
**Baltimore Inner Harbor
Environmental Media
Monitoring Plan
Quarterly Report No. 91
2nd Quarter 2012**

Prepared for

Honeywell

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Introduction

1.1 Purpose

This document represents the partial fulfillment of the Consent Decree entered into between Honeywell (formerly AlliedSignal, Inc.), the U.S. Environmental Protection Agency (EPA), and the Maryland Department of the Environment (MDE) on September 29, 1989. Specifically, this document satisfies Section V.3 of the Consent Decree, Exhibit 4 (RCRA Correction Action Plan Task XV.A.9.). This section requires that a progress report be submitted every calendar quarter during the life of the Consent Decree. This report provides the data required by the Environmental Media Monitoring Program, as set forth in the Environmental Media Monitoring Plan (EMMP) and the Surface Soil Monitoring Plan (SSMP), as submitted to MDE and EPA.

This particular report summarizes the data collected during the second quarter of 2012.

1.2 Scope of Work

The scope of work outlined in the EMMP covers sampling and analysis of environmental media before, during, and after dismantlement of the former plant, and the completion of the Corrective Measures Implementation activities at the Honeywell Baltimore Inner Harbor Site (Site). The environmental media sampled as part of the EMMP are air, surface water, groundwater, and sediment.

The scope of work outlined in the SSMP covers sampling and analysis of environmental media after completion of Corrective Measures Implementation activities at the Site. The only environmental medium sampled as part of the SSMP is the drainage layer effluent.

Media are sampled on varying frequencies as required by the EMMP and the SSMP (quarterly, twice annually, annually, and every 3 years). Only data for the media sampled during each quarter are reported in the associated quarterly report.

1.3 Sampling Conducted this Quarter

Surface water, groundwater, drainage layer, and sediment samples were collected during the second quarter of 2012. All data have been validated by Critigen and the validation reports and data for the various sampling events are provided in Appendix E. All data quality objectives were met for samples collected during the second quarter 2012.

1.4 Progress Report Organization

Progress reports prepared in accordance with the Consent Decree are organized by medium. Each of these media sections includes a summary of methodology, the current quarter's

sampling plan, and a summary of results. Also provided in each section is a discussion of the sampling event(s); explanations for any deviations from the EMMP or SSMP procedures; presentation of data summaries; and discussion of the data, quality control results, and pertinent data trends. Raw data and chain-of-custody records are provided as appendixes to these reports.

This progress report contains sections on surface water monitoring, groundwater monitoring, drainage layer monitoring, and sediment sampling, which were performed during the second quarter 2012. Appendixes are provided for surface water, groundwater, drainage layer, and sediment data.

Surface Water Monitoring

2.1 Methodology

The surface water monitoring program provides information about surface water quality around the perimeter of the Site, at 18 predetermined stations, and 2 stations upstream of the Site. Samples are collected at each station during each quarter and analyzed for total dissolved chromium.

Sampling is conducted within 1 hour of low tide and close to the predetermined sampling locations. The pH, temperature, specific conductance, and depth to the river bottom are measured before each sample is collected. A decontaminated Kemmerer sampler is used to collect the samples, which are placed in 500-milliliter plastic bottles. Two samples are collected – the first 1 foot below the water surface and the second 1 foot above the river bottom – at all locations except station 20, where the water depth may be at or below 1 foot. When this is the case, only one sample is collected at Station 20. A mid-depth sample is required from sampling locations where the depth is more than 10 feet. The lateral placement of each sample location is about 5 feet from the bulkhead/shoreline. Measurements and observations are recorded on sampling sheets by laboratory sampling personnel and are presented in Appendix A.

All surface water samples are placed on ice as soon as they are collected. Field duplicate samples, field blanks, and rinsate blanks are also collected. At the end of the sample round, the samples are filtered and preserved. The samples are then transferred to the laboratory using documented chain-of-custody procedures and a dedicated courier. The samples are analyzed for total dissolved chromium using EPA SW-846 Method 6010B.

The results received from the laboratory are entered into a database in which data for each month are tabulated. When duplicate samples for a given station are taken, the average of the concentrations is used for that station. The analytical results, chain-of-custody documentation, and field sampling reports are presented in Appendix A.

2.2 Current Quarter Results

Surface water monitoring for the second quarter of 2012 was performed at the Site on May 4, 2012. Results for the surface water samples collected by Maryland Environmental Services (MES) on March 19, 2012, are included in this report. Results of the analysis of the surface water samples collected on May 4, 2012, will be reported in the third quarter 2012 report. All samples were transported to Lancaster Laboratories in Lancaster, Pennsylvania, for total dissolved chromium analysis.

The locations of all surface water samples are presented in Figure 2-1. Summaries of the surface water data and average concentrations are presented in Table 2-1, including individual sample detection limits and validated data qualifiers.

Surface water samples were collected from all 20 sampling locations on March 19, 2012, and during the surface water sampling event on May 4, 2012.

2.3 Data Review

The surface water monitoring program is intended to provide information on surface water quality in the immediate vicinity of the waterside perimeter of the Site. This information is used to assess the performance of the corrective measures.

The Consent Decree, Section V, Part 12, establishes the Surface Water Performance Standard: “The surface water performance standard [...] for total chromium shall be 50 parts per billion (ppb), calculated for each sample location by arithmetically averaging the samples taken at all depths over 4 consecutive days.” In October 2002, the sample frequency was amended to be 1 day of sampling at each sampling location per quarter.

In addition, the EMMP states that Honeywell will review analytical data for results greater than 11 ppb of dissolved hexavalent chromium. The 11 ppb reporting level is based on the following:

- Code of Maryland Regulation 26.08.02.03-1B, which states that the numerical toxic substance criteria for freshwater shall be applied to the surface water near the Site
- National Recommended Water Quality Criteria Correction EPA 822-Z-99-001 (April 1999), which states the chronic exposure level for dissolved hexavalent chromium in freshwater is 11 ppb

Total dissolved chromium concentrations in surface water reported for the second quarter 2012 (first quarter 2012 results) are similar to the analytical values reported in the first quarter 2012 (fourth quarter 2011 results). The percentage of actual or average surface water results meeting specific criteria (performance standard, chronic freshwater exposure, and detection limit) is listed in Table 2-1. Results of analyses for total dissolved chromium from each sampling location and each depth are presented in Table 2-2. The average of the analytical results from each of the sampling locations is presented in Table 2-3.

Table 2-1**Percent of Average or Actual Surface Water Results Below Specific Criteria**

Sample Event	<u>Performance Standard</u> Actual Concentration < 50 ppb	<u>Fresh Water Chronic Exposure Level*</u> <u>Actual Concentration</u> <10 ppb	Analytical Detection Limit† Actual Concentration <10 ppb	Method Detection Limit† Actual Concentration <1.1 ppb
March	100%	100%	100%	76%

* Chronic exposure percentage includes estimated results below the Method Detection Limit and NonDetects

† The Analytical Detection Limit as determined by the Laboratory QC is ppb

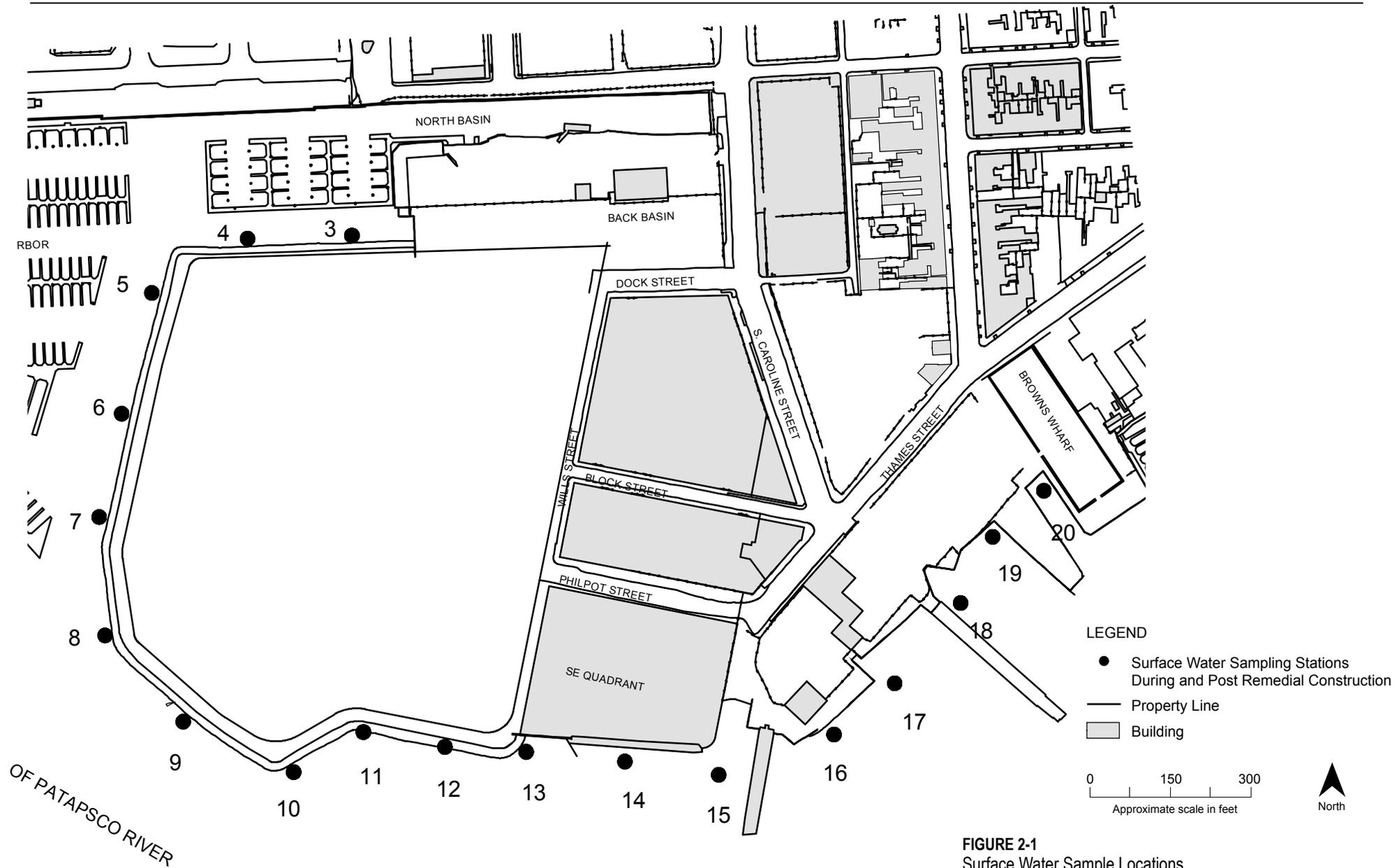


FIGURE 2-1
 Surface Water Sample Locations
 Environmental Media Monitoring

Table 2-2
Surface Water Sampling Data per Location
March 2012

Station Number	Detection Limit	Total Dissolved Chromium (mg/L)
		3/19/2012
3B	0.01	0.005 U
3T	0.01	0.005 U
4B	0.01	0.005 U
4T	0.01	0.005 U
5B	0.01	0.005 U *
5T	0.01	0.005 U *
6B	0.01	0.005 U
6T	0.01	0.005 U
7B	0.01	0.005 U
7T	0.01	0.005 U
8B	0.01	0.0012 J
8T	0.01	0.0012 J
9B	0.01	0.0014 J
9T	0.01	0.0011 J
10B	0.01	0.005 U
10T	0.01	0.005 U
11B	0.01	0.0012 J *
11T	0.01	0.005 U *
12B	0.01	0.0016 J
12T	0.01	0.0016 J
13B	0.01	0.0023 J
13T	0.01	0.0014 J
14B	0.01	0.0017 J
14T	0.01	0.0011 J
15B	0.01	0.005 U
15T	0.01	0.0014 J
16B	0.01	0.005 U
16M	0.01	0.005 U
16T	0.01	0.005 U
17B	0.01	0.005 U
17T	0.01	0.005 U
18B	0.01	0.0012 J
18M	0.01	0.005 U
18T	0.01	0.0011 J
19B	0.01	0.005 U
19T	0.01	0.005 U
20B	0.01	0.005 U
20T	0.01	0.005 U
Cent B	0.01	0.005 U
Cent T	0.01	0.005 U
LADY B	0.01	0.005 U
LADY T	0.01	0.005 U

NOTES

T - Sample collected 1 foot below the surface (TOP)

M - Sample collected from the measured middle of the TOP and BOTTOM measurements (MIDDLE)

B - Sample collected 1 foot from the bottom (BOTTOM)

* - Average of the sample and its Field Duplicate

J - Results was reported below the Dection Limit

Table 2-3
 Surface Water Sampling Data per Sampling Station
 March 2012

	Total Dissolved Chromium (mg/L)
Station Number	3/19/2012 Station Average of All Depths
3	0.005
4	0.005
5	0.005
6	0.005
7	0.005
8	< 0.0012
9	< 0.00125
10	0.005
11	0.004
12	< 0.0016
13	< 0.00185
14	< 0.0014
15	0.003
16	0.005
17	0.005
18	0.002
19	0.005
20	0.005
Cent	0.005
Lady	0.005

Groundwater Monitoring

3.1 Methodology

The Consent Decree required monthly groundwater monitoring for the first 2 years following completion of remedial construction at nine locations around the perimeter of the Site, and three locations (OP-2, OP-11, and NWM-27) in offsite areas. Four of the perimeter locations (SW-06, SW-11, SW-13, and SW-15) are monitored by collecting surface water samples within 1 foot of the bottom, as described in Section 2.1. The other five perimeter locations (OP-3, OP-4, OP-5, OP-7, and OP-9) are monitored by collecting groundwater samples from onsite piezometers. The three offsite locations are monitored by collecting one sample from a conventional monitoring well (NWM-27) and one sample each from two piezometers (OP-2 and OP-11). All monitoring locations are shown in Figure 3-1.

As of January 2002, and as described in Sections 1.2.3 and 5.2.3, the groundwater monitoring frequency was reduced from monthly to twice per year, which was approved by EPA and MDE.

Before the monitoring well and piezometers are purged and sampled, measurements of depth to water are recorded on a sampling summary sheet. All designated monitoring wells/piezometers are sampled in accordance with the low-flow sampling procedures detailed in the following documents:

- “Low-Flow (Minimal Drawdown) Groundwater Sampling Procedures” by Robert W. Puls and Michael J. Barcelona, April 1996, EPA/540/S-95/504
- EPA Region III Quality Assurance Directive, “Recommended Procedures for Low-Flow Purging and Sampling of Groundwater Monitoring Wells” (Bulletin No. QAD023, August 8, 1994)

During purging and before sample collection, field measurements, including conductivity, pH, temperature, oxidation reduction potential, dissolved oxygen, and turbidity, are measured until the well stabilizes. The sampling time is recorded. The collected samples are filtered, preserved, and placed on ice, then transferred to the laboratory according to chain-of-custody procedures. The samples are analyzed for total dissolved chromium by the laboratory using EPA SW-846 Method 6010B. Two of the samples (OP-3 and OP-2) are also analyzed for total dissolved cyanide using EPA SW-846 Method 9014. Field blanks, temperature blanks, and rinsate blanks are also collected and analyzed for the same parameters.

Results received from the laboratory are entered into a database. Data for each month, quarter, and year are tabulated, averaged, and compared to previous results.

3.2 Current Quarter Results

Groundwater samples were taken on April 11, 2012. MES performed all sample collection and Lancaster Laboratories performed the sample analysis.

3.2.1 Chromium

Total dissolved chromium was detected in all of the groundwater samples collected from piezometers and monitoring wells. There was no significant difference in chromium concentrations between the second quarter 2012 monitoring data and the total dissolved chromium concentrations detected at each respective sampling station during monitoring performed over the last 5 years, with the exception of the results for location OP-4, which was lower than previously reported concentrations. The analytical data report is attached as Appendix B-3.

All bottom surface water samples collected along the Site perimeter from locations proximal to historical groundwater sampling well locations, as described in Section 3.1, had total dissolved chromium levels below the analytical method detection limit.

3.2.2 Cyanide

Total dissolved cyanide concentrations were within expected variations, based on a review of the historical concentrations. The analytical data report is provided in Appendix B-3.

3.3 Historical Results

3.3.1 Chromium

The second quarter 2012 results from groundwater sampling, averaged to represent two sampling events per year for data comparison for each groundwater monitoring location, are presented in Table 3-1. A statistical review of the analytical data, including the minimum, maximum, average, and standard deviations values for each well location, are presented in Table 3-2. Validated analytical groundwater monitoring results with data qualifiers from the second quarter 2012, including annual averages for data collected during the last 5 years, are presented in Table 3-3.

The historical total dissolved chromium concentrations in groundwater for each monitoring location are shown in Figure 3-2. Trends for total dissolved chromium concentrations for each groundwater monitoring location are depicted in Figures 3-3 through 3-10. The historical data in these figures were averaged to allow current data to be compared to past sample rounds. Current groundwater results are in line with the trends anticipated from the past sample analysis concentration.

3.3.2 Cyanide

Groundwater samples were collected from two locations (OP-2 and OP-3) for cyanide analysis. The historical trend of cyanide levels is presented in Table 3-4. The concentrations of cyanide detected in samples collected from each location are presented in Figures 3-11 and 3-12 respectively.

Table 3-1
Total Dissolved Chromium Concentrations in Groundwater (mg/l+)

Monitoring Wells	Elevation (ft) Top of Well Screen	Current Results mg/l	Sample Detection Limit mg/l	Sample Event Dates							
				Apr, 2012	Oct, 2011	Jun, 2011	Apr, 2010	Oct, 2009	Apr, 2009	Oct, 2008	Apr, 2008
<u>Outboard Piezometers</u>		Apr, 2012		Apr, 2012	Oct, 2011	Jun, 2011	Apr, 2010	Oct, 2009	Apr, 2009	Oct, 2008	Apr, 2008
11B		0.0011	0.01	0.0011	0.001	0.0034	0.003	0.003	0.003	0.003	0.0023
13B		0.0023	0.01	0.0023	0.001	0.0034	0.003	0.003	0.003	0.003	0.0023
15B		0.0011	0.01	0.0011	0.001	0.0034	0.003	0.0034	0.003	0.003	
6B		0.0011	0.01	0.0011	0.001	0.0034	0.003	0.004	0.003	0.003	0.003
NWM-27	32.68	2310	2	2150	2310	1910	1840	1950	2240	174	2130
OP11	44.47	0.210	0.01	0.507	0.210	0.390	0.470	0.201	0.368	0.192	0.483
OP2	64.31	5.82	0.01	5.20	5.82	5.79	6.31	6.36	6.05	7.12	5.77
OP3	68.53	142	0.2	126	142	144	146	153	165	6	189
OP4	69.14	457	0.01	17	457	504	503	533	548	616	601
OP5	60.7	2.84	0.01	1.89	2.84	4.61	5.03	6.52	5.36	7.72	7.660
OP7	55.42	0.010	0.01	0.012	0.010	0.005	0.006	0.005	0.003	0.004	0.005
OP9	47.13	2110	2	1950	2110	2200	2040	2150	2070	5020	4800

<u>Outboard Piezometers</u>	Oct, 2007	Apr, 2007	Oct, 2006	Apr, 2006	Oct, 2005	Apr, 2005	Oct, 2004	Apr, 2004	Oct, 2003	Apr, 2003	Oct, 2002
11B	0.002	0.015	0.015	0.015	0.015	0.015	0.005	0.010	0.005	0.005	0.005
13B	0.002	0.015	0.015	0.015	0.015	0.015	0.005	0.010	0.005	0.005	0.005
15B	0.002	0.015	0.015	0.015	0.015	0.015			0.005	0.005	0.005
6B	0.004	0.015	0.015	0.015	0.015	0.015	0.005	0.010	0.005	0.005	0.005
NWM-27	699	1690	710	1540	1010	874	744	422	603	603	550
OP11	0.033	0.122	0.015	0.235	0.182	0.026	0.017	0.080	0.005	0.005	0.017
OP2	7.34	6.33	6.39	6.20	6.32	6.08	5.98	5.75	6.16	6.00	5.63
OP3	166	202	199	219	286	288	297	309	342	342	378
OP4	526	684	584	812	1020	1100	1150	1260	1290	1210	1620
OP5	8.050	7.80	.8	.3	8.7	11.5	11.9	11.9	13.3	15.4	16.9
OP7	0.002	0.015	0.015	0.015	0.015	0.005	0.005	0.010	0.004	0.006	0.005
OP9	3020	3170	3050	2790	2810	2680	2780	2510	2480	2510	2410

**Table 3-1
Total Dissolved Chromium Concentrations in Groundwater (mg/l+)**

<u>Outboard Piezometers</u>	Apr, 2002	Jan, 2002	Dec, 2001	Nov, 2001	Oct, 2001	Sep, 2001	Aug, 2001	Jul, 2001	Jun, 2001	May, 2001	Apr, 2001
11B	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.010	0.010	0.010
13B	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.010	0.010	0.010
15B	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.008	0.010	0.010	0.010
6B	0.008	0.009	0.008	0.008	0.008	0.008	0.008	0.008	0.010	0.010	0.010
NWM-27	930	1100	690	1300	830	1000	1500	1300	1600	1700	1300
OP11	0.009	0.029	0.033	0.026	0.032	0.049	0.034	0.032	0.042	0.031	0.010
OP2	4.90	5.50	5.60	4.90	6.20	6.50	5.80	4.80	5.80	6.00	5.75
OP3	440	440	440	480	570	420	410	450	420	430	460
OP4	1800	1400	1700	2000	1700	1800	1800	1800	1900	1800	1900
OP5	21.0	19.5	18.5	20.0	20.5	21.0	17.5	23.5	23.0	23.0	24.0
OP7	0.008	0.008	0.008	0.008	0.012	0.008	0.008	0.008	0.010	0.010	0.010
OP9	2500	2200	2500	2650	2500	2600	2400	2500	2500	2400	2400

<u>Outboard Piezometers</u>	Mar, 2001	Feb, 2001	Jan, 2001	Dec, 2000	Nov, 2000	Oct, 2000	Sep, 2000	Aug, 2000	Jul, 2000	Jun, 2000	May, 2000
11B	0.011	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
13B	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
15B	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
6B	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010	0.010
NWM-27	1500	1600	1600	1600	1700	1700	1800	1700	1600	1700	1700
OP11	0.050	0.014	0.012	0.015	0.022	0.011	0.010	0.011	0.010	0.010	0.010
OP2	4.90	6.20	6.10	6.00	5.90	6.10	5.85	5.90	3.15	3.60	3.70
OP3	470	450	470	480	500	490	500	510	530	540	580
OP4	1900	2000	2000	2100	2100	2400	2250	2400	2400	2400	2800
OP5	25.0	25.5	26.0	25.0	26.0	28.0	25.0	24.0	18.0	34.0	27.0
OP7	0.010	0.010	0.010	0.010	0.010	0.010	0.013	0.010	0.012	0.041	0.050
OP9	2400	2300	2600	2500	2400	2700	2500	2500	2400	2400	2800

Table 3-1
Total Dissolved Chromium Concentrations in Groundwater (mg/l+)

Outboard Piezometers	Apr, 2000	Mar, 2000	Feb, 2000	Dec, 1999	Aug, 1999	May, 1999	Mar, 1999	Dec, 1998	Sep, 1998	Jun, 1998	Mar, 1998
11B	0.01	0.01	0.002								
13B	0.010125	0.0105	0.002								
15B	0.01	0.01	0.002								
6B	0.01	0.01	0.002								
NWM-27	1800	3600	2600	1800	2300	1900	1400	1000			610
OP11	0.01	0.004	0.047	0.020	0.010	0.010	0.030	.01	2.7		
OP2	5.4	8	4.40	7.30	6.50	1.80	2.40	2.80	4.6		
OP3	570	1045	630	670	800	670	690	750	780	890	2200
OP4	2500	3300	2300	2900	3800	2900	2000	3000	1900	2000	2500
OP5	33	47	44.0	42.0	31.0	59.0	45.0	58.0	65.0	70	130
OP7	0.051	0.002	0.002	0.020	0.010	0.010	.06	1.60	8.600	0.300	0.020
OP9	2500	4500	2400	3200	2200	1800	3200	2200	2300	2800	3600

Outboard Piezometers	Dec, 1997
11B	
13B	
15B	
6B	
NWM-27	
OP11	
OP2	
OP3	2400
OP4	3700
OP5	150
OP7	0.02
OP9	

Table 3-2
Current and Annual Total Dissolved Chromium Concentrations in Groundwater (mg/l)

Monitoring Wells	Elevation (ft) Top of Well Screen	Current Results ppm	Sample Detection Limit ppm	Last Sample Round Results ppm	Average					Notes
					2012	2011	2010	2009	2008	
<u>Outboard Piezometers</u>										
OP-3	-53.5	126	0.200	141	126	139	145	160	97	4
OP-4	-57.1	16.6	0.010	457	16.6	457	504	548	614	4
OP-5	-51.3	1.89	0.010	2.84	1.89	3.10	4.82	5.94	7.69	4
OP-7	-47.6	0.0118	0.010	0.0098	0.0118	0.0103	ND	ND	ND	4
OP-9	-37.8	1950	2.000	2110	1950	2045	2120	2110	4910	4
<u>Deep Surface Water</u>										
SW-06	NA	0.0011	0.010	0.0011	ND	ND	ND	ND	ND	4
SW-11	NA	0.0013	0.010	0.0011	ND	ND	ND	ND	ND	4
SW-13	NA	0.0023	0.010	0.0011	ND	ND	ND	ND	ND	4
SW-15	NA	0.0011	0.010	0.00125	ND	ND	ND	ND	ERROR	4
<u>Offsite Wells</u>										
OP-2	-48.0	5.2	0.010	5.82	5.20	5.81	6.11	6.21	6.45	4
OP-11	-35.5	0.507	0.010	0.21	0.507	0.381	0.442	0.285	0.338	4
NWM-27	-24.7	2150	2.000	2310	2150	2270	1875	2095	1152	4

NA - Not Applicable

ND - Not Detected

ERROR - Numerical data not reported for some portion of the referenced time period

U - Not detected validated results

B - Indicates that the calibration blank had some carryover contamination from these sample

* - Average of the sample and its duplicate

1 - Consists of averages of monthly data

2 - Consists of averages of quarterly data

3 - Consists of twice annual data (single data point)

4 - Average consists of all available data

Table 3-3 - Groundwater Trend Analysis ⁽¹⁾

Wells	Sample Dates	Data Points	Minimum	Maximum	Average	Standard Deviation	Current Quarter Concentrations
<u>Outboard Piezometers</u>							
OP-3	December,31 1980 to June,30 2012	61	6	2400	489	406	126
OP-4	December,31 1980 to June,30 2012	59	17	3800	1689	872	17
OP-5	December,31 1980 to June,30 2012	71	0.27	150	24	24.82	1.89
OP-7	December,31 1980 to June,30 2012	56	0.002	9	0.201	1.163	0.012
OP-9	December,31 1980 to June,30 2012	56	1800	5020	2639	613	1950
<u>Offsite Wells</u>							
OP-2	December,31 1980 to June,30 2012	63	1.80	8.00	5.57	1.19	5.20
OP-11	December,31 1980 to June,30 2012	54	0.004	2.700	0.150	0.386	0.507
NWM-27	December,31 1980 to June,30 2012	51	174	3600	1467	647	2150

1 - Trend analysis based on Sample Event Results stored in central electronic database.

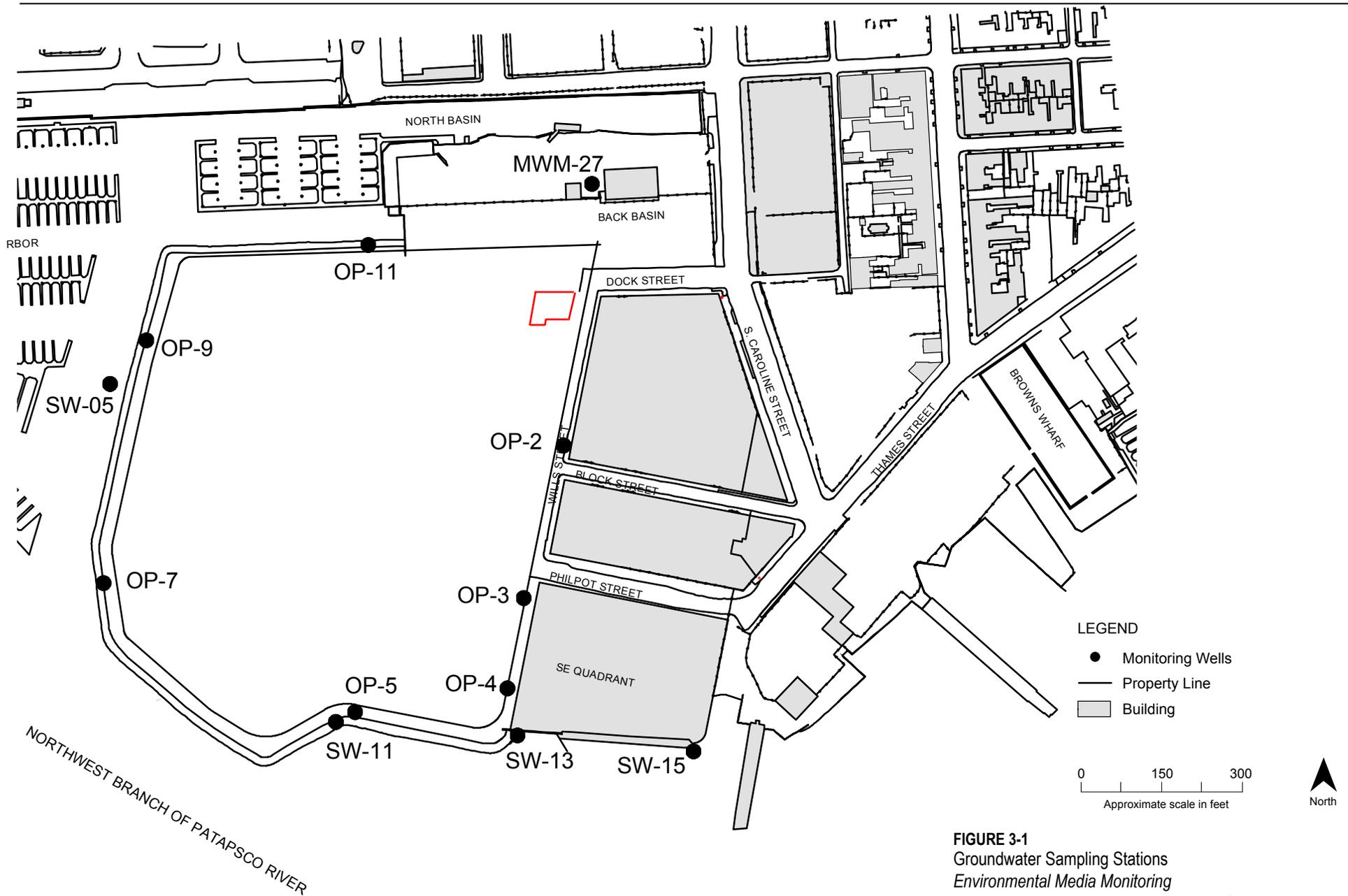


FIGURE 3-1
 Groundwater Sampling Stations
 Environmental Media Monitoring

Figure 3-2
Historical Total Dissolved Chromium Concentrations in Groundwater

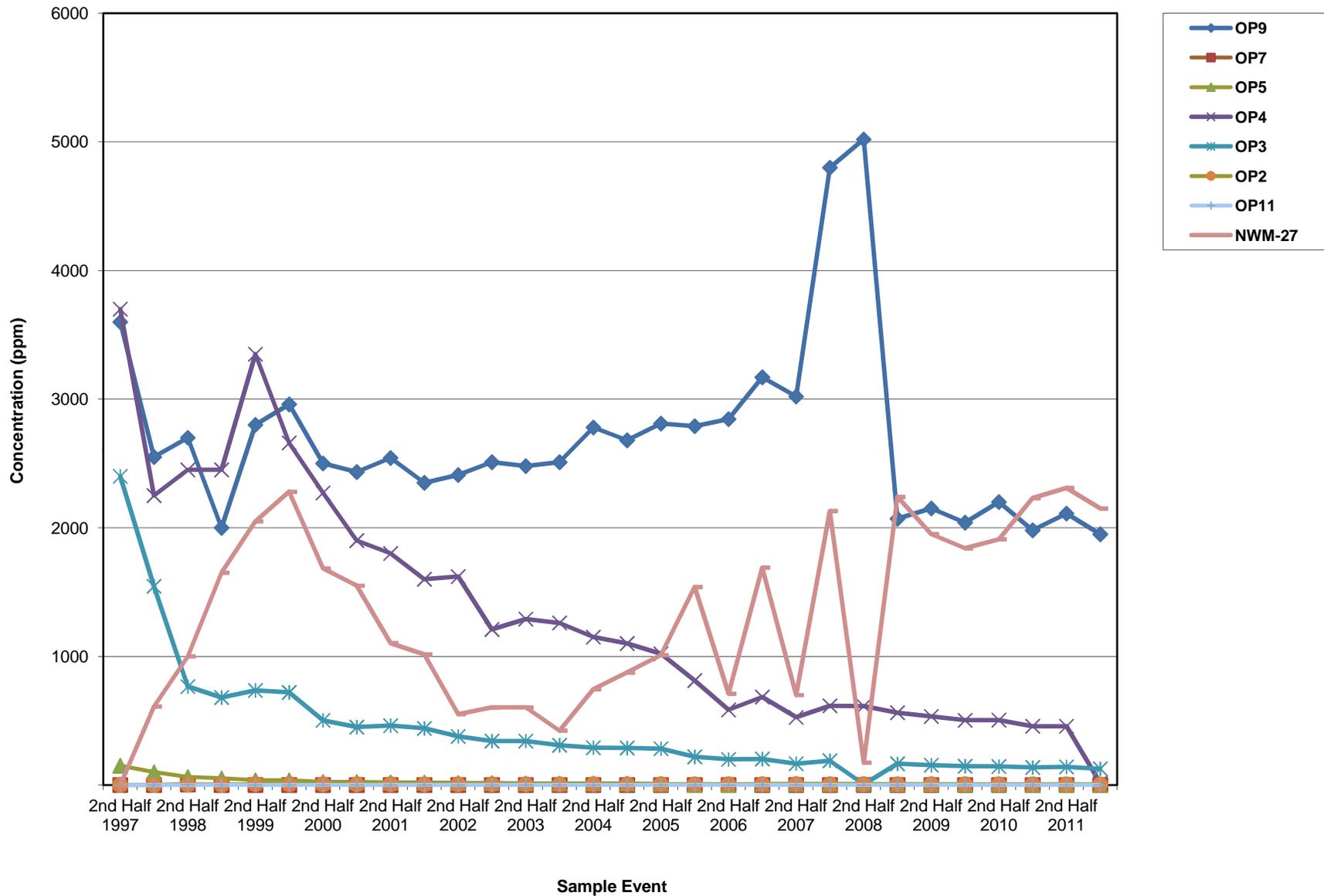


Figure 3-3
Total Dissolved Chromium Concentrations in Groundwater for OP- 3

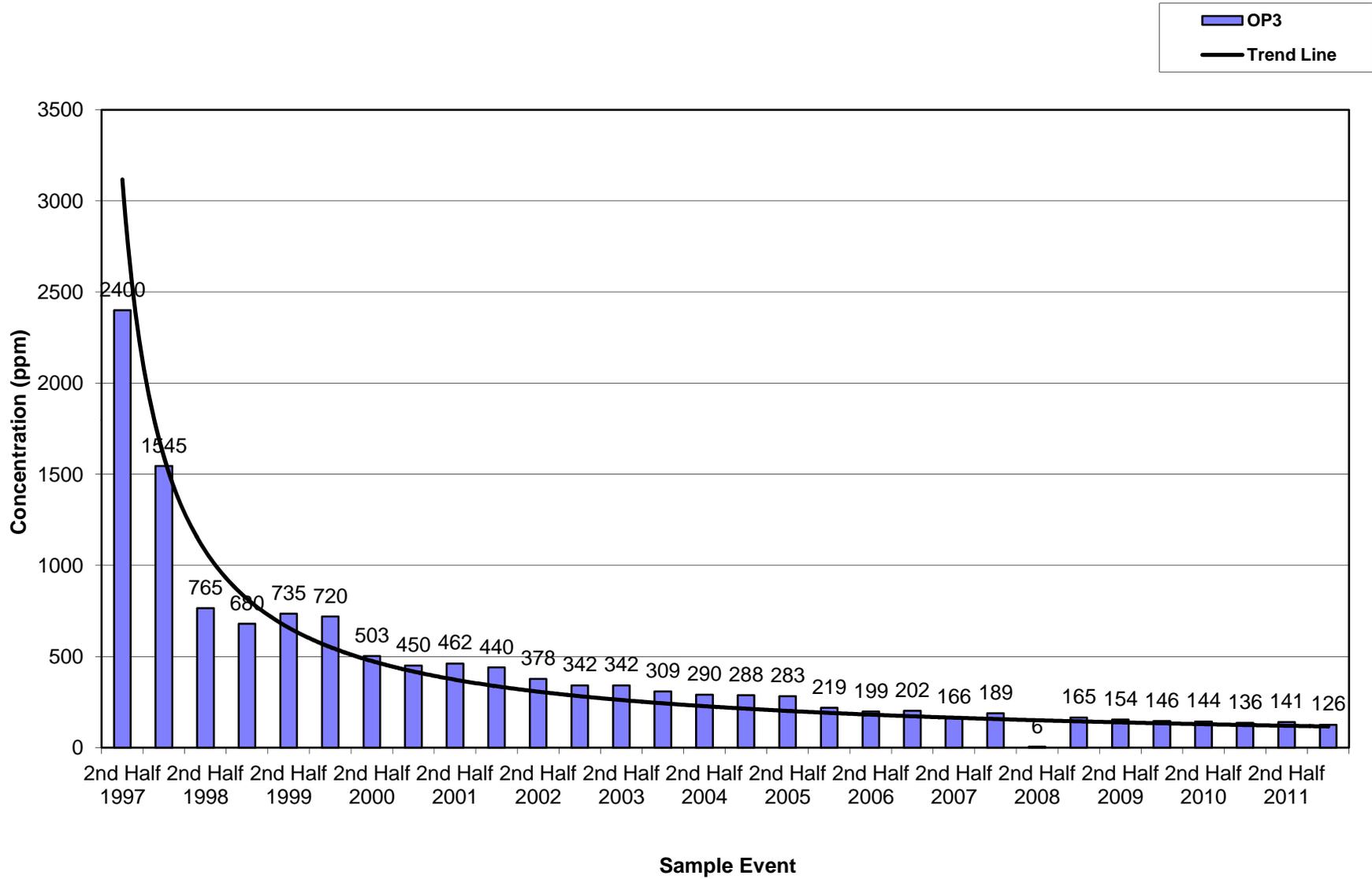


Figure 3-4
Total Dissolved Chromium Concentrations in Groundwater for OP-4

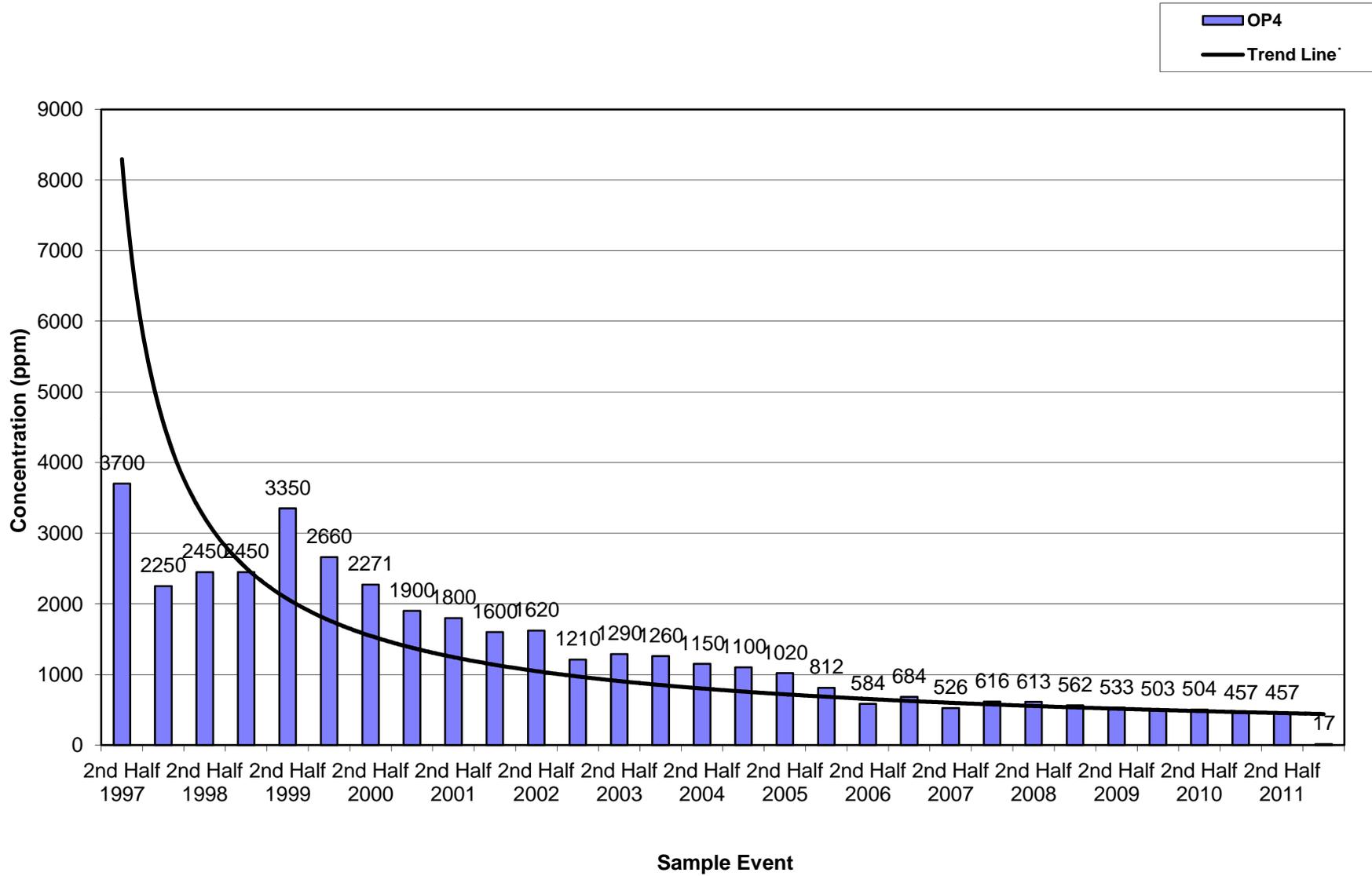


Figure 3-5
Total Dissolved Chromium Concentrations in Groundwater for OP-5

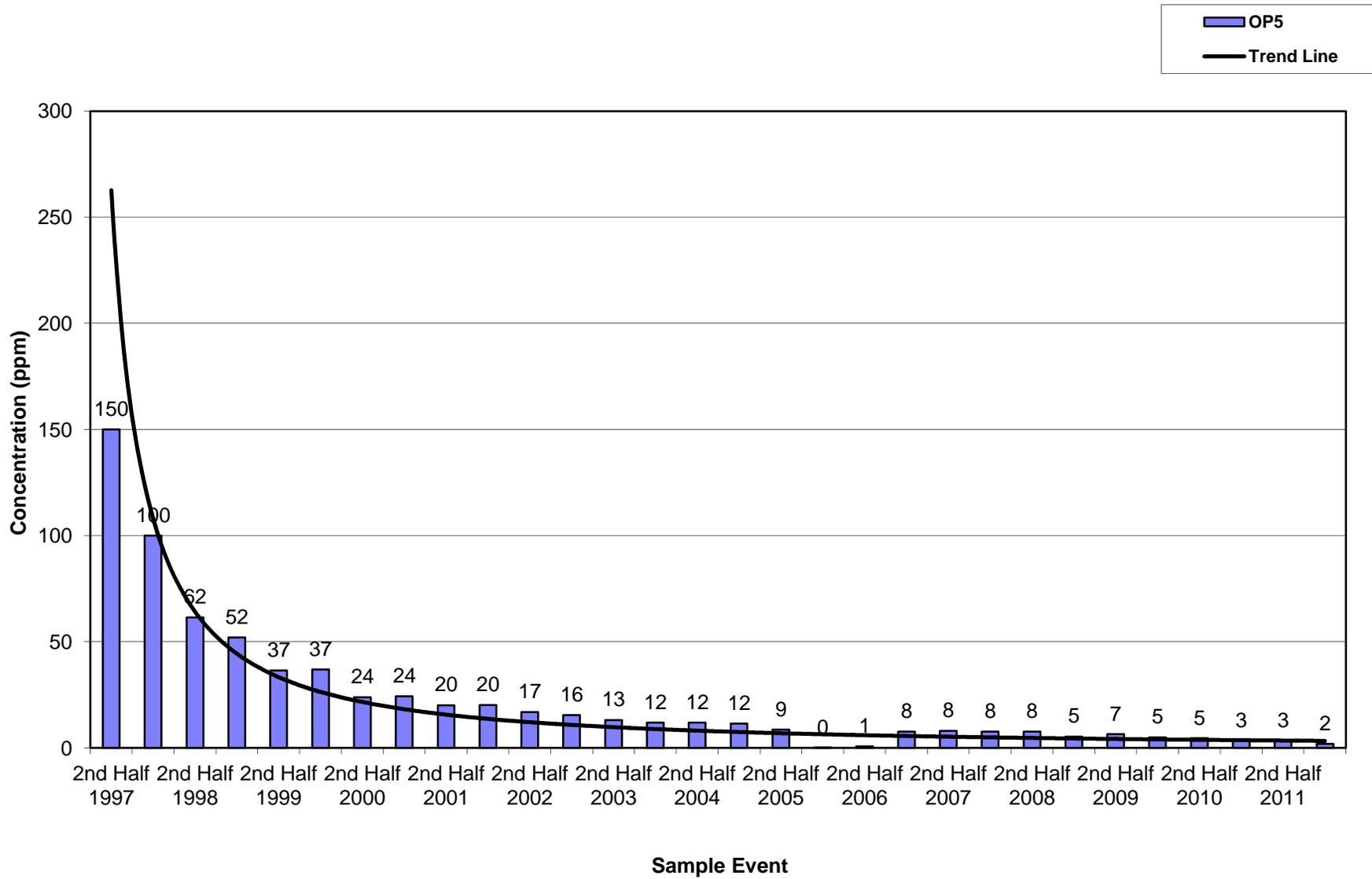


Figure 3-6
Total Dissolved Chromium Concentrations in Groundwater for OP-7

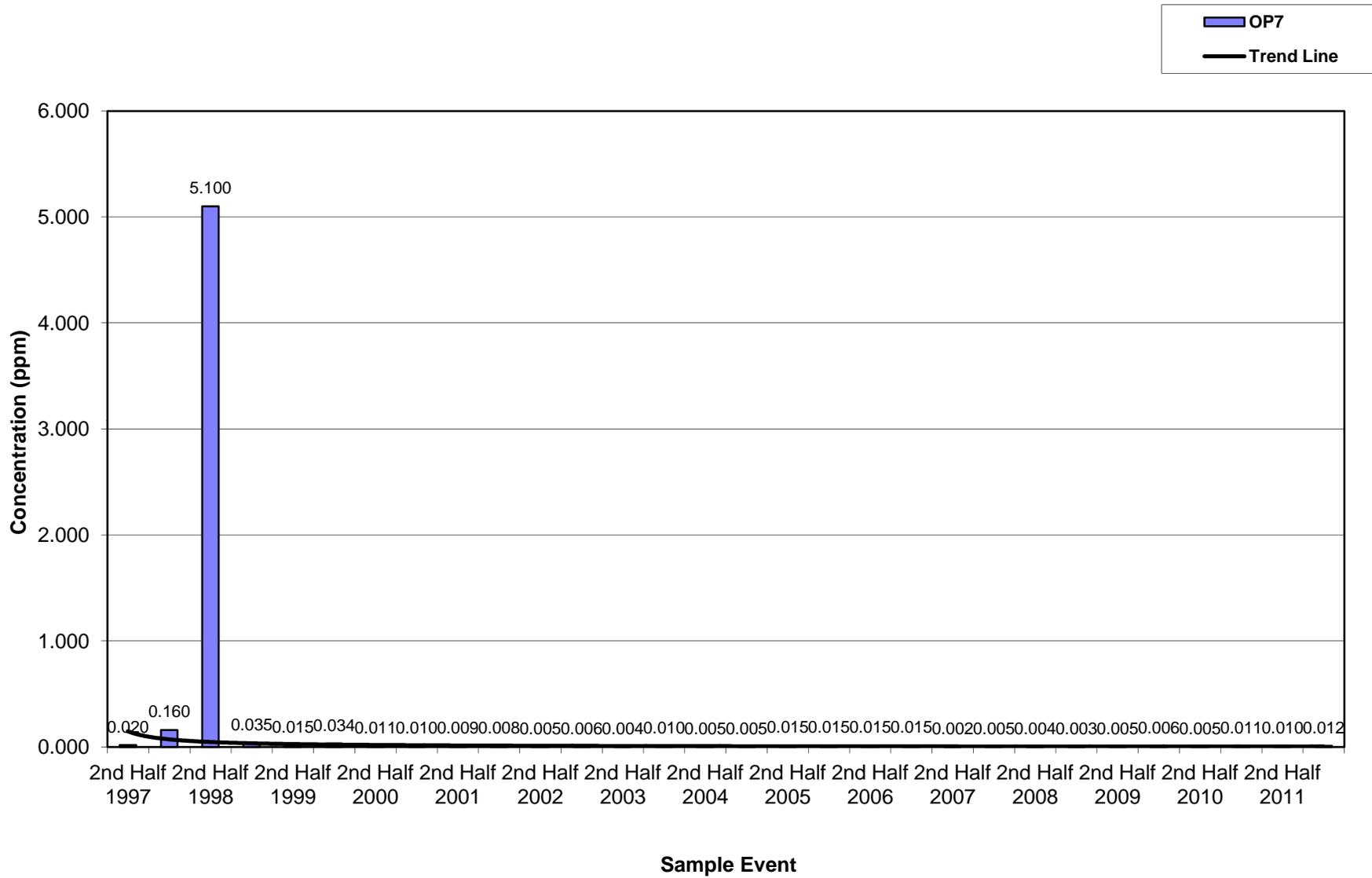


Figure 3-7
Total Dissolved Chromium Concentrations in Groundwater for OP-9

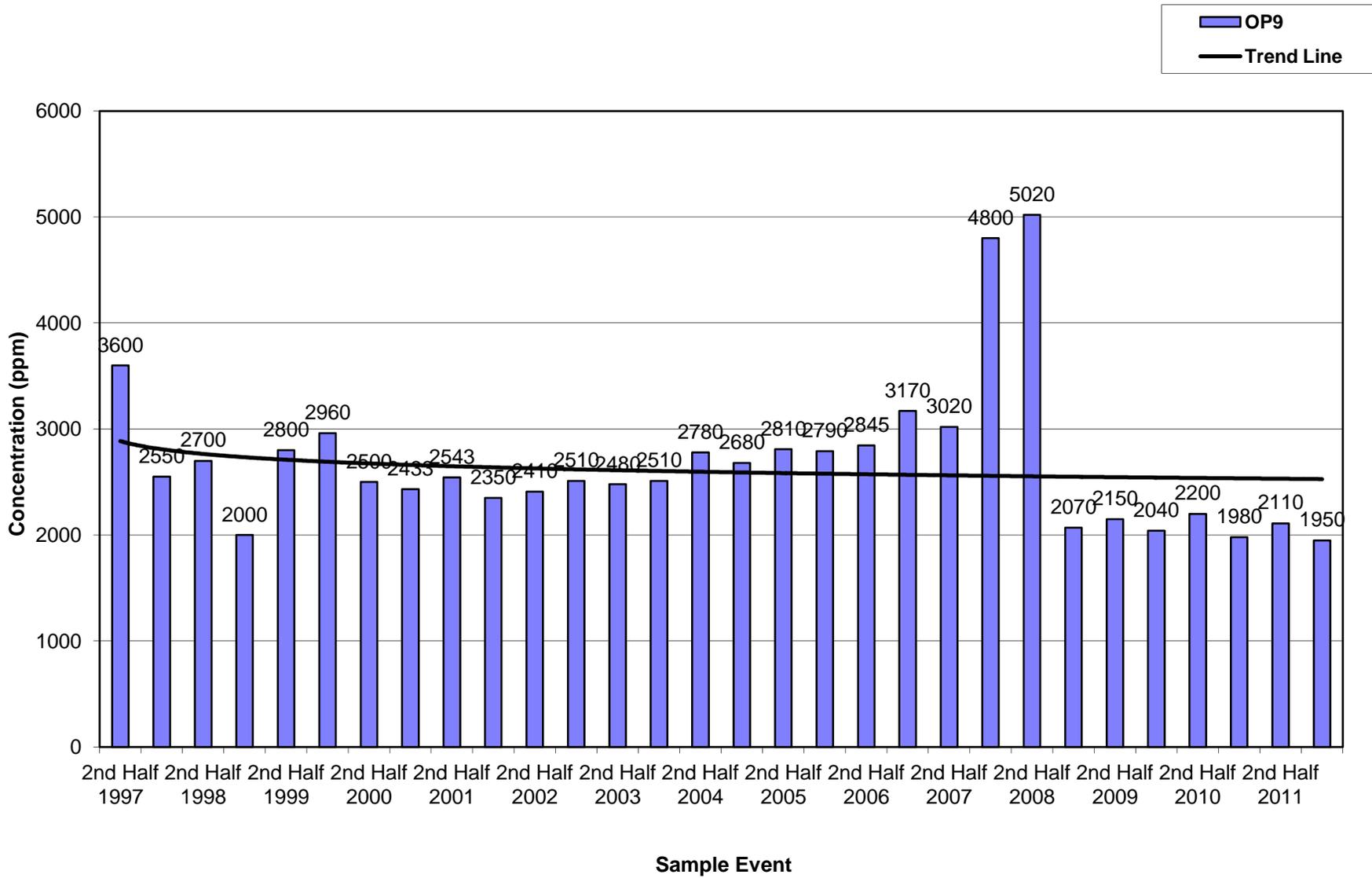


Figure 3-8
Total Dissolved Chromium Concentrations in Groundwater for OP- 2

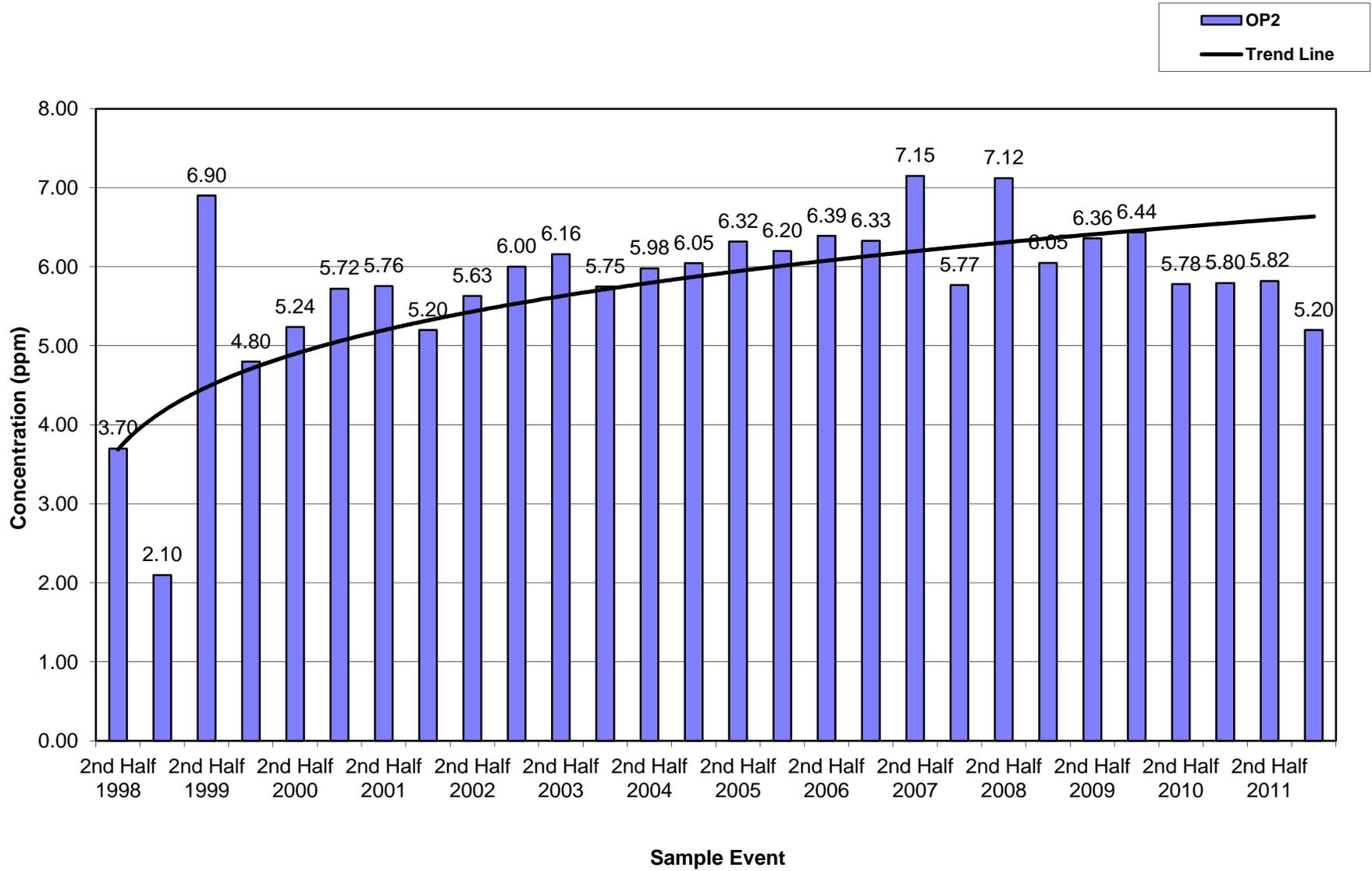


Figure 3-9
Total Dissolved Chromium Concentrations in Groundwater for OP-11

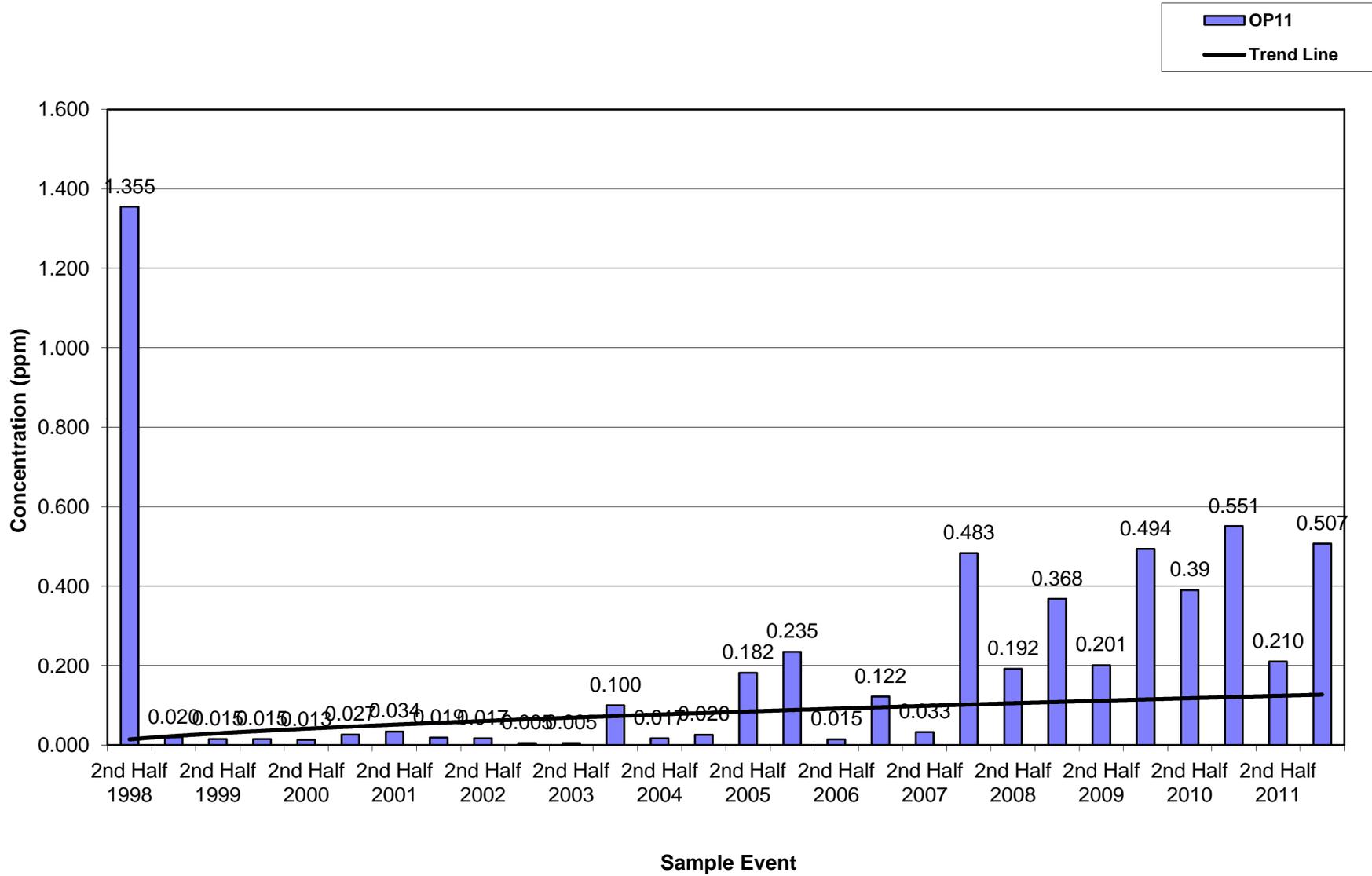


Figure 3-10
Total Dissolved Chromium Concentrations in Groundwater for NWM-27

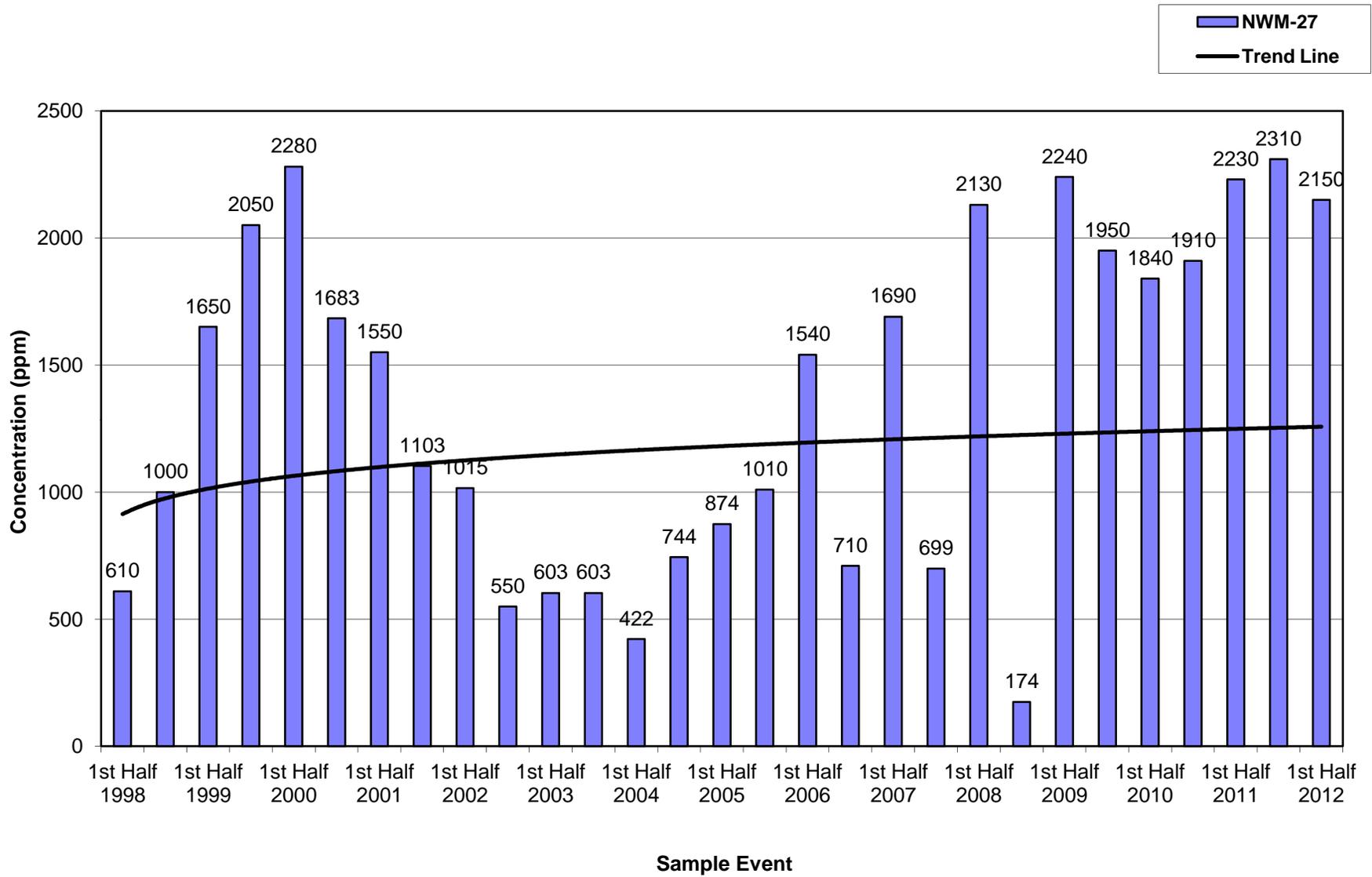


Table 3-4
Current and Annual Total Dissolved Cyanide Concentrations in Groundwater (ug/l)

Monitoring Wells	Elevation (ft) Top of Well Screen	Current Results ug/l	Sample Detection Limit ug/l	Sample Event Dates							
				Oct, 2011	Jun, 2011	Sep, 2010	Apr, 2010	Oct, 2009	Apr, 2009	Oct, 2008	Apr, 2008
<u>Outboard Piezometers</u>		Apr, 2012									
OP2	64.31	5.00	10	5.00	5.0	11.0	23.00	5.00	5.00	5.00	5.00
OP3	68.53	9.5	10	13.0	13.0	24.00	5.0	18.0	19.0	12.0	25.00

<u>Outboard Piezometers</u>	Oct, 2007	Apr, 2007	Oct, 2006	Apr, 2006	Oct, 2005	Apr, 2005	Oct, 2004	Apr, 2004	Oct, 2003	Apr, 2003	Oct, 2002
OP2	5.0	10.0	10.0	10.0	10.0	10.0	10.0	10.00	5.00	5.00	5.0
OP3	9.5	26.0	22.0	10.0	35.0	17.0	34.0	20.0	30.0	36.0	40.4

<u>Outboard Piezometers</u>	Apr, 2002	Jan, 2002	Nov, 2001	Aug, 2001	May, 2001	Feb, 2001	Nov, 2000	Aug, 2000	May, 2000	Feb, 2000	Dec, 1999
OP2	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0	10.00	5.00
OP3	24.0	15.0	47.0	42.0	18.0	37.0	10.0	41.0	53	110	110.0

<u>Outboard Piezometers</u>	Aug, 1999	May, 1999	Mar, 1999	Dec, 1998	Dec, 1998	Sep, 1998	Jun, 1998	Mar, 1998
OP2	5.00	5.00	5.00	5.00	5.00			
OP3	37.0	69.0	55.0	29.0	29.0	9.00	14.0	1.00

Figure 3-11
Total Dissolved Cyanide Concentrations in Groundwater OP-2

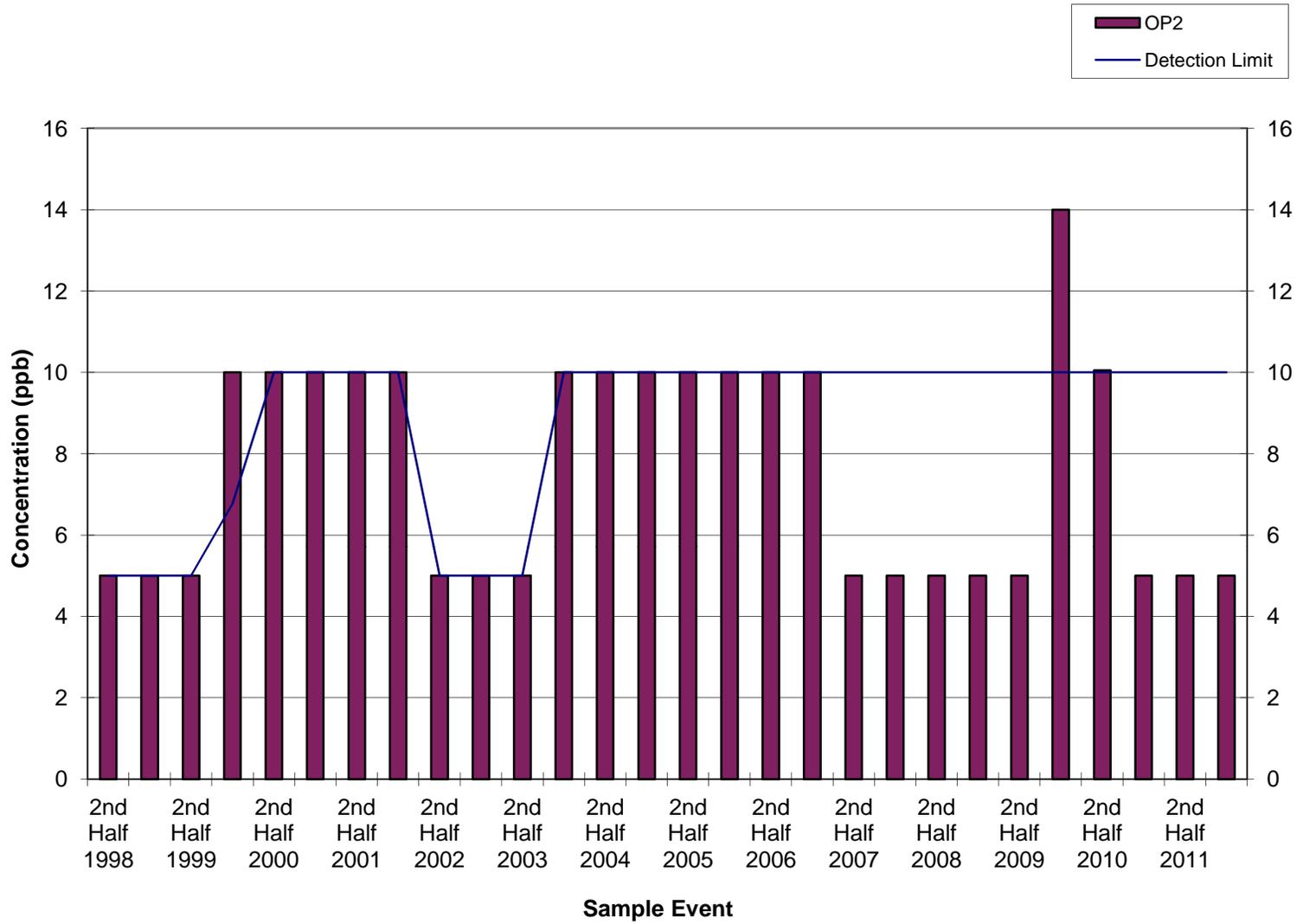
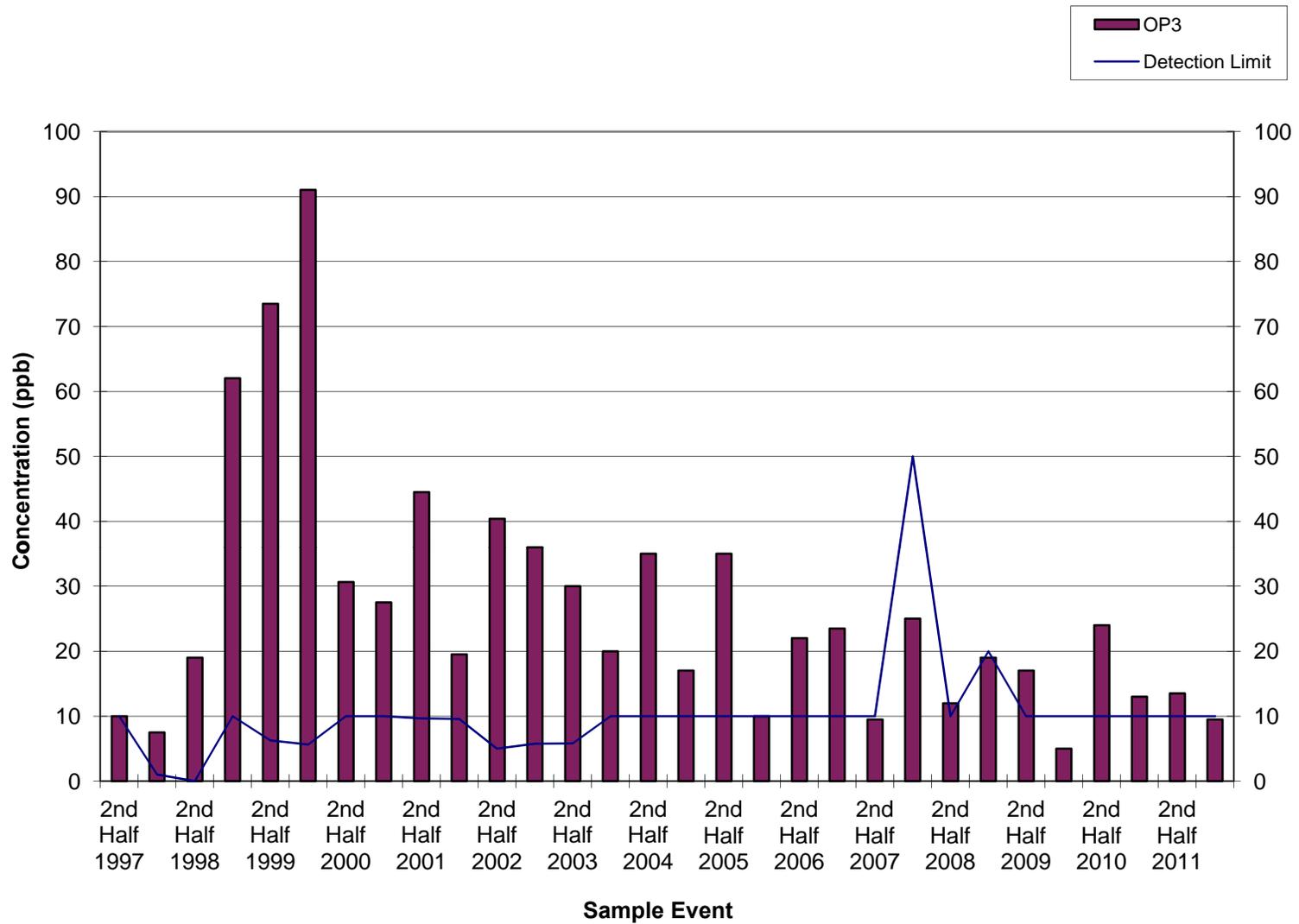


Figure 3-12
Total Dissolved Cyanide Concentrations in Groundwater for OP-3



Drainage Layer Monitoring

4.1 Methodology

Section V, Paragraph 7(a) of the Consent Decree requires the promulgation of an SSMP to establish requirements to monitor the performance of the remedial action. Annual sampling of water passing through the drainage layer and infiltration trench is one of the methods used to evaluate this performance. Four perimeter locations, depicted in Figure 4-1, are sampled for total chromium, filtered total chromium, and total cyanide. Additionally, the depth to water in each sampling location is checked monthly to gauge the flow of water, if any, from the drainage layer into the sample point. Two of the sample points (SSSP1 and SSSP4) are located at the end of a perforated pipe running within a toe drain for the landward perimeter of the Site. The other two points are located within an infiltration trench running along the harbor perimeter of the Site.

Before sample collection begins, a volume of water is analyzed for temperature, dissolved oxygen, specific conductance, and redox potential. Three sample volumes are then withdrawn from the sample point with a peristaltic pump, using dedicated tubing. The sampling time is recorded. Once the samples are collected, the appropriate samples are filtered; then all of the samples are preserved, placed on ice, and transferred to the laboratory using documented chain-of-custody procedures. The samples are analyzed for total chromium and total dissolved chromium by the laboratory using EPA SW-846 Method 6010B, or for total dissolved cyanide using EPA SW-846 Method 9014, whichever method is stated on the chain-of-custody form for that particular sample. Field blanks, temperature blanks, and rinsate blanks are also collected.

MES performs all sampling. Lancaster Laboratories performs all analysis. Results received from the laboratory are entered into a database.

4.2 Current Quarter Results

Drainage layer samples were taken on April 26, 2012. The results from all sampled locations were below established baseline levels. Water elevations from each sample point, as well as the tidal elevation when the water elevation was taken, and monthly rainfall totals are presented in Figure 4-2.

Drainage layer sample results are presented in Appendix C.

4.2.1 Chromium

The total chromium results for the current sample round, as well as historical results, are shown in Tables 4-1 through 4-4. All total chromium results were below the sample detection limit, but concentrations above the method detection limit were reported. All results were at or below the baseline results; however, the results for SSMP4 were slightly

higher than baseline results that were reported at the detection limit for analysis at that time.

4.2.2 Dissolved Chromium

The total dissolved chromium results for the current sample round, as well as historical results, are shown in Tables 4-1 through 4-4. All dissolved chromium results were below the sample detection limit, but concentrations above the method detection limit were reported. All results were at or below the baseline results; however, the results for SSMP4 were slightly higher than baseline results that were reported at the detection limit for analysis at that time.

4.2.3 Cyanide

The total dissolved cyanide results, as well as historical results, for the sample points are shown in Tables 4-1 through 4-4. The total dissolved cyanide results were below the sample detection limit and were at or below the baseline results.

4.3 Trend Analysis

All results were at or below the sample detection limits, but above the method detection limits for all drainage layer samples taken to date. All parameters are in line with baseline results; however, the results for the dissolved chromium sample taken from location SSMP4 are higher than the results reported since the 2006 results, which were below the sample detection limit at that time. Current and historical sample results are provided in Tables 4-1 through 4-4.

Table 4-1
 Drainage Layer Sampling Data SSMP1
 Second Quarter 2012

Year	CR	CR (Filtered)	Cyanide	Spec. Cond.	pH	Temp.	D.O.	ORP
2012	0.0046	0.0029	10	0.795	5.68	14.58	6.13	260
2011	0.0079	0.0034	5	0.901	6.62	19.7	0.37	9
2010	0.0061	0.0034	5	-	-	-	-	-
2009	0.0032	0.0095	5	0.704	-	13.5	8.95	-
2008	0.0289	0.0023	5	-	-	20	6.43	-
2007	0.0793	0.015	10	-	-	17.38	0	-
2006	0.0103	0.015	10	0.661	6.39	19.1	7.98	-
2005	0.0053	0.015	10	795	6.64	16.4	-	-
2004	0.01	0.01	10	1448	6.7	22.6	4.9	-
2003	0.0121	0.006	5	568	7.64	15.1	3.15	-
2002	0.008	0.008	10	0.63	7.16	11.1	9.26	-
2001	0.01	0.01	10	3.3	6.5	8.8	-	-
2000	0.011	0.01	10	-	-	-	-	-

Table 4-2
 Drainage Layer Sampling Data SSMP2
 Second Quarter 2012

Year	CR	CR (Filtered)	Cyanide	Spec. Cond.	pH	Temp.	D.O.	ORP
2012	0.0028	0.0014	1	2.54	6.59	14.22	5.07	200
2011	0.0034	0.0034	5	2.01	6.5	20.1	0.88	34
2010	-	-	-	-	-	-	-	-
2009	-	-	-	-	-	-	-	-
2008	-	-	-	-	-	-	-	-
2007	0.116	0.015	10	-	-	-	-	-
2006	0.015	0.015	10	20.1	2.59	19.4	7.84	-
2005	0.015	0.015	10	11360	7.27	18.3	-	-
2004	0.01	0.01	10	123.5	6.99	23.5	3.37	-
2003	0.005	0.005	5	360.8	7.92	15	5.16	-
2002	0.008	0.008	10	0.246	7.14	8.3	10.65	-
2001	0.01	0.01	10	66.4	7.23	6.7	-	-
2000	0.01	0.01	10	-	-	-	-	-

Table 4-3
 Drainage Layer Sampling Data SSMP3
 Second Quarter 2012

Year	CR	CR (Filtered)	Cyanide	Spec. Cond.	pH	Temp.	D.O.	ORP
2012	0.0016	0.0019	10	13.8	7.14	14.79	8.82	167
2011	0.0034	0.0034	5	2.696	6.89	19.8	0.75	12
2010	0.0034	0.0034	5	-	-	-	-	-
2009	0.003	0.003	5	31.9	-	13.8	9.88	-
2008	0.0023	0.0023	5	-	-	19.1	3.26	-
2007	0.015	0.015	10	-	-	20.89	0	-
2006	0.015	0.015	10	12.9	6.71	20	4.11	-
2005	0.015	0.015	10	6460	6.35	19.5	-	-
2004	0.01	0.01	10	5750	7.45	23.8	4.9	-
2003	0.005	0.005	5	1919	7.38	15.1	3.35	-
2002	0.008	0.008	10	23.8	6.95	8.3	4.9	-
2001	0.01	0.01	10	23.55	7.21	6.8	-	-
2000	0.01	0.01	10	-	-	-	-	-

Table 4-4
 Drainage Layer Sampling Data SSMP4
 Second Quarter 2012

Year	CR	CR (Filtered)	Cyanide	Spec. Cond.	pH	Temp.	D.O.	ORP
2012	0.0106	0.0110	10	2.38	7.32	15.40	9.18	189
2011	0.0058	0.004	5	1.592	7.34	19.8	0.88	41
2010	0.0073	0.0069	5	-	-	-	-	-
2009	0.0093	0.0086	5	6.44	-	13.1	10.79	-
2008	0.0023	0.0023	5	-	-	19	3.1	-
2007	0.0049	0.0024	10	-	-	19.94	9.02	-
2006	0.015	0.015	10	1.46	7.19	18.7	5.82	-
2005	0.015	0.015	10	1215	7.01	19.1	-	-
2004	0.0043	0.0037	10	5756	7.44	21.1	6.14	-
2003	0.0031	0.0024	5	677	8.26	15	6.71	-
2002	0.008	0.008	10	1.62	7.3	9.7	10.27	-
2001	0.01	0.01	10	1376	7.78	7.2	-	-
2000	0.01	0.01	10	-	-	-	-	-

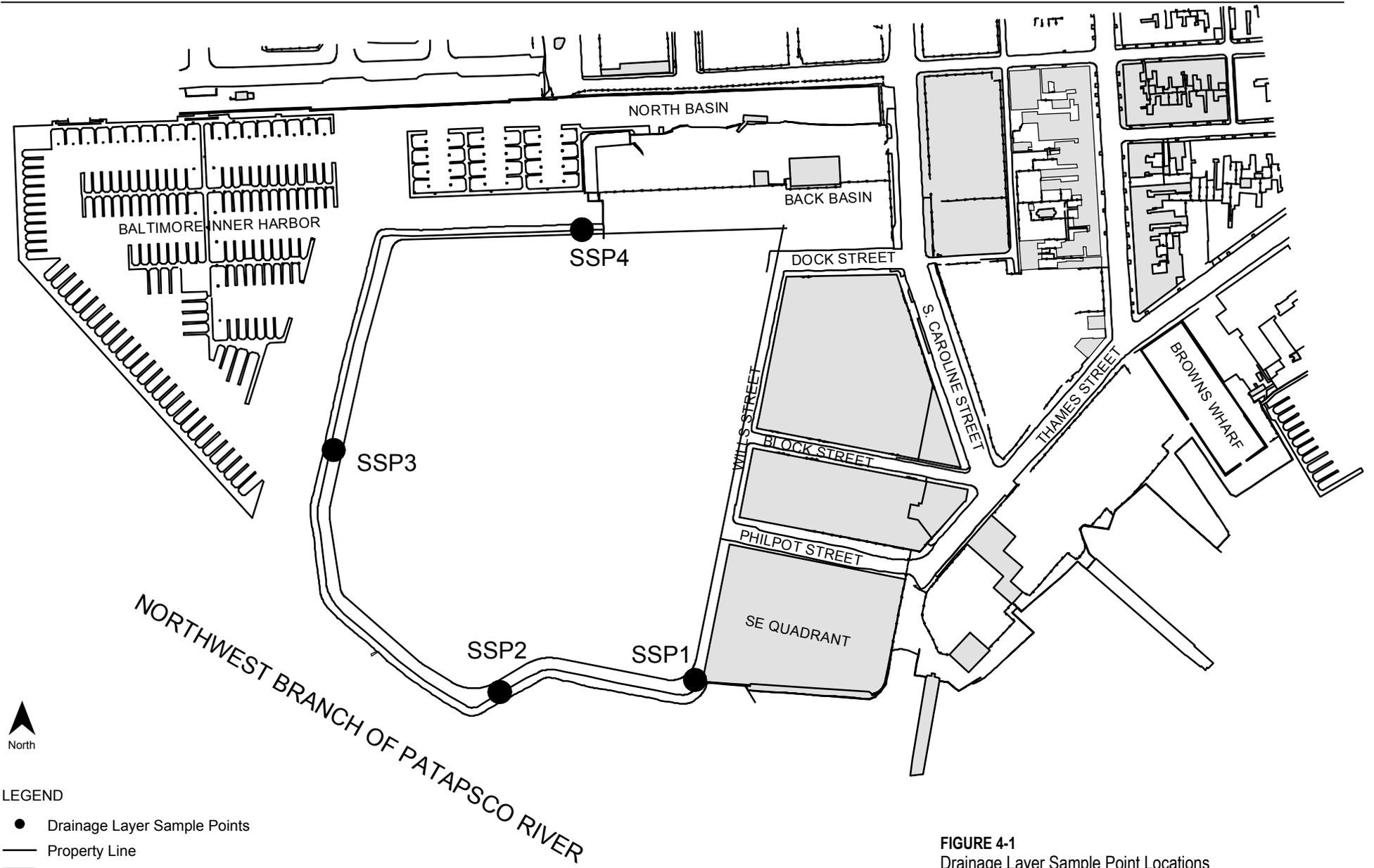
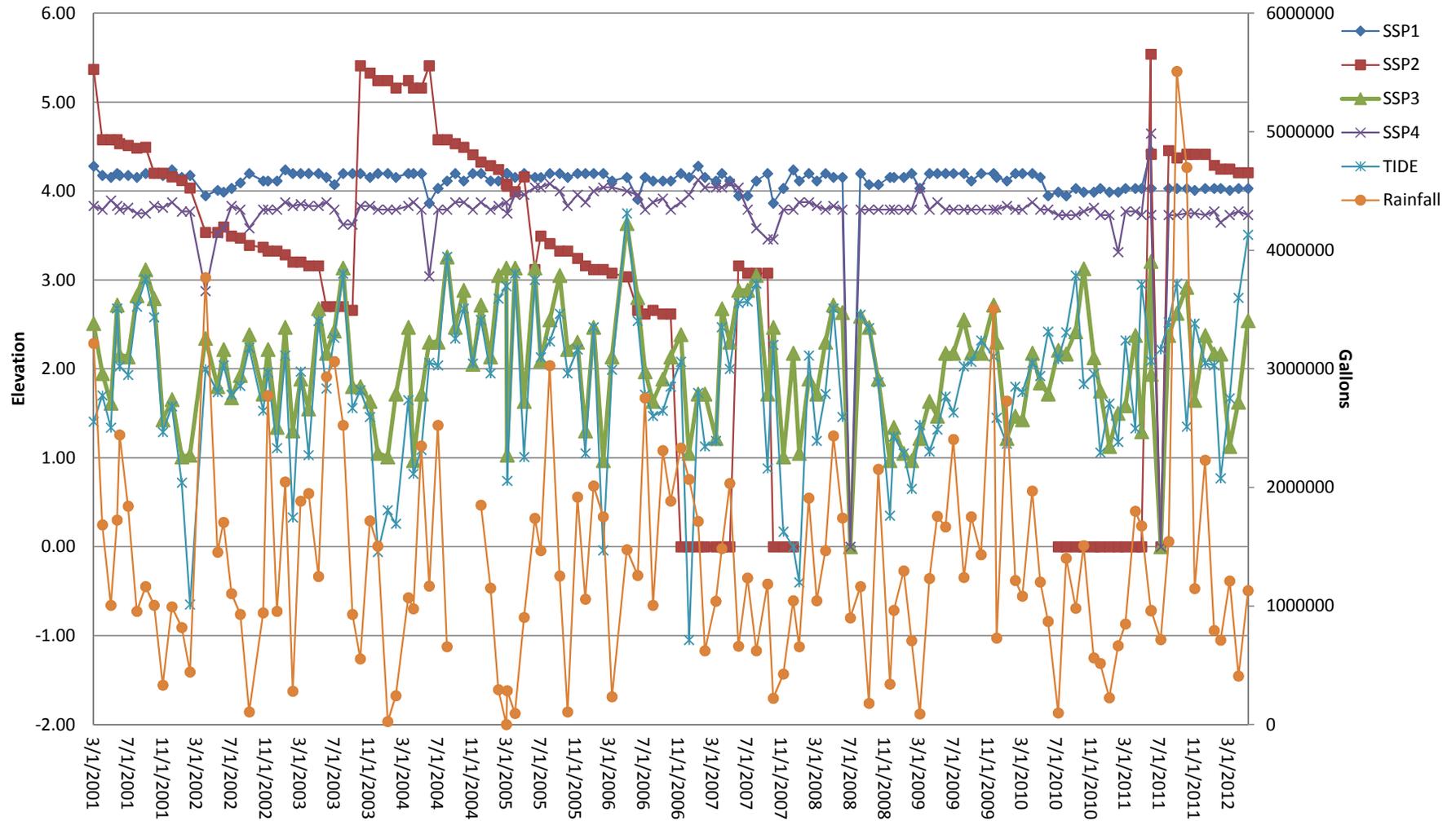


FIGURE 4-1
 Drainage Layer Sample Point Locations
Environmental Media Monitoring

Drainage Layer Sample Points Water Depths

Figure 4-2



Sediment Monitoring

5.1 Methodology

Harbor sediment sampling is part of the required sampling established in response to modifications of Exhibit 9 of the Consent Decree. The sediment is to be sampled within 1 year of completing the installation of corrective measures, and thereafter every 3 years for at least 10 years. The sample of the 9th year was taken in 2009. A final round of sediment samples were taken in May of 2012.

The sediment sampling is intended to provide information to assess the reduction of constituents in the vicinity of the Site. Samples are collected at six locations around the perimeter of the Site, immediately outboard of the rock embankment. In addition, samples are taken from two locations distant from the Site to indicate background conditions. All sample locations were selected based on historical sample locations. Figure 5-1 shows the location of the harbor sediment samples.

A permitted watercraft is piloted to each of the sample locations in accordance with the Sediment Sampling Work Plan. Field measurements of surface water at the sediment interface are then taken using a five-sensor flow cell type meter, which is lowered through the water column and into the vicinity of the water/sediment interface. These readings are noted on the appropriate field forms presented in Appendix D. Two grab samples of sediment are taken from the bottom of the harbor with a Ponar dredge sampler. The first sample is placed in an appropriate sample container that is labeled for grain size and chromium analysis. The second grab sample is sent to a separate lab for total organic content (TOC) analysis, as required by Table 4.4.6.1 and Section 4.4.5 of the EMMP. The location of the sample site is then surveyed using a global positioning system unit installed on the sampling vessel. Sampling equipment is decontaminated in accordance with the Sediment Sampling Work Plan.

MES took the sediment samples, and Lancaster Laboratories performed the analyses.

5.2 Current Quarter Results

Sediment samples were taken on May 24, 2012. Prior to the collection of sediment samples, from early March through late May, the portion of the northwest branch of the Patapsco River from the Baltimore Inner Harbor to a location south of the Site was dredged to a depth of 26 feet. The channel was dredged to accommodate the depth of ships scheduled for the celebration of the 200th anniversary of the War of 1812. Locations SED-4, SED-5 and SED-6 were located near the northern edge of the defined dredge channel.

The sediment sample locations are presented in Figure 5-1. For the perimeter samples (Stations 1 through 6), total chromium concentrations ranged from 74 parts per million (ppm) to 5,300 ppm, and TOC concentrations ranged from 39,700 ppm to 65,200 ppm.

Background samples showed total chromium concentrations ranging from 194 ppm to 422 ppm, and TOC concentrations from 38,600 ppm to 38,700 ppm. The locations from which the current samples were taken as global positioning system coordinates, as well as the results of the analysis of those samples, are tabulated in Table 5-1. The analysis reports from the laboratories are presented in Appendix D.

With the exception noted below, both the total chromium and TOC concentrations in the collected samples are consistent with values reported historically. The chromium concentrations reported for locations SED-3 and SED-6 and the TOC concentration reported for location SED-5 are higher than the historically reported values. Analytical results may have been affected by the dredging activities in the harbor that preceded the sampling event, which could have altered the sediment profile. For this reason, current results may not be comparable to those of prior sampling events.¹

5.3 Data Review

Limited sediment sampling was performed as part of the Baltimore Works, now known as the Baltimore Inner Harbor Site, remedial investigation. Sediment samples were also collected in September 1989 and as part of the “New Outboard Embankment” dredging in February 1993.

The engineering firm EA collected sediment samples as part of the risk assessment for the Baltimore Inner Harbor remedial investigation performed in 1989. One sample was taken from the North Slip of the Site and analyzed for total chromium, hexavalent chromium, and TOC. The result for total chromium was 4,200 ppm on a wet basis, and the result for TOC was 10,000 ppm on a wet basis. There is no direct correlation between this sample point and the current sample points.

During the 1989 sampling event, 11 samples were taken at stations around the Site as well as at two offsite locations. These stations are roughly equivalent to the most recently sampled locations; however, they were not analyzed for total chromium or TOC but rather for grain size distribution.

Baseline sediment samples were collected in January 2001. Additional sets of sediment samples were taken in June 2003, November 2006, March 2009, and May 2012. The current and historical sediment sample results are compared in Table 5-2.

¹ The sediment profile can be affected by dredging, which, for example, adds water content: phone interviews with the sampler (H. Bennett) indicated that the high water content of the samples required several attempts to collect sufficient sample volume. The moisture content of the samples determined from analysis was high (ca. 66 percent), which effects the calculation of analytical results. In the case of SED-6, the initial dry weight result of 1,777 milligrams per kilogram was divided by $(1 - \text{water content}) = (1 - 0.66)$ to give 5,300 milligrams per kilogram on a dry weight basis.



Legend

- Sediment Sample Location
May 2012



Figure 5-1
Sediment Sample Locations
Baltimore Inner Harbor
Baltimore, Maryland

TABLE 5-1

Current Harbor Sediment Sample Results

Sample Identifier	GPS Location		Total Chromium ppm	Total Organic Carbon ppm	Percent Passing # 200 or 0.6 mm Sieve percent silt/clay
	Latitude	Longitude			
SED-1	39°16.896	76°35.937	74	58,600	89.0
SED-2	39°16.888	76°36.046	318	63,500	80.3
SED-3	39°16.830	76°36.060	1,670	49,200	58.3
SED-4	39°16.761	76°36.060	182	39,700	75.0
SED-5	39°16.725	76°35.963	494	65,200	63.6
SED-6	39°16.717	76°35.829	5,300	50,200	62.8
SED-10	39°16.939	76°36.394	422	38,700	62.1
SED-11	39°16.521	76°35.320	194	38,600	68.5

TABLE 5-2
Historical Harbor Sediment Sample Results

Location	Date	Total Chromium ppm	Total Organic Carbon ppm	Grain Size % Passing #200 or 0.6 mm seive
SED-1	2001	93	87,600	44.1
	2003	1,710	88,800	63.7
	2006	223	72,750	97.5
	2009	31	14,000	94.9
	2012	74	58,600	89.0
SED-2	2001	270	46,500	27.0
	2003	419	99,050	79.9
	2006	311	71,150	98.0
	2009	2,030	27,500	86.3
	2012	318	63,500	80.3
SED-3	2001	180	54,400	45.5
	2003	244	60,850	81.1
	2006	284	52,150	98.6
	2009	62	10,600	91.8
	2012	1,670	49,200	58.3
SED-4	2001	770	53,350	50.1
	2003	193	58,300	71.5
	2006	237	57,100	97.3
	2009	41	14,400	93.8
	2012	182	39,700	75.0
SED-5	2001	1,100	52,850	48.9
	2003	608	64,900	47.7
	2006	487	62,000	71.9
	2009	91	17,400	92.6
	2012	494	65,200	54.2
SED-6	2001	1,400	54,500	44.1
	2003	991	68,250	74.3
	2006	711	69,900	76.4
	2009	391	18,000	81.2
	2012	5,300	50,200	62.8
SED-10	2001	310	63,050	40.6
	2003	450	51,050	43.1
	2006	583	72,600	81.7
	2009	80	11,700	71.1
	2012	422	38,700	62.1
SED-11	2001	400	48,000	42.3
	2003	275	56,500	61.5
	2006	344	61,250	76.4
	2009	38.8	9,480	63.1
	2012	194	38,600	68.5