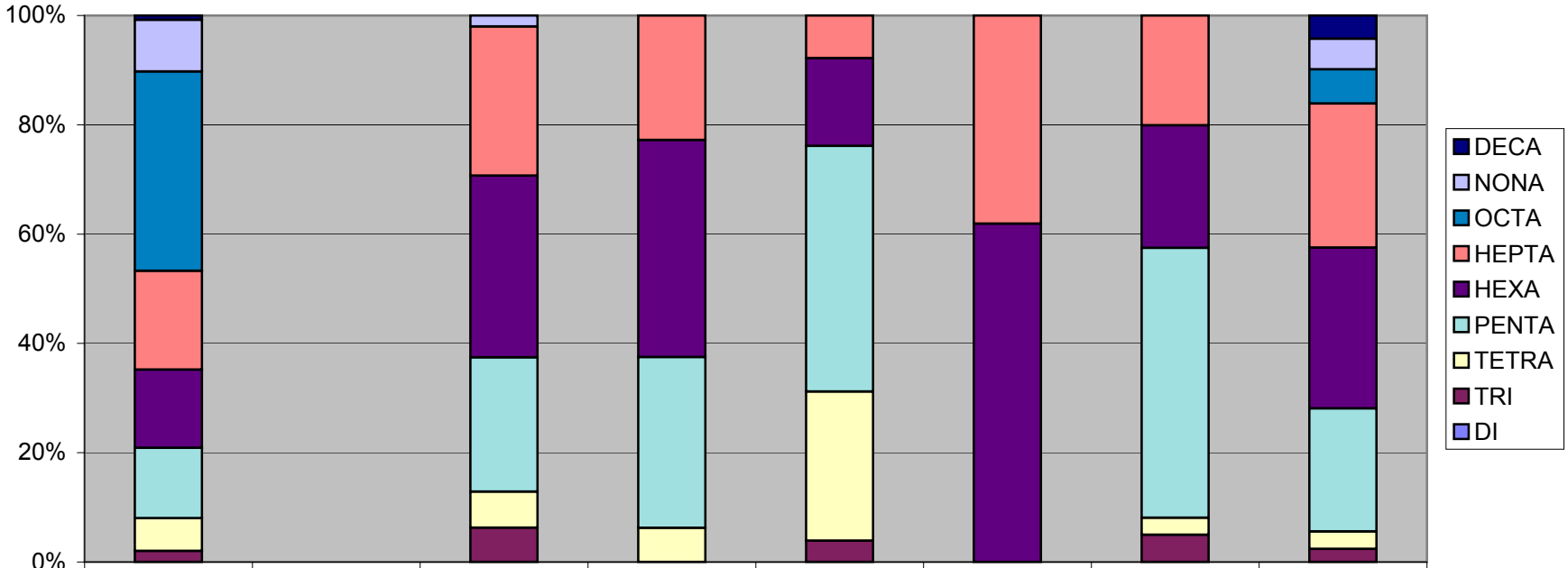


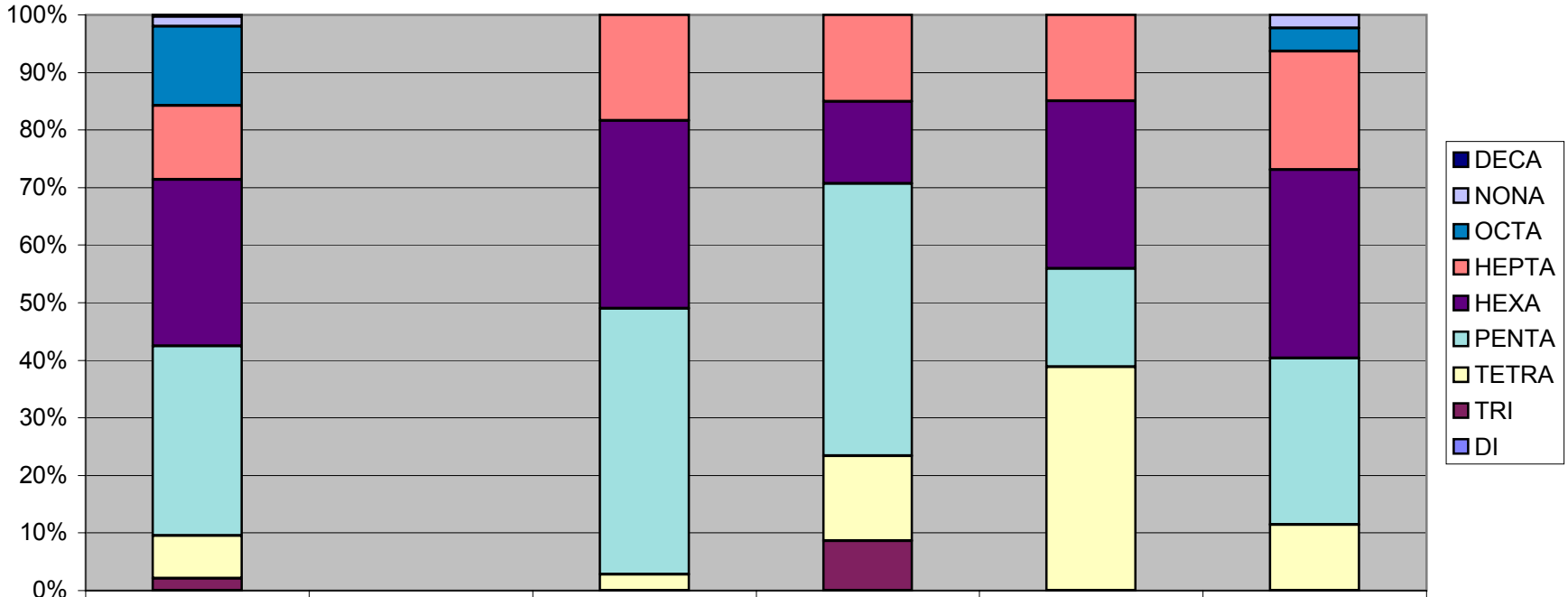
Figure 5. Sampling Sites within the Broadway Pump Station Case Study Area.

Figure 6. Bradford Pump Station Case Study Concentration of PCB Homologs



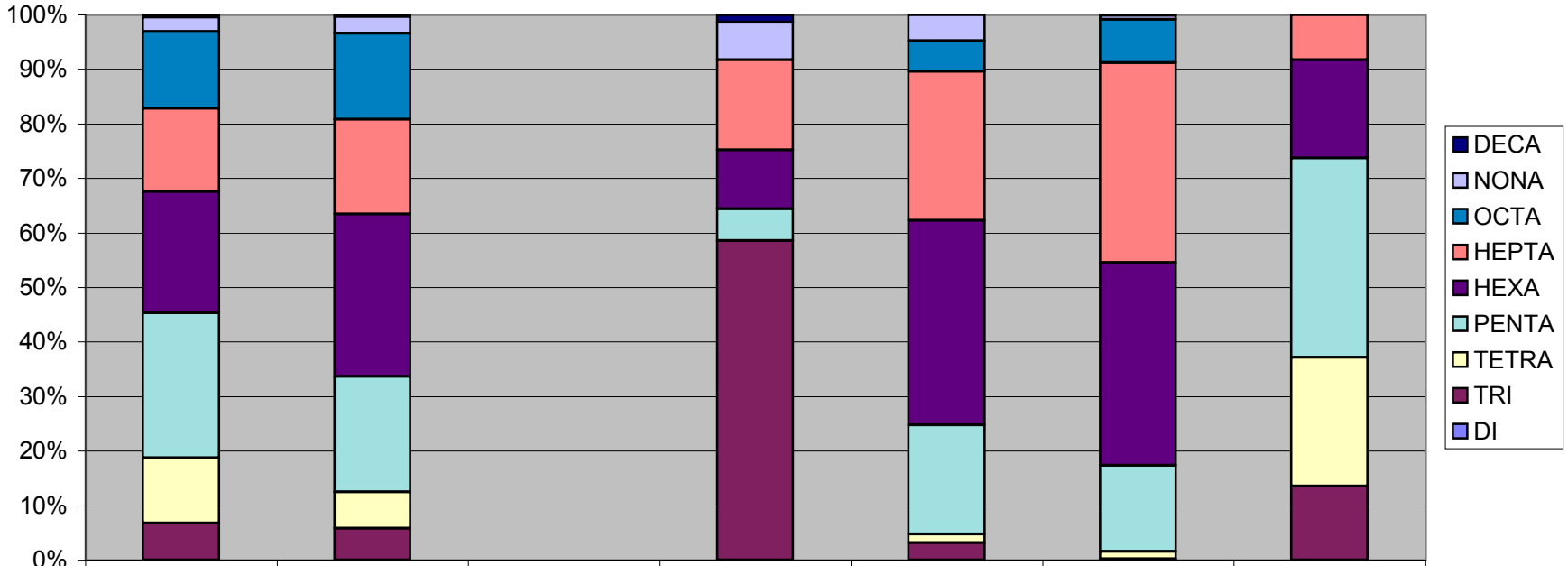
	SMC011 (2000)		SMC011 (2001)	SMC032 (2001)	SMC032FR (2001)	SMC033 (2001)	SMC034 (2001)	SMC035 (2001)
DECA	3		0	0	0	0	0	3
NONA	32		3	0	0	0	0	4
OCTA	124		0	0	0	0	0	5
HEPTA	61		34	5	3	1	16	20
HEXA	49		41	9	7	1	18	22
PENTA	44		31	7	20	0	40	17
TETRA	20		8	1	12	0	3	2
TRI	7		8	0	2	0	4	2
DI	0		0	0	0	0	0	0

Figure 7. Broadway Pump Station Case Study Concentration of PCB Homologs



	SMC002 (2000)		SMC002 (2001)	SMC036 (2001)	SMC037 (2001)	SMC038 (2001)
DECA	0		0	0	0	0
NONA	2		0	0	0	2
OCTA	16		0	0	0	4
HEPTA	15		11	11	2	19
HEXA	34		20	10	4	30
PENTA	38		28	34	2	27
TETRA	9		2	11	5	11
TRI	2		0	6	0	0
DI	0		0	0	0	0

Figure 8. South Maple Pump Station Case Study Concentration of PCB Homologs



	SMC009 (2000)	SMC009FR (2000)		SMC009 (2001)	SMC039 (2001)	SMC040 (2001)	SMC041 (2001)
DECA	2	1		1	0	2	0
NONA	13	7		5	3	21	0
OCTA	67	36		0	4	216	0
HEPTA	73	40		12	20	998	3
HEXA	107	67		8	27	1010	7
PENTA	127	48		4	15	428	14
TETRA	57	15		0	1	39	9
TRI	33	13		41	2	1	5
DI	0	0		0	0	4	0

ATTACHMENT 1

SAN MATEO COUNTY CASE STUDIES – SITE DESCRIPTIONS

1.0 BRADFORD PUMP STATION

Sediment was collected from five locations. Three manholes and one catch basin were sampled from the Bradford Pump Station sub-drainage area. In addition, a re-sampling of the Bradford Pump Station was performed.

1.1 SMC011 – Bradford Pump Station (Sample 1)

Sediment was sampled from the sump of the Bradford Pump Station (37° 29.322'N; 122° 13.611'W). This is the same SMC011 sampling location used during the Fall 2000 sampling. The sediment consisted of very soupy silt with some organic material (leaves). Sediment was collected with a stainless steel Ponar Grab and the surface layer was transferred into the sample jar using a Tefzel-coated spoon.

1.2 SMC032 – Catch Basin between Pump Station and Fire Department (Sample 2)

Sediment was sampled from a catch basin located in a parking lot just southwest of the Bradford Pump Station and just northeast of the Fire Department (37° 29.300'N; 122° 13.620'W). The sediment consisted of wet silty sand with some organic debris and trash. The surface layer of sediment was collected with a Tefzel-coated spoon attached to a pole and placed directly into the sample jar.

1.3 SMC033 – Manhole at Intersection of Bradford, Allerton, and Winslow Streets (Sample 3)

Sediment was sampled from a manhole near the north corner of the intersection of Bradford Street and Allerton Street where they meet Winslow Street (37° 29.339'N; 122° 13.890'W). The sediment collected was brown soupy silt with some sand and organic debris. The surface layer of sediment was collected with a Tefzel-coated spoon attached to a pole, lifted slowly through the overlying water, and placed directly into the sample jar.

1.4 SMC034 – Manhole at Intersection of Bradford Street and Jefferson Avenue (Sample 4)

Sediment was sampled from a manhole near the southeast corner of the intersection of Bradford Street and Jefferson Avenue (37° 29.327'N; 122° 13.698'W). The sediment collected was wet fine silty sand with a heavy amount of organic debris. In addition, some deposits on the vault bottom looked calcified. The surface layer of sediment was collected with a Tefzel-coated spoon attached to a pole and placed directly into the sample jar.

1.5 SMC035 – Manhole at Intersection of Perry Street and Broadway (Sample 5)

Sediment was sampled from a manhole near the northeast corner of the intersection of Perry Street and Broadway (37° 29.190'N; 122° 13.986'W). The Caltrain railroad line is just east of this intersection. The sediment collected was fine silty sand with some gravel and organic debris. The surface layer of sediment was collected with a Tefzel-coated spoon attached to a pole and placed directly into the sample jar.

2.0 BROADWAY PUMP STATION

Sediment was collected from four locations. Two grated vaults and one metal plate covered vault were sampled from the Broadway Pump Station sub-drainage area. In addition, a re-sampling of the Broadway Pump Station was performed.

2.1 SMC002 – Broadway Pump Station (Sample 1)

Sediment was sampled from the sump of the Broadway Pump Station (37° 29.233'N; 122° 12.839'W). This is the same SMC002 sampling location used during the Fall 2000 sampling. The sediment collected was silty sand with some organic debris and trash. The sample was collected from the outer well (outside of the pump house). A strong hydrocarbon odor and extensive oil and grease sheen was observed in the inner well (inside the pump house) but sediment could not be collected there. Sediment was collected with a stainless steel Ponar Grab and the surface layer was transferred into the sample jar using a Tefzel-coated spoon.

2.2 SMC036 – Grated Vault at Intersection of Highways 84 and 101 (Sample 2)

Sediment was sampled from a grated vault in the middle of the island surrounded by the southbound ramps off of Highway 84 onto Highway 101 (37° 29.277'N; 122° 12.801'W). The grated vault was surrounded by ice plant and there was a lot of pine needles on the ground. The sediment sampled was coarse with a strong foul odor observed. The surface layer of sediment was collected with a Tefzel-coated spoon attached to a pole and placed directly into the sample jar.

2.3 SMC037 – Metal Plated Vault on Highway 84 (Sample 3)

Sediment was sampled from a grated vault on the south side of Highway 84 (eastbound Woodside Expressway) between Middlefield Road and Spring Street (37° 28.979'N; 122° 13.055'W). Hoover Park is just behind the sampling location and it was apparent that groundskeepers are removing dog feces from the playground sandbox and throwing over the fence to the vicinity of the grated vault. The sediment sampled was wet coarse sand with some fine silt and gravel, and a lot of organic debris. The surface layer of sediment was collected with a Tefzel-coated spoon attached to a pole and placed directly into the sample jar.

2.4 SMC038 – Grated Vault at Intersection of Highway 84 and Spring Street (Sample 4)

Sediment was sampled from a large grated vault on the southwest corner of the intersection of Highway 84 (westbound Woodside Expressway) and Spring Street (37° 29.044'N; 122° 13.005'W). The sediment collected was wet coarse sand and gravel with some fine silt and organic debris. The surface layer of sediment was collected with a Tefzel-coated spoon attached to a pole and placed directly into the sample jar.

3.0 SOUTH MAPLE PUMP STATION

Sediment was collected from four locations. One catch basin, a manhole, and a composite of a large grated vault and a manhole were sampled from the South Maple Pump Station sub-drainage area. In addition, a re-sampling of the South Maple Pump Station was performed.

3.1 SMC009 – South Maple Pump Station (Sample 1)

Sediment was sampled from the sump of the South Maple Pump Station (37° 38.655'N; 122° 24.999'W). This is the same SMC009 sampling location used during the Fall 2000 sampling. The sediment collected was wet black coarse sand with some silt and organic debris. A large component of the sediment looked like asphalt roofing material. A trace hydrogen sulfide odor was detected along with a trace oil and grease sheen. Sediment was collected with a stainless steel Ponar Grab and the surface layer was transferred into the sample jar using a Tefzel-coated spoon.

3.2 SMC039 – Catch Basin on South Maple Avenue (Sample 2)

Sediment was collected from the second catch basin north of the South Maple Avenue Pump Station on the west side of South Maple Avenue (37° 38.701'N; 122° 24.979'W). This sampling location is representative of flow coming from the north toward Victory Avenue as the catch basin drops straight into the storm drain line. The sediment collected was very like in appearance to that collected from the pump house. It was wet, black, coarse sand with some silt and had the same component that looked like asphalt roofing material. The surface layer of sediment was collected with a Tefzel-coated spoon attached to a pole and placed directly into the sample jar.

3.3 SMC040 – Large Grated Vault and Manhole East of South Maple Pump Station (Sample 3)

A composite sample of sediment was collected from a large grated vault and a manhole almost due west of the South Maple Pump Station (37° 38.661'N; 122° 25.032'W). The manhole was immediately south of the large grated vault. Access to this sampling location is made from Spruce Avenue. The sediment collected from the large grated vault resembled the roofing-like material observed at SMC009 and SMC039. The sediment was generally wet coarse sand but there was fine mud (silt) flowing in from the west. The sediment collected from the manhole was a combination of the roofing like

material and fine mud (silt) with an underlying layer of anoxic sediment. The surface layer of sediment was collected with a Tefzel-coated spoon attached to a pole. Approximately the same quantity of sediment was collected from each of the two sampling locations, composited in a Tefzel-coated bucket, and placed in the sample jar.

3.4 SMC041 – Manhole on South Maple Avenue (Sample 4)

Sediment was collected from a manhole almost due east of the South Maple Pump Station on the east side of South Maple Avenue (37° 38.646'N; 122° 24.992'W). The manhole was in the middle of a driveway and has a distinctive concentric circular ring pattern to it. This storm drain line flows to a slough to the east, eventually drains into Colma Creek and to San Francisco Bay. There is a side branch at this location that could possibly flow to the South Maple Pump Station when the water level is high. This overflow could result from a large storm flow or possibly the combination of storm flow and a flooding tide. The sediment collected was wet brown coarse sand with some fine material. The surface layer of sediment was collected with a Tefzel-coated spoon attached to a pole and placed directly into the sample jar.