Partitioning Coefficient Study Report, Marina del Rey Harbor Toxic Pollutants TMDL

Prepared for

County of Los Angeles
Department of Public Works

City of Los Angeles (Los Angeles)

City of Culver City (Culver City)

California Department of Transportation (Caltrans)

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Project No. 140695

Brown AND Caldwell

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1. Introduction

The County of Los Angeles Department of Public Works (County), City of Los Angeles (Los Angeles), City of Culver City (Culver City), and California Department of Transportation (Caltrans) are named the responsible parties in the Los Angeles Regional Water Quality Control Board's (Regional Board's) Marina del Rey (MdR) Harbor (MdRH) Toxics Total Maximum Daily Load (TMDL). The County is serving as the lead agency for compliance with the TMDL for MdR and has retained Brown and Caldwell (BC) to assist with compliance with various monitoring and special studies required therein. This Study Report summarizes the background, objectives, approach, and intended outcomes of the partitioning coefficient study.

1.1 Project Objective

The objective of this project is to conduct the following Special Study mandated under the Toxics TMDL:

Partitioning Coefficient Study. This study involves an evaluation of partitioning coefficients for metals between the water column and sediment to assess the contribution of water column discharges to sediment concentrations in the harbor. The study focuses on copper; however, lead and zinc were also analyzed and the results were used to refine the conclusions.

1.2 Background

On October 6, 2005, the Regional Board adopted the MdRH Toxics TMDL. Section 7.3 of the TMDL document describes the need for Special Studies, as follows:

> *"Special studies are necessary to refine source assessments, to provide better estimates of loading capacity, and to optimize implementation efforts. The Regional Board will reconsider the TMDL in the sixth year after the effective date in light of the findings of these studies.*
>
> *Studies required for this TMDL include:*
>
> - *Evaluate partitioning coefficients between water column and sediment to assess the contribution of water column discharges to sediment concentrations in the harbor, and*
> - *Evaluate the use of low detection level techniques to determine water quality concentrations for those contaminants where standard detection limits cannot be used to assess compliance for CTR standards or are not sufficient for estimating source loadings from tributaries and storm water.*
>
> *Studies recommended for this TMDL include:*
>
> - *Develop and implement a monitoring program to collect the data necessary to apply a multiple lines of evidence approach;*
> - *Refine the relationship between pollutants and suspended solids aimed at better understanding of the delivery of pollutants to the watershed, and*
> - *Evaluate the effectiveness of BMPs to address pollutants and/or sediments."*

1.2.1 Problem Statement

The TMDL for Toxic Pollutants in MdRH prepared by the Regional Board and U.S. Environmental Protection Agency (USEPA) Region 9 presents the required elements of the TMDL in MdR's back basins (Basins D, E, and F). It summarizes the technical analyses performed by the Regional Board and USEPA Region 9 to develop this TMDL.

The back basins of the Marina are listed for a variety of toxic pollutants, including metals, organic compounds and sediment toxicity. These sections of MdRH were included on the 1996, 1998 and 2002 California 303(d) list of impaired water bodies (Regional Board 1996, 1998, 2002). The Clean Water Act requires a TMDL be developed to restore the impaired water bodies to their full beneficial uses. The listings for MdR's back basins are based on concentrations of chlordane, dieldrin, dichlorodiphenyltrichloroethane (DDT) and polychlorinated biphenyls (PCBs) in fish tissue and concentrations of copper, lead, zinc, chlordane, and PCBs in sediments.

1.2.2 Project Management Team

The project management team is presented in Table 1.1.

Table 1-1. Project Management Team

Firm / Agency	Contact Name	Contact Title	Contact Number
BC	Lisa Skutecki	Special Studies Toxic TMDL Project Manager	(858) 571-6739
	Melissa Ingalsbe	CMP TMDL Implementation Phase 1 Project Manager	(213) 271 - 2239
MBC	Michael J. Mancuso	Sampling Project Manager	(714) 850 - 4850
ATL	Rachelle Arada	Laboratory Project Manager	(562) 989 - 4045
Physis	Mark Baker	Laboratory Project Manager	(714) 602 - 5320
	Misty B. Mercier	Laboratory Project Manager	(714) 602 - 5320
County of Los Angeles Department of Public Works	Raymond To	Special Studies Toxic TMDL Project Manager	(626) 458-7123
	Antonino Monterrosa	CMP TMDL Implementation Phase 1 Project Manager	(626) 458-4376
City of Los Angeles, Bureau of Sanitation	Huub Cox	Assistant Division Head	(213) 485-3984
	Wendy Dinh	Environmental Engineering Associate	(213) 485-3912
California Department of Transportation	Bob Wu	Senior Transportation Engineer	(213) 897-8636
	Chien Pei Yu	Tranportation Engineer	(213) 897-0974
Culver City	Kaden Young	Associate Engineer	(310) 253-6445
Beaches and Harbors	Chris Sellers	Planner	(310) 578-0961

CMP = Coordinated Monitoring Plan

1.3 Site Location

The MdR watershed is approximately 2.9 square miles and drains into Santa Monica Bay, California. Located south of Venice and north of Playa del Rey, it includes the City of Los Angeles, Culver City, Caltrans, and unincorporated areas of Los Angeles County. The climate is warm and dry most of the year with intermittent wet weather events typically between November and March.

MdRH was developed in the early 1960s on degraded wetlands that formed part of the estuary of the Ballona Creek Wetlands. MdRH, which opens into Santa Monica Bay was constructed by the United

States Army Corps of Engineers (USACE) and is the largest artificial small-craft harbor in the United States. MdRH has more than 5,300 wet berthed slips for privately owned pleasure craft, dry storage of approximately 3,000 boats and launch facilities which can accommodate approximately 240 trailered boats. The back basins (Basins D, E and F) house approximately 2,000 slips.

The USACE maintains the harbor entrance channel and main channel for navigation by dredging. Since the late 1980s the USACE has not been able to use open water disposal for sediments dredged from the entrance channel due to the elevated levels of contaminants deposited from adjacent Ballona Creek. Based on the USACE hydrodynamic numerical modeling (RMA4 model) results, the contaminant influence from Ballona Creek does not travel to nor affect the back basins (USACE 1999). Therefore, the back basins of the MdRH are assumed to be outside any significant influence from Ballona Creek.

The MdR watershed is highly developed with high-density single-family residence, multiple family residence and mixed residential comprising the primary land use in the watershed (46.6 percent) followed by retail, commercial and general office representing the second largest land use (12.2 percent). The receiving waters of MdRH constitute 11.6 percent of the land area and marina facilities cover 9.2 percent of the land use. Open space and recreation represents 4.8 percent of the land use in the watershed. Light industrial and vacant/urban vacant each represent 4.7 percent of the land use. The remaining 6 percent of land area is covered by educational institutions (3.8 percent), under construction (1.2 percent), institutional and military installations (0.6 percent), transportation (0.3 percent), and mixed urban (0.2 percent).

1.4 Associated Reports and Technical Memoranda

Coordinated Monitoring Plan. This Plan was developed by the TMDL responsible parties and submitted to the Los Angeles Regional Water Quality Control Board on March 31, 2008. It established the monitoring guidelines and objectives for the (MdRH Toxics TMDL Coordinated Monitoring Program and includes programs for both wet and dry weather monitoring. The dry weather monitoring consists of harbor water column, harbor sediment and bioaccumulation sample collection and analysis. The wet weather program is comprised of the design and installation of stormwater sampling stations and the collection and analysis of stormwater samples.

Partitioning Coefficient Study Plan. Draft and Final Study Plans were prepared for the study. The Study Plan identifies the locations in which the samples are being collected, specifies the analyses and reporting limits to be achieved, describes the sampling logistics and coordination with the Ambient Monitoring Program (AMP) for MdRH and discusses sample handling, documentation and reporting.

LDL Study Plan. Draft and Final Study Plans were prepared for the study. The Study Plan identifies the locations in which the samples are being collected, specifies the analyses and reporting limits to be achieved, describes the sampling logistics and coordination with the AMP for MdRH and discusses sample handling, documentation and reporting.

Draft and Final Quality Assurance Project Plan (QAPP). The QAPP establishes measureable expectations for evaluation of quality control samples (e.g., spikes, blanks, and replicates), chain of custody forms, detection limits, and other measures that ensure data quality adequate to the study objectives.

Draft and Final Data Management and Reporting Plan (DMP). The DMP identifies the protocols by which the data needs to be collected, compiled, archived and uploaded to Los Angeles County's Integrated Water Quality Database.

Draft and Final Study Reports for the Partitioning Coefficient Study and the LDL Study. These reports will provide formal documentation of all work conducted on the two studies as well as a compilation of all data collected, statistical analyses and interpretation, results and conclusions.

2. Methodology

This section summarizes key points of the sampling and analysis approach necessary to understand the findings of the partitioning coefficient study. Details are available in the Partitioning Coefficient Study Plan and QAPP.

2.1 Sampling Locations, Frequency, and Analyses Monitoring Program Design

The Study Plan for the Partitioning Coefficient Study was implemented in parallel and in combination with the existing monitoring program being conducted for MdRH. The sampling locations, type, frequency, constituents and analytical methods for the stormwater monitoring are presented in Table 2-1. The sampling locations, type, frequency, constituents and analytical methods for the harbor water column monitoring and harbor sediment are presented in Tables 2-2 and 2-3, respectively. An overview of the monitoring area is presented in Figure 2.1. A close up of the monitoring locations is presented in Figure 2.2.

Table 2-1. Marina del Rey Stormwater* Ambient Monitoring Sites

Monitoring Location Name	Sampling Location	Monitoring Types	Partitioning Coefficient Constituents	Method	Lat.	Long.	% of Total Drainage Area	Thomas Guide	Comment
MdR-3	Project No. 5243 LFD	Composite Grab Up to 6 storm events	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 200.7 - fresh water EPA 200.7 - fresh water EPA 200.7 - fresh water ASTM 2000 D3977C	33.989	118.45	40.90%	672:A6	Washington Blvd. and Thatcher Ave.
MdR-4	Project No. 3872 LFD	Composite Grab Up to 6 storm events	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 200.7 - fresh water EPA 200.7 - fresh water EPA 200.7 - fresh water ASTM 2000 D3977C	33.986	118.453	16.50%	672:A6	At the pump house at the east end of Oxford Basin. Construction completed on 3/2010.
MdR-5	Project No. 3874 LFD	Composite Grab Up to 6 storm events	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 200.7 - fresh water EPA 200.7 - fresh water EPA 200.7 - fresh water ASTM 2000 D3977C	33.985	118.459	6.70%	671:J6	At the existing Boone-Olive Pump House and LFD
MdRU-C1	Catch Basin	Composite Grab Up to 6 storm events	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved)	EPA 200.7 - fresh water EPA 200.7 - fresh water EPA 200.7 - fresh water	33.98 3	118.443	0.50%	672:B7	North of Bali and Admiralty Ways

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Table 2-1. Marina del Rey Stormwater* Ambient Monitoring Sites									
Monitoring Location Name	Sampling Location	Monitoring Types	Partitioning Coefficient Constituents	Method	Lat.	Long.	% of Total Drainage Area	Thomas Guide	Comment
			SSC	ASTM 2000 D3977C					
MdRU–C2	Catch Basin	Composite Grab Up to 6 storm events	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 200.7 - fresh water EPA 200.7 - fresh water EPA 200.7 - fresh water ASTM 2000 D3977C	33.98 9	118.457	2.20%	671:J6	North of Abbot Kinney Blvd. and Woodlawn Ave.

SSC = suspended sediment concentration

** Stormwater is wet-weather sampling*

Table 2-2. Marina del Rey Harbor Ambient Monitoring Sites (Front and Back Basins)					
Monitoring Location Name	Sampling Location	Monitoring Types	Partitioning Coefficient Constituents	Method	Thomas Guide
MDRH-B-1	Harbor Basin D Back Basin	Water Column (Monthly) At-Depth At-Surface Mid-Depth	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 1640 - salt water EPA 1640 - salt water EPA 1640 - salt water ASTM 2000 D3977C	672: A7
MDRH-B-2	Harbor Basin E Back Basin	Water Column (Monthly) At-Depth At-Surface Mid-Depth	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 1640 - salt water EPA 1640 - salt water EPA 1640 - salt water ASTM 2000 D3977C	672: A7
MDRH-B-3	Harbor Basin F Back Basin	Water Column (Monthly) At-Depth At-Surface Mid-Depth	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 1640 - salt water EPA 1640 - salt water EPA 1640 - salt water ASTM 2000 D3977C	672: B7
MDRH-B-4	Harbor End of Main Channel Back Basin	Water Column (Monthly) At-Depth At-Surface Mid-Depth	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 1640 - salt water EPA 1640 - salt water EPA 1640 - salt water ASTM 2000 D3977C	671: A7
MDRH-F-1	Harbor Basin A Front Basin	Water Column (Monthly) At-Depth At-Surface Mid-Depth	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 1640 - salt water EPA 1640 - salt water EPA 1640 - salt water ASTM 2000 D3977C	702: A1
MDRH-F-2	Harbor Basin B Front Basin	Water Column (Monthly) At-Depth At-Surface Mid-Depth	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 1640 - salt water EPA 1640 - salt water EPA 1640 - salt water ASTM 2000 D3977C	701: J1
MDRH-F-3	Harbor Basin C Front Basin	Water Column (Monthly) At-Depth At-Surface Mid-Depth	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 1640 - salt water EPA 1640 - salt water EPA 1640 - salt water ASTM 2000 D3977C	672: J7

Table 2-2. Marina del Rey Harbor Ambient Monitoring Sites (Front and Back Basins)					
Monitoring Location Name	Sampling Location	Monitoring Types	Partitioning Coefficient Constituents	Method	Thomas Guide
MDRH-F-4	Harbor Basin G Front Basin	Water Column (Monthly) At-Depth At-Surface Mid-Depth	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 1640 - salt water EPA 1640 - salt water EPA 1640 - salt water ASTM 2000 D3977C	672: B7
MDRH-F-5	Harbor Basin H Front Basin	Water Column (Monthly) At-Depth At-Surface Mid-Depth	Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) SSC	EPA 1640 - salt water EPA 1640 - salt water EPA 1640 - salt water ASTM 2000 D3977C	672: B7/ 702:B1

SSC = suspended sediment concentrations

Table 2-3. Benthic Sediment Constituents For Marina del Rey Harbor					
Monitoring Location Name	Sampling Location Type	Sampling Frequency	Partitioning Coefficient Constituents	Method	Thomas Guide
MDRH-B-1	Harbor Basin D	Quarterly (March and June)	% Solids Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) Grain Size	% Solids Determination EPA 6010 EPA 6010 EPA 6010 SM 2560D	672: A7
MDRH-B-2	Harbor Basin E	Quarterly (March and June)	% Solids Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) Grain Size	% Solids Determination EPA 6010 EPA 6010 EPA 6010 SM 2560D	672: A7
MDRH-B-3	Harbor Basin F	Quarterly (March and June)	% Solids Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) Grain Size	% Solids Determination EPA 6010 EPA 6010 EPA 6010 SM 2560D	672: B7
MDRH-B-4	Harbor End of Main Channel	Quarterly (March and June)	% Solids Copper (total, dissolved) Lead (total, dissolved) Zinc (total, dissolved) Grain Size	% Solids Determination EPA 6010 EPA 6010 EPA 6010 SM 2560D	671: A7

Total metals measurements were made on sediments; dissolved metals measurements were made on porewater samples collected by centrifuging benthic samples.

Figure 2.1: Area Map of Sampling Sites

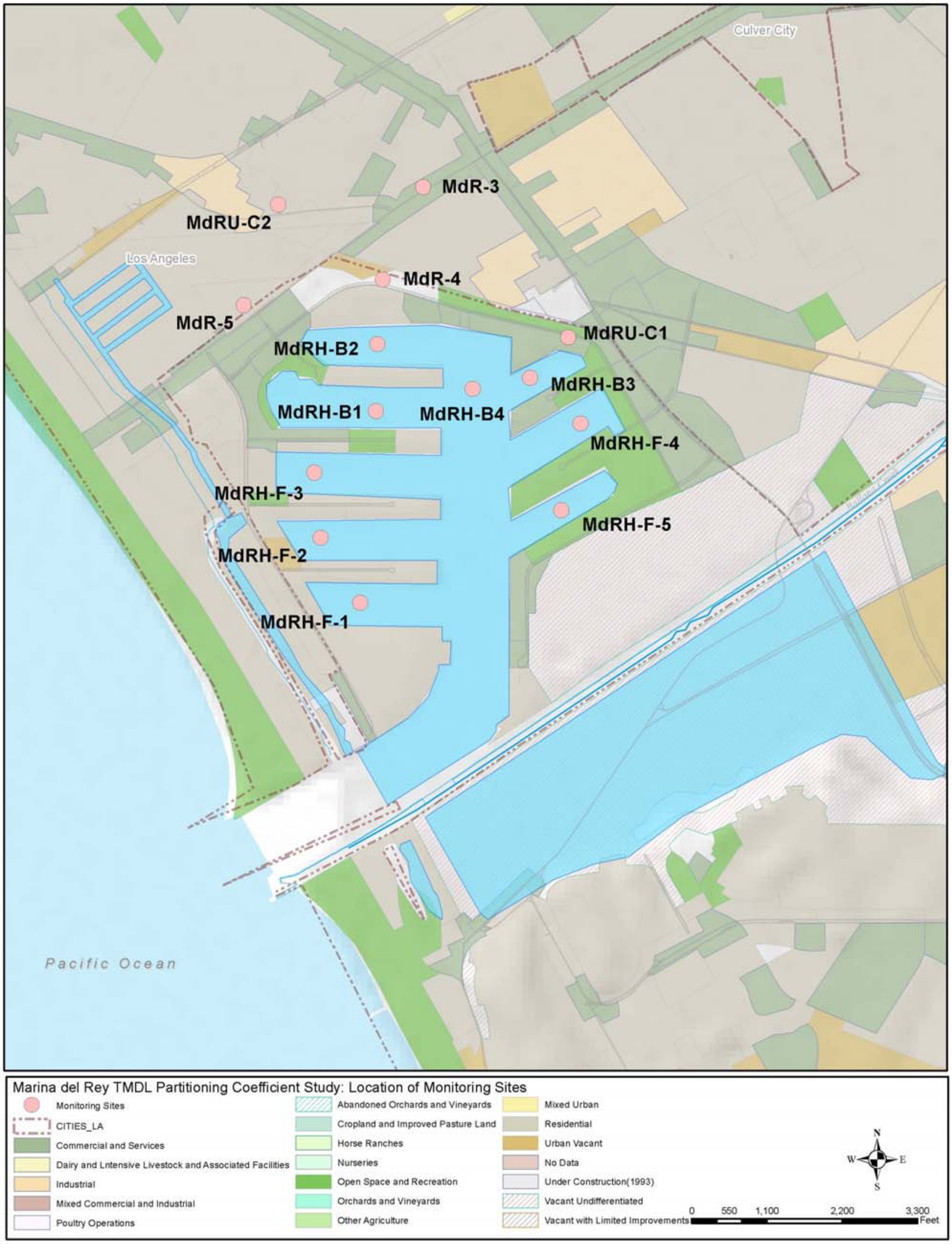

Figure 2.2: Location Map of Sampling Sites

At-depth samples are collected at a depth that is one-foot above channel bottom. At-surface samples are collected from a depth that is one-foot below the water surface. Mid-depth samples are collected at a depth that is one half the total depth of the channel (e.g., if the total depth is 13 feet, the mid-depth sample is collected at 6.5 feet.)

2.2 Blanks and Replicate Samples

2.2.1 Field/Laboratory Blanks and Trip Blanks

Potential field contamination was assessed through analysis of trip blanks and duplicate grab samples. One field trip blank was collected during every stormwater sampling event to quantify post-sampling contamination. For the harbor sampling, a trip blank was provided by the laboratory. For the stormwater sampling, a composite bottle from the laboratory was filled in the field with deionized water.

The monitoring program also includes field duplicates to assess the precision of laboratory results. A field duplicate, the origin of which is unknown to the laboratory, was collected during each sampling event. This methodology for assessing post-sampling contamination and laboratory testing procedures provides data to measure the precision and accuracy of the laboratory results.

2.3 Monitoring

Monitoring was conducted in accordance with the protocols defined in the Partitioning Coefficient Study Plan. It consisted of harbor water column monitoring, harbor sediment collection and stormwater monitoring. A brief summary of the monitoring is provided below.

2.3.1 Water Quality Monitoring

Water quality monitoring for the Special Studies program were performed in accordance with the TMDL Coordinated Monitoring Plan (CMP). Grab samples were collected on a monthly basis and analyzed for the constituents provided in Table 2-2.

Water quality samples were collected from one of MBC's vessels at-surface, mid-depth, and at-depth in the water column using a remotely activated Van Dorn water grab sampler.

2.3.2 Sediment Sampling

Sediment chemistry sampling for the Ambient Phase and Special Studies Project were performed in accordance with the CMP.

Grab samples were collected on a quarterly basis and analyzed for both benthic sediment chemistry and toxicity testing as listed in Table 2-3. The sediment samples were collected from one of MBC's vessels utilizing a modified Van Veen grab sampler to obtain sufficient material for toxicity tests.

Good faith efforts were made to collect representative samples from each of the four locations. If samples could not be obtained from the exact sample point, a reasonable attempt was made to collect a sample from the vicinity of the original sample point.

2.3.3 Stormwater Monitoring

Stormwater (wet weather) samples were collected at the five locations presented in Table 2-1 and analyzed for the constituents also listed in Table 2-1. The composite stormwater samples were collected using auto-samplers, programmed based on a flow-rating curve for the portion of the watershed draining to the sampling site. MdR-4 and MdR-5 were permanently installed ISCO samplers. MdR-3, MdRU-C1, and MdRU-C2 were temporary enclosures with mobile ISCO samplers. The enclosure and sampler were set-up, programmed, and calibrated prior to all storms, based on weather forecasts. Due to time constraints with the contract and the regulatory deadline, only the later storms of the season were captured. The five (5) storm events that were sampled, were collected on the following dates:

1. February 15, 2011
2. February 17, 2011
3. February 25, 2011
4. March 20, 2011
5. March 25, 2011.

2.4 Study Design Philosophy and Approach

This study was developed to evaluate the partitioning coefficients for metals between the water column and sediment, in order to assess the contribution of water column discharges to sediment concentrations in the harbor. Lead and zinc were included to round out the data analysis and interpretation, with only a slight increase in analytical costs.

For the protection of aquatic life, the California Toxic Rule (CTR) establishes short-term (acute) and long-term (chronic) criteria in both freshwater and saltwater. The acute criterion equals the highest concentration of a pollutant to which aquatic life can be exposed, for a short period of time, without deleterious effects. The chronic criterion equals the highest concentration of a pollutant to which aquatic life can be exposed for an extended period of time (four days) without deleterious effects. Table 2-4 presents the applicable CTR Water Quality Objectives (WQOs) for metals in MdR.

Table 2-4. CTR WQOs for Marina del Rey

Pollutant	Saltwater Criteria for the Protection of Aquatic Life	
	Acute (µg/L)	Chronic (µg/L)
Copper (dissolved)	4.8	3.1
Lead (dissolved)	210	8.1
Zinc (dissolved)	90	81

The partitioning coefficient relates concentrations of dissolved metals, particulate (i.e., sediment) metals, and SSC. Although the primary study driver is assessing the contribution of water column discharges to sediment copper concentrations, additional information may also be derived about the extent to which sediment metal concentrations may or may not affect attainment of water column numeric targets.

2.5 Analytical Method Details

The dissolved and total metal concentrations (copper, lead, and zinc) were used with SSC to determine the partitioning coefficients for each depth at each location in the harbor. Water quality samples were collected at three depths at each location: at-depth, mid-depth, and surface. Sediment samples were analyzed for total metal concentrations. Porewater, collected with the harbor sediment samples, were analyzed for dissolved metal concentrations. Collecting dissolved porewater metal concentrations concurrently with sediment samples allowed a direct, in-situ measurement of the partitioning of copper in the benthos.

Water-column partitioning coefficients will be calculated as presented in the following equation (from Allison et.al. 2005):

$$K_p = \frac{sorbed\ metal\ concentration\ (\frac{mg}{kg})}{dissolved\ metal\ concentration\ (\frac{mg}{L})} = \frac{(Ct - Cd)}{Cd \times SSC}$$

where:

C_t = total concentration of the metal (µg/L)

C_d = dissolved concentration of the metal (µg/L)

SSC = suspended sediment concentration (kg/L)

Benthic sediment partitioning coefficients will be calculated by a similar approach, as presented in the following equation.

$$K_p = \frac{sorbed\ metal\ concentration\ (\frac{mg}{kg})}{dissolved\ metal\ concentration\ (\frac{mg}{L})} = \frac{Ctsed}{Cd} = \frac{\text{Metal Conc Sediment}}{\text{Metal Conc Pore Water}}$$

where:

C_{tsed} = total concentration of the metal in the sediment (µg/L)

C_d = total concentration of the metal in the pore water (µg/L)

However, in the case of benthic sediments, sorbed metal concentration is measured directly (as copper concentrations in sediments), and therefore would not require evaluation using the (C_t-C_d)/SSC term.

For context, some published partitioning coefficient values (log K_p in L/kg) for copper, lead, and zinc are presented in Table 2-5 (Allison et.al. 2005).

Table 2-5. Published Partitioning Coefficient Values (log K_p in L/kg) from Allison et.al. 2005

Metal	Soil/Water	Suspended Matter/Water	Sediment/Water
Zinc			
median	3.1	5.1	3.7
range	(-1.0) – 5.0	3.5 – 6.9	1.5 – 6.2
N	21	75	18
Copper			
median	2.7	4.7	4.2
range	0.1 – 3.6	3.1 – 6.1	0.7 – 6.2
N	20	70	12
Lead			
median	4.2	5.6	5.1
range	0.7 – 5.0	3.4 – 6.5	2.0 – 7.0
N	33	48	24

Shaded cells indicate that this Study Report is focused on the “suspended matter / water” and “sediment / water” partitioning coefficients.

The literature values for partitioning coefficients shown in Table 2-5 illustrate some properties of the partitioning coefficient and how those properties are used to interpret monitoring data. First, the partitioning coefficient is an inherently "noisy" calculation (i.e., high relative uncertainty), because it combines three different measurements (total metal, dissolved metal, and SSC); the relative uncertainty is greatest when the calculation involves a reasonably small difference between two measurements (i.e., when dissolved concentrations are close to the total). For all three metals, in all media, the calculated K_p spans several orders of magnitude for individual estimates. This inherent noisiness requires that large data sets be used to evaluate the median value of K_p.

Table 2-5 shows that the K_p values (presented as the log value of K_p) for lead are about ten-fold higher than for zinc and copper. This means that about ten-fold more lead is sorbed to particles at equilibrium compared to copper or zinc. The K_p values for zinc and copper are close to each other and depend on the media—the sediment/water zinc K_p is somewhat lower than that of copper, whereas the soil/water and suspended matter/water zinc K_p is somewhat higher than that of copper. This underscores the fact that partitioning between solids and water is not only an intrinsic property of the metal, but also an extrinsic property of the media of interest (i.e., the K_p can change depending on where and when samples are collected).

2.6 Blank Correction

As presented in Appendix A, the trip blank results were generally non-detect; therefore, the data were not blank corrected.

3. Data and Results

This section presents a summary of the data, reported in detail in Appendix A. The results presented below address the following study objectives:

1. Evaluate potential factors affecting copper concentrations in harbor sediments and overlying harbor waters. Two factors in particular are of interest in this study:
   a. Releases of dissolved copper from benthic sediments; and
   b. Discharges of copper-enriched particles from urban stormwater. Details on how those two factors are evaluated follow are shown below.
2. Evaluate spatial gradients in the copper partitioning coefficient (K_p).
   a. A lower K_p in benthic sediments and bottom waters compared to overlying waters may potentially indicate that bottom sediments are a source of dissolved copper to overlying waters—i.e., higher relative proportions of dissolved copper at-depth can be an indicator of dissolved copper fluxes to overlying waters.
3. Compare the calculated particulate copper concentrations in stormwater to measured copper concentrations in benthic sediments.

3.1 Copper

3.1.1 Comparison to Water Quality Objectives

The dissolved copper concentrations for the three depths – at the surface (At-surface), at the bottom of the harbor (At-depth), and at the mid-depth (Mid-depth) – were compared to the CTR. The standard deviations (error bars) represent the temporal variability of dissolved copper concentrations for each location at the three depths. The average At-surface concentrations were consistently above the CTR (Figure 3.1). Overall, the average At-depth and Mid-depth concentrations were below the CTR.

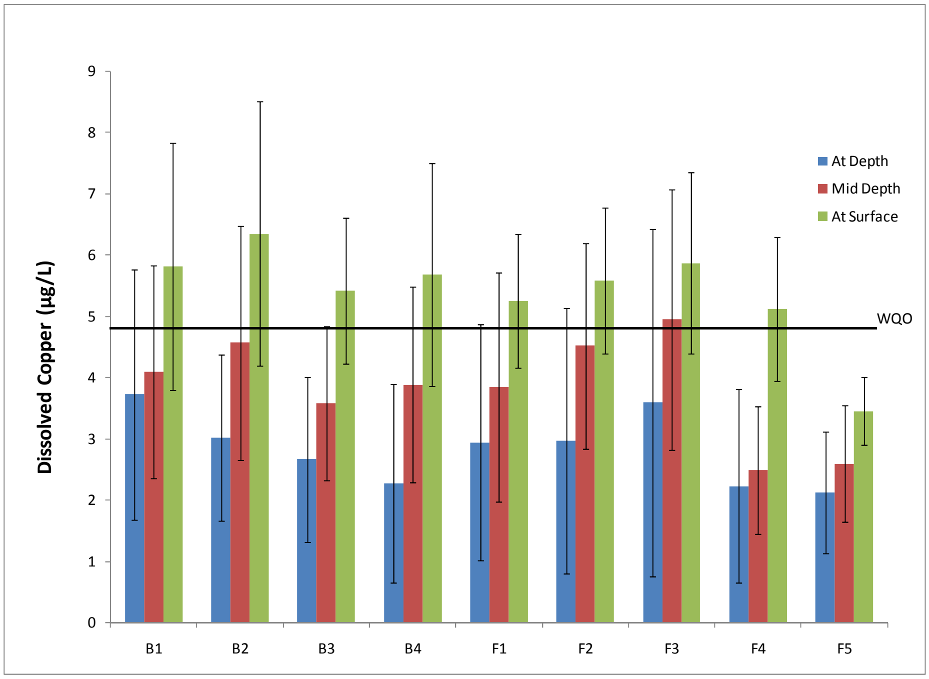

Figure 3.1: Average Dissolved Copper Concentrations for Each Harbor Location and Depth

Blue bars represent at-depth average dissolved copper concentrations. Red bars represent mid-depth average concentrations. Green bars represent at-surface average concentrations. Error bars represent the standard deviation, or the temporal variability, for each location and depth. The solid line represents the acute WQO for the MdRH.

3.1.2 Factors Affecting Copper Concentrations

As described above, there are two main factors of interest being considered in this study – releases of dissolved copper from benthic sediments, and discharges of copper-enriched particles from urban stormwater.

3.1.3 Benthic Sediments

The dissolved copper concentration in the porewater from the benthic sediments, presented in Figure 3.2, and the total copper concentrations in the sediment (Figure 3.3) are used to estimate benthic K_p values for copper.

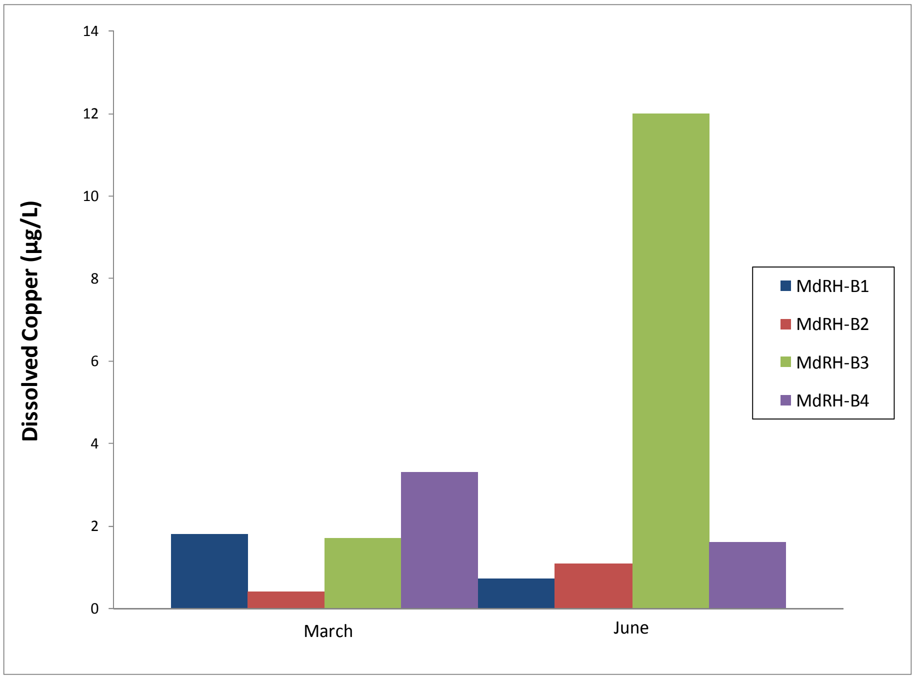

Figure 3.2: Dissolved Copper Concentrations in the Sediment Porewater

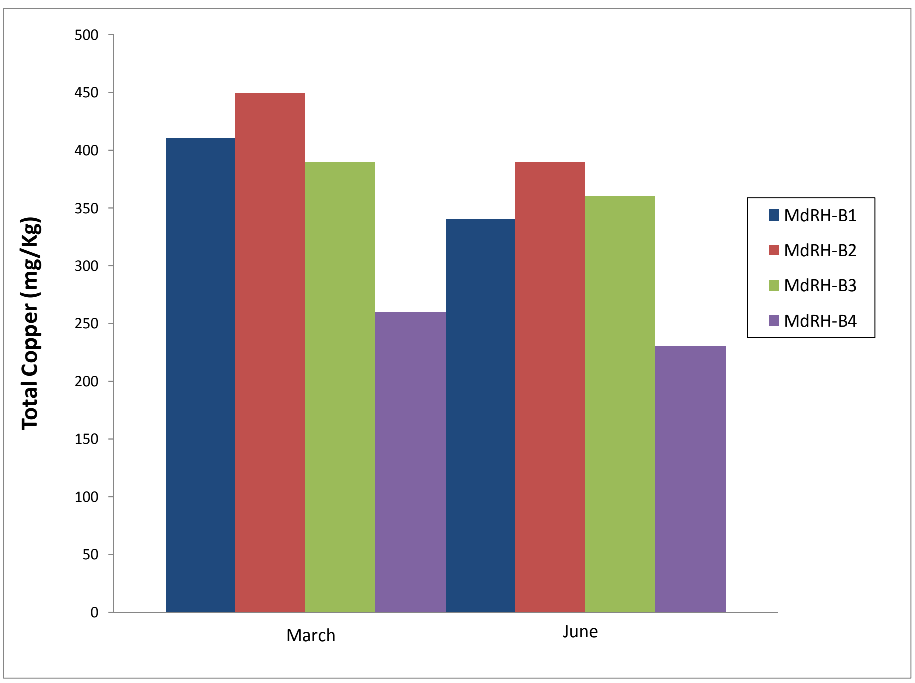

Figure 3.3: Total Copper Concentrations (mg/Kg) in the Benthic Sediments

Given the variation between the dissolved and total copper concentrations, the K_p values, calculated using the equation presented in Section 2.5 (Table 3-1, Figure 3.4 as log K_p), are comparable to and at the upper end of the range of literature values shown in Table 2-5 above. Therefore, even though copper concentrations in bottom sediments are elevated, the K_p measurements in this study do not provide direct evidence for a sediment source of dissolved copper to the water column.

Table 3-1. Sediment K_p Values

Date	Location	Dissolved Copper (µg/L)	Total Copper (mg/Kg)	K_p Copper (L/kg)	Log K_p Copper
3/22/2011	MdRH-B1	1.8	410	230000	5.4
	MdRH-B2	0.41	450	1100000	6.0
	MdRH-B3	1.7	390	230000	5.4
	MdRH-B4	3.3	260	79000	4.9
6/22/2011	MdRH-B1	0.73	340	460000	5.7
	MdRH-B2	1.1	390	350000	5.5
	MdRH-B3	12	360	30000	4.5
	MdRH-B4	1.6	230	140000	5.2
Mean		2.8	350	330000	5.3
Standard Deviation		3.8	75	340000	0.5
Median		1.7	380	230000	5.4
Maximum		12	450	1100000	6.0
Minimum		0.41	230	30000	4.5

Mean, standard deviation, median, maximums and minimums are provided above.

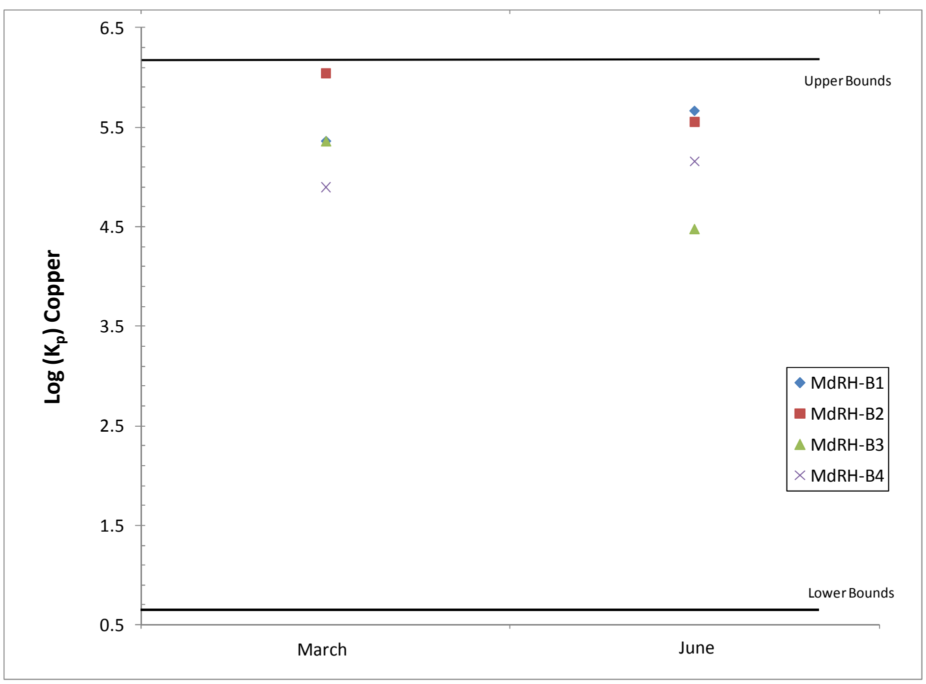

Figure 3.4: Log Kp Values of Copper for the Benthic Sediments versus Time

The solid lines represent the range of Log K_p values from Allison et.al 2005. Upper solid line represents Log K_p of 6.2. Lower solid line represents Log Kp of 0.7.

Stormwater Discharges

Comparing the average dissolved copper concentrations from the five stormwater monitoring sites (Figure 3.5), the larger contributors are the underrepresented areas of MdRU-C1 and MdRU-C2, representing 0.5 and 2.2 percent of the contributing watershed respectively. MdR-3, which accounts for the largest percentage of the watershed (40.9 percent), has an average dissolved copper concentration of 0.013 µg/L. With the exception of MdR-3 contributing the most total copper to the watershed, the same relationships for the total copper concentrations are observed in Figure 3.6.

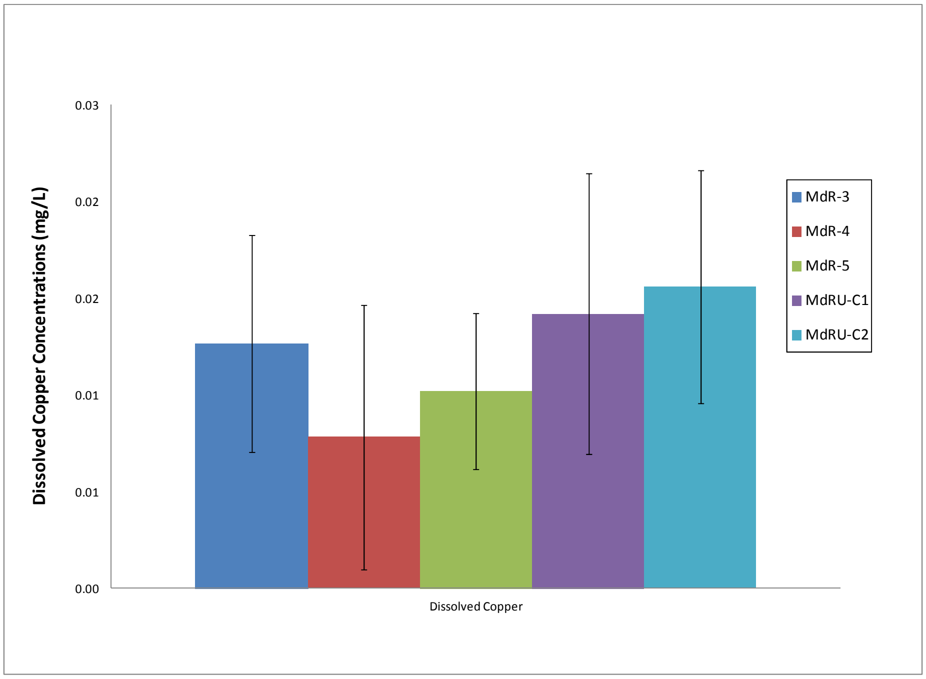

Figure 3.5: Average Dissolved Copper Concentration for Five Stormwater Monitoring Sites for Four Sampling Events

Error bars represent the standard deviation, or the temporal variability, for each location.

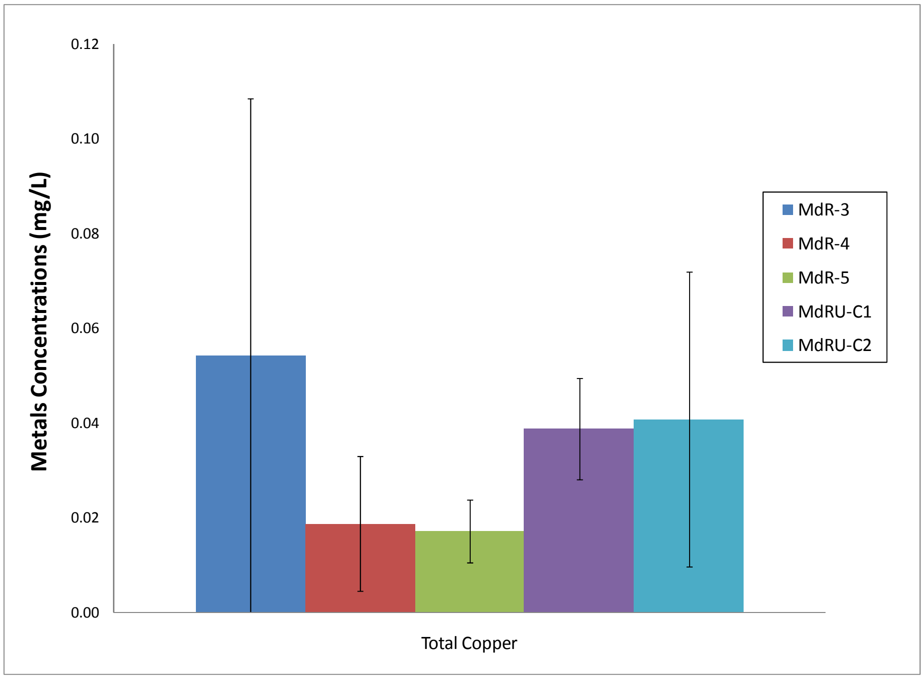

Figure 3.6: Average Total Copper Concentrations for the Five Stormwater Monitoring Sites

Error bars represent the standard deviation, or the temporal variability, for each location.

The partitioning coefficient for the copper was calculated using the equation presented in Section 2.5 (Figure 3.7, as Log K_p). The log K_p values for copper are presented in Table 3-2, and range from 3.9 to 5.7.

Table 3-2. Stormwater Sampling K_p Values

Date	Location	Total Copper (mg/L)	Dissolved Copper (mg/L)	Total SSC (mg/L)	K_p Copper	Log K_p Copper
2/15/2011	MdR-3	0.02	0.02	5.4	33000	4.5
	MdR-4	0.04	0.02	20	60000	4.8
	MdR-5	0.02	0.02	1.7	69000	4.8
	MdRU-C1	0.03	0.03	0.0	NA[1]	NA
	MdRU-C2	0.03	0.03	1.6	72000	4.9
2/17/2011	MdR-3	0.15	0.01	390	37000	4.6
	MdR-4	0.01	0.01	2.1	480000	5.7
	MdR-5	0.03	0.01	29	61000	4.8
	MdRU-C1	0.06	0.01	68	49000	4.7
	MdRU-C2	0.09	0.01	360	21000	4.3
2/25/2011	MdR-3	0.03	0.01	52	60000	4.8
	MdR-4	0.01	0.004	11	170000	5.2
	MdR-5	0.02	0.01	9.3	59000	4.8
	MdRU-C1	0.03	0.01	27	64000	4.8
	MdRU-C2	0.04	0.01	220	8600	3.9

Table 3-2. Stormwater Sampling K_p Values

Date	Location	Total Copper (mg/L)	Dissolved Copper (mg/L)	Total SSC (mg/L)	K_p Copper	Log K_p Copper
3/20/2011	MdR-3	0.04	0.02	68	18000	4.3
	MdR-4	0.02	0.01	11	180000	5.3
	MdR-5	0.01	0.01	16	51000	4.7
	MdRU-C1	0.04	0.01	51	61000	4.8
	MdRU-C2	0.02	0.02	30	20000	4.3
3/25/2011	MdR-3	0.03	0.01	61	31000	4.5
	MdR-4	0.01	0.005	12	130000	5.1
	MdR-5	0.01	0.01	4.3	130000	5.1
	MdRU-C1	0.04	0.01	48	56000	4.8
	MdRU-C2	0.02	0.01	18	18000	4.3
Mean		0.03	0.01	61	81000	4.7
Standard Deviation		0.03	0.01	110	96000	0.4
Median		0.03	0.01	20	59000	4.8
Maximum		0.15	0.03	390	480000	5.7
Minimum		0.01	0.004	0.00	8600	3.9

Mean, standard deviation, median, maximums and minimums are provided above.

[1]NA indicates that due to the non-detected SSC for this event, a Kp value could not be calculated.

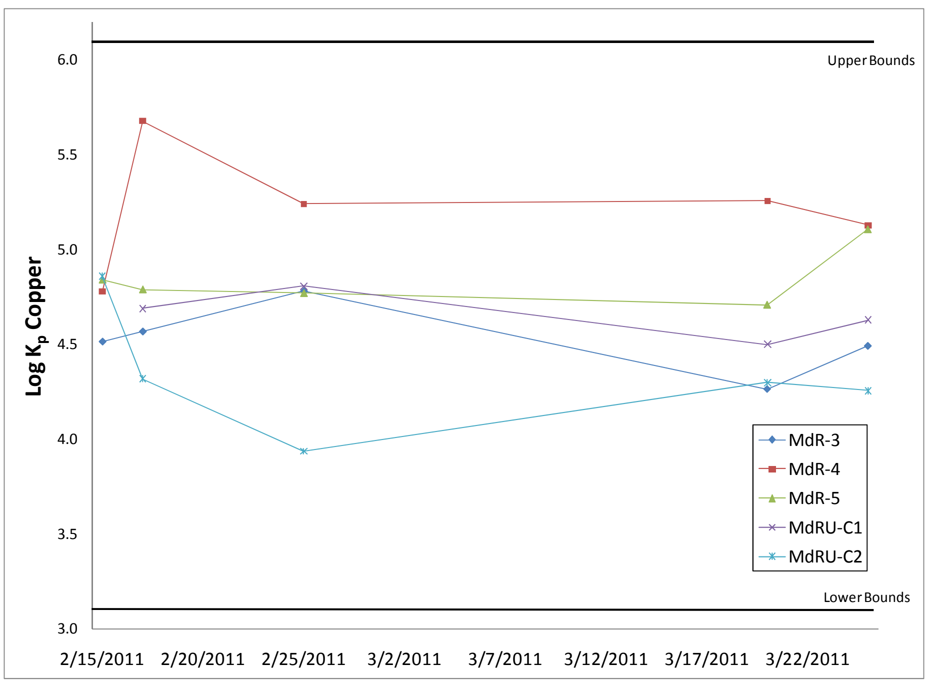

Figure 3.7: Log K_p Values for Copper for the Stormwater Monitoring Sites

MdR-3 is represented by blue diamonds. MdR-4 is represented by red squares. MdR-5 is represented by green triangles. MdRU-C1 is represented by purple x. MdRU-C2 is represented by blue asterisks. The solid lines represent the range of Log K_p values from Allison et.al 2005. Upper solid line represents Log K_p of 6.1. Lower solid line represents Log K_p of 3.1.

3.1.4 Spatial and Temporal Gradients in Copper Partitioning Coefficients

If the K_p between the benthic sediments and bottom waters is less than the K_p of the overlying waters, this may indicate that the sediments are a source of dissolved copper. These higher relative proportions of dissolved copper at-depth can be an indication of dissolved copper fluxes from the sediment to the harbor.

As presented in Figure 3-1, the dissolved copper concentrations At-surface are higher than the concentrations at Mid-depth, which are higher than the concentrations At-depth, indicating that runoff contributions from the watershed are more likely the source of the dissolved copper in the harbor; however, this comparison does not account for differences in sampling dates and times.. The dissolved copper concentrations in the water column decrease with depth, demonstrating that the legacy contaminations in the sediments could be the lesser source.

Although this elementary comparison presents potential factors for the contamination, a more sophisticated analysis will provide better evidence of this. The dissolved copper concentrations decrease with distance from the watershed outfalls. MdRH-B1 through MdRH-B4 are in the back basins of the harbor, while MdRH-F1 through MdRH-F5 are in the front basins of the harbor, as presented in Figure 2.2.

The log K_p for copper for harbor monitoring locations MdRH-B1 through MdRH-B4 were plotted versus time (Figures 3.8 – 3.11). The log K_p for copper for the benthic sediments were included in these plots. The mean, median, standard deviation and the range for the K_p and the log K_p for the harbor monitoring locations are presented in Table 3-3. The copper K_p and the log K_p for the individual harbor monitoring locations is presented in Appendix D. The remaining log K_p for copper plots, MdRH-F1 through MdRH-F5, are presented in Appendix B. The log K_p versus total copper plots are also presented in Appendix B. Sediment samples were not collected from the front basins. The log K_p for the benthic sediment are higher than the log K_p for the overlying water at all locations except for the March sample at MdRH-B4, Figure 3.11.

Table 3-3. Harbor Water Quality K_p Values, Mean, Standard Deviation, Median, Maximums and Minimums

Statistics	Total Copper (µg/L)	Dissolved Copper (µg/L)	Total SSC (mg/L)	K_p Copper	Log K_p Copper
Mean	5.74	4.02	8.07	124646	4.91
Standard Deviation	2.32	1.98	8.09	99594	0.48
Median	6.05	4.05	3.90	116291	5.07
Maximum	12.00	10.00	32.00	686499	5.84
Minimum	0.78	0.36	0.00	4308	3.63

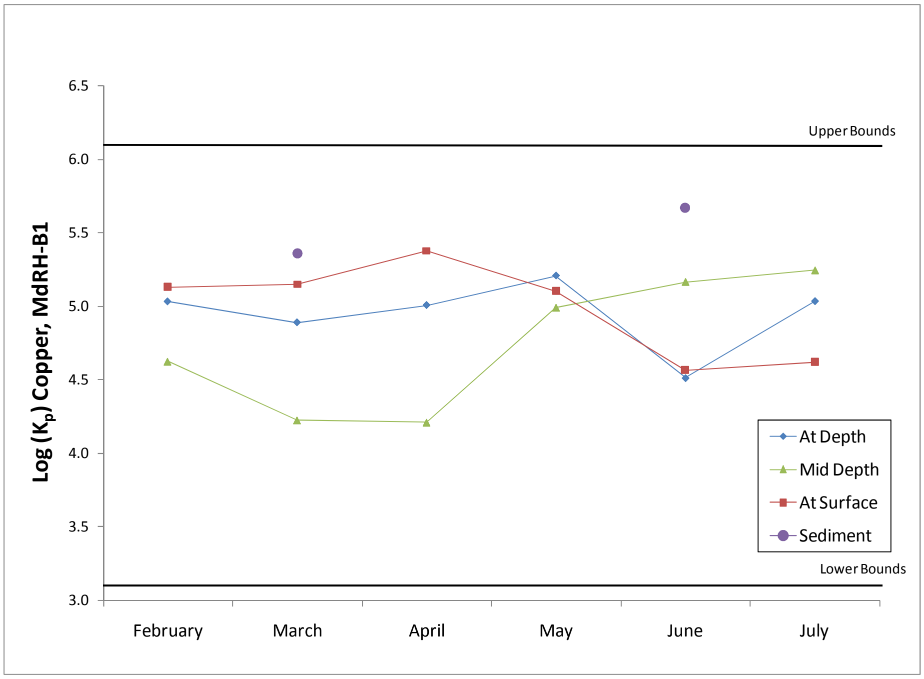

Figure 3.8: Log K_p Values for Copper at MdHR-B1

The Harbor Water Quality At-depth data are represented by blue diamonds. The Mid-depth data are represented by green triangles. The At-surface data are represented by red squares. The Harbor Sediment data are represented by purple circles. The solid lines represent the range of Log K_p values from Allison et.al 2005. Upper solid line represents Log K_p of 6.1. Lower solid line represents Log K_p of 3.1.

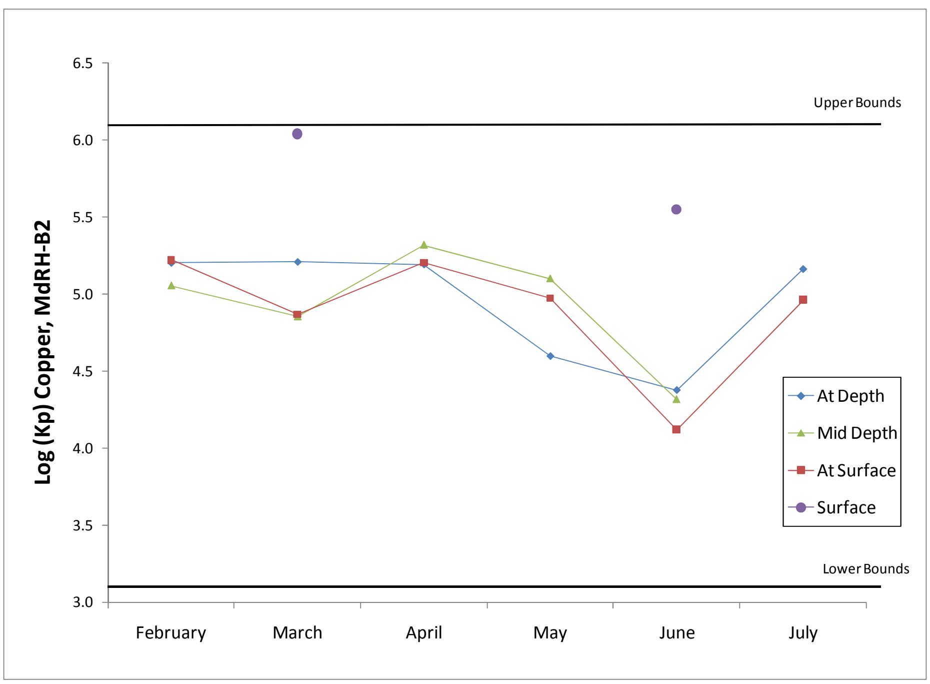

Figure 3.9: Log K_p Values for Copper at MdHR-B2

The Harbor Water Quality At-depth data are represented by blue diamonds. The Mid-depth data are represented by green triangles. The At-surface data are represented by red squares. The Harbor Sediment data are represented by purple circles. The solid lines represent the range of Log K_p values from Allison et.al 2005. Upper solid line represents Log K_p of 6.1. Lower solid line represents Log K_p of 3.1.

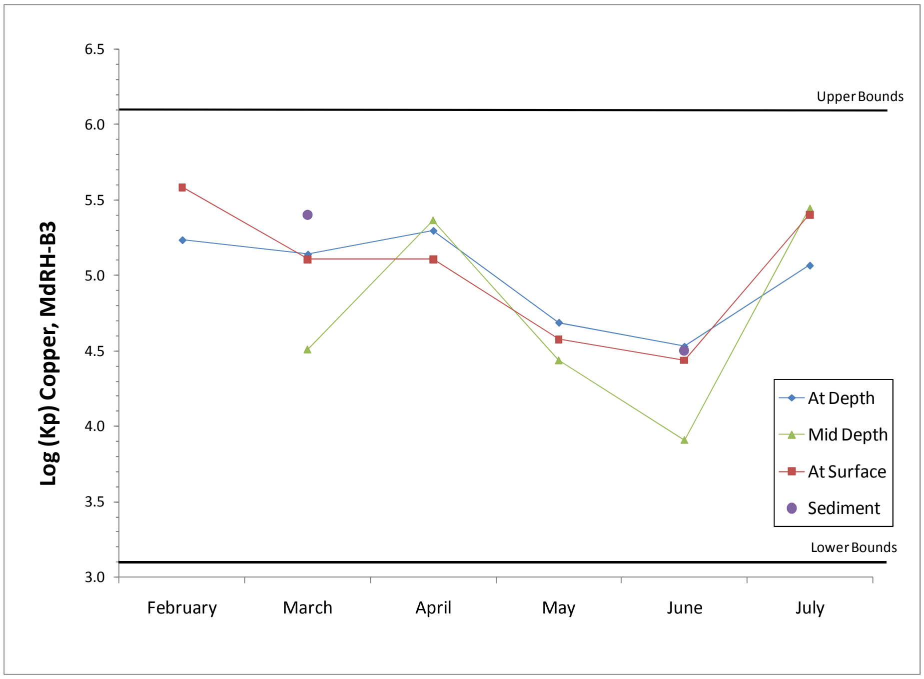

Figure 3.10: Log K_p Values for Copper at MdHR-B3

The Harbor Water Quality At-depth data are represented by blue diamonds. The Mid-depth data are represented by green triangles. The At-surface data are represented by red squares. The Harbor Sediment data are represented by purple circles. The solid lines represent the range of Log K_p values from Allison et.al 2005. Upper solid line represents Log K_p of 6.1. Lower solid line represents Log K_p of 3.1.

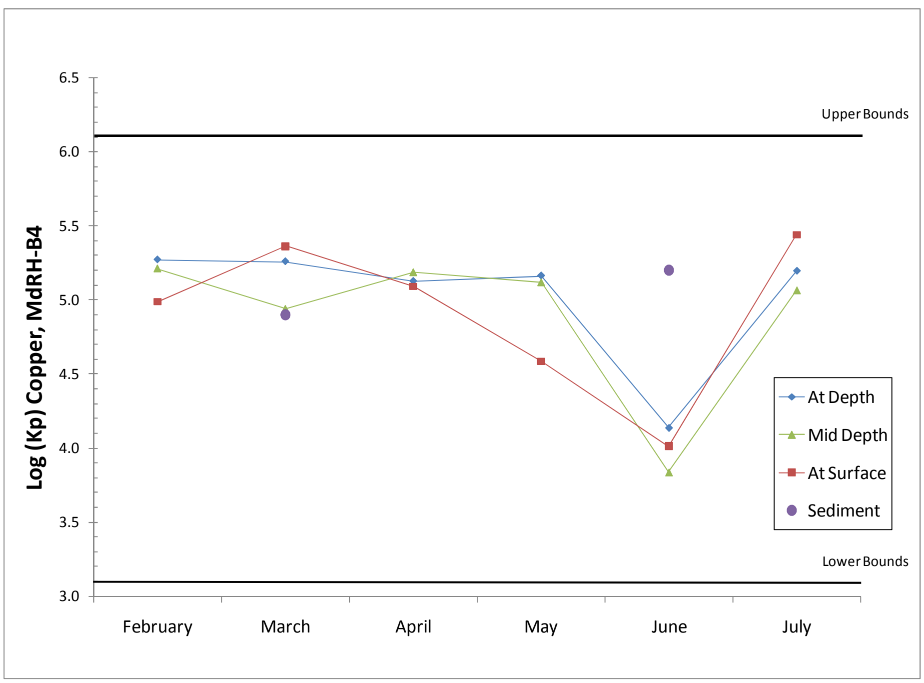

Figure 3.11: Log K_p Values for Copper at MdHR-B4

The Harbor Water Quality At-depth data are represented by blue diamonds. The Mid-depth data are represented by green triangles. The At-surface data are represented by red squares. The Harbor Sediment data are represented by purple circles. The solid lines represent the range of Log K_p values from Allison et.al 2005. Upper solid line represents Log K_p of 6.1. Lower solid line represents Log K_p of 3.1.

The distribution of log K_p for the three depths varied from location to location; therefore, more rigorous statistics were employed to determine if the data varied. A series of analysis of variance (ANOVA) (Tables 3-4 and 3-5) were performed on the dissolved copper concentrations, the total copper concentrations, and log K_p for the overlying water depths. The ANOVA tests for significant differences between two data sets. The results of the ANOVAs performed on each location comparing the depths and the months are presented in Table 3-4. The results of the ANOVAs performed comparing all the depths and months, then the depths and months for the back basins and the depths and months for the front basins are presented in Table 3-5. An "x" is used to indicate if the results of the ANOVA proved that there was a difference between the data sets (i.e., if the *F ratio* was greater than the *F critical*), a "0" indicates that there is no difference present. The full output of the ANOVAs are presented in Appendix C. (The translator is a ratio of dissolved copper to total copper. This is used in greater detail in Appendix E. Additional statistics used to determine correlations between the SSC and the total and dissolved metal concentrations were employed and are presented in Appendix D. The spatial and temporal variability can be viewed on the monitoring location maps presented in Appendix F.)

Table 3-4. Results of the ANOVAs for Each Monitoring Location

Location	Copper		Dissolved Copper		Copper Translator	
	Depth	Month	Depth	Month	Depth	Month
MdRH-B1	0	X	0	X	0	X
MdRH-B2	0	0	X	0	X	0
MdRH-B3	X	X	X	0	X	0
MdRH-B4	X	X	X	X	X	X
MdRH-F1	0	0	X	0	X	X
MdRH-F2	0	0	X	0	X	0
MdRH-F3	0	0	0	X	0	X
MdRH-F4	X	0	X	X	X	X
MdRH-F5	X	X	0	X	0	0

"X" Indicates that a Statistical Difference Exists between the Data Sets.

Based on these results, it is difficult to determine if the data are different and therefore impacted by depth and time. In some cases, no temporal differences were seen, such as total copper concentrations in the front basins. For dissolved copper, temporal differences were seen for MdRH-B1, MdRH-B4, and MdRH-F3 through MdRH-F5, which could be a result of the spatial differences seen in Table 3-5.

Table 3-5. Results of the ANOVAs for Depth

Location	Copper		Dissolved Copper		Copper Translator	
	Spatial	Month	Spatial	Month	Spatial	Month
At-depth	X	X	X	X	0	X
At-surface	X	X	X	X	0	X

Table 3-5. Results of the ANOVAs for Depth

Location	Copper		Dissolved Copper		Copper Translator	
	Spatial	Month	Spatial	Month	Spatial	Month
Mid-depth	X	X	X	X	0	X
Back Basin At-depth	X	X	X	X	0	X
Back Basin At-surface	0	X	0	X	0	X
Back Basin Mid-depth	0	X	0	X	0	X
Front Basin At-depth	X	X	0	X	0	X
Front Basin At-surface	X	X	X	X	0	X
Front Basin Mid-depth	X	X	X	X	0	X

"X" Indicates that a Statistical Difference Exists between the Data Sets.

Based on the results in Table 3-5, there is no difference in the overall log K_p or copper translator (ratio of dissolved copper to total copper) throughout the harbor. However, temporal variations do exist. These could be attributed to dissolved metal discharges from the watershed during the storm season or possible dissolved copper fluxes from the sediments during the dry-weather season.

These ANOVA results (and other statistical analyses presented in Appendix D) suggest that the K_p measurements are inherently noisy and demonstrate a large overall uncertainty. This can be attributed to low SSC in the harbor, which creates a greater relative uncertainty in the data. However, the data are comparable to the literature (Table 3-6, based on Table 2-5).

Table 3-6. Marina del Rey Harbor log K_p Values Compared to Literature Values (log K_p in L/kg) (from Allison et.al. 2005)

Metal	Suspended Matter/Water	Sediment/Water	Suspended Matter/Water	Sediment/Water
Zinc				
median	5.1	3.7	4.4	4.0
range	3.5 – 6.9	1.5 – 6.2	2.9 – 5.5	3.6 – 4.8
N	75	18	162	8
Copper				
median	4.7	4.2	4.9	5.4
range	3.1 – 6.1	0.7 – 6.2	3.6 – 5.8	4.5- 6.0
N	70	12	162	8
Lead				
median	5.6	5.1	5.9	5.3
range	3.4 – 6.5	2.0 – 7.0	4.9 – 6.8	5.1 – 5.8
N	48	24	162	8

Shaded cells indicate the results of the study plan. This study plan is focused on the suspended matter / water and sediment / water partitioning coefficients.

3.1.5 Particulate Copper Concentrations in Stormwater Versus Benthic Sediments

A comparison of the particulate copper concentrations in the stormwater to the copper concentrations in the sediments was performed. Higher particulate concentrations in the stormwater could indicate that the stormwater is an ongoing source of copper to the harbor. If the SSC are higher, this could indicate that there is some other existing or historical source of copper in the harbor.

Copper concentrations in sediment samples are presented in Table 3-1. The range of copper concentrations is 230 to 450 mg/Kg.

The average calculated suspended particulate copper, in mg/Kg, are presented in Figure 3.12. The error bars represent the standard deviations, in this case, the temporal variability of the suspended particulate copper concentrations.

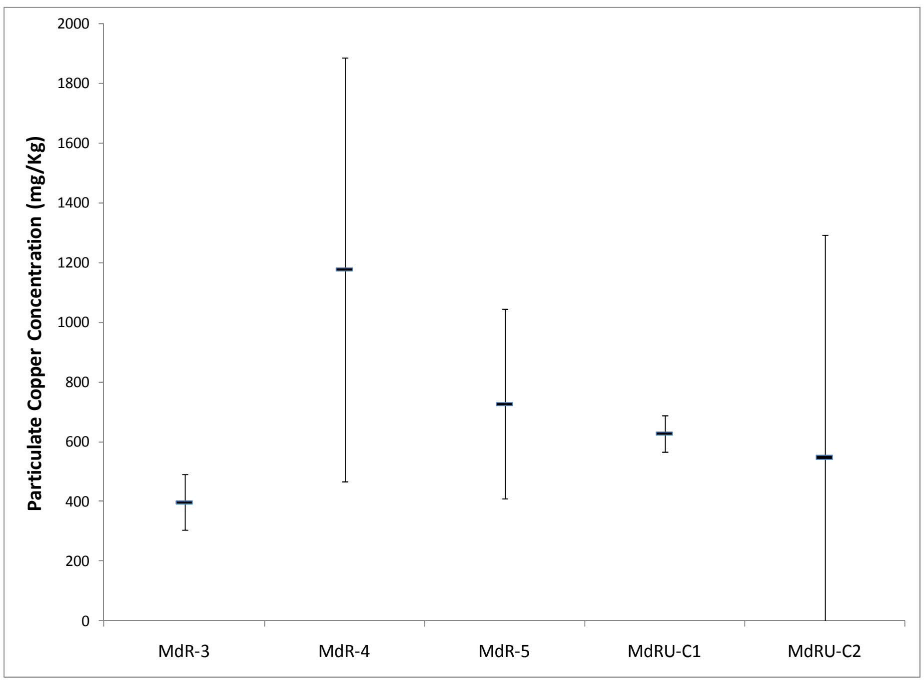

Figure 3.12. Average Suspended Particulate Copper Concentrations for the Stormwater Monitoring Locations

The error bars represent the standard deviations, or the temporal variability.

The range of suspended particulate copper concentrations in the stormwater is between 121 mg/Kg and 2381 mg/Kg. This range is within the same order of magnitude and a little higher than the total copper concentrations in the sediment, indicating that stormwater discharges from the watershed could be contributing to the harbor sediment contamination. The stormwater suspended particulate copper concentrations are higher than the background concentrations established by natural soils (approximately 80 mg/kg in typical California soils), and are consistent with the expected range for urban stormwater runoff.

4. Conclusions

The purpose of this study, per the TMDL, was to:

- *Evaluate partitioning coefficients between water column and sediment to assess the contribution of water column discharges to sediment concentrations in the harbor.*

Studies recommended for this TMDL include:

- *Develop and implement a monitoring program to collect the data necessary to apply a multiple lines of evidence approach;*
- *Refine the relationship between pollutants and suspended solids aimed at better understanding of the delivery of pollutants to the watershed, and*

4.1 Conclusions

The findings fulfill the requirements of the TMDL and the initial study objectives, as outlined in Section 3.

The K_p values were determined for the study. The log K_p values for the harbor water quality and sediment total and dissolved copper concentrations demonstrated that, based on this study and this analysis, the sediments are not the sole source for dissolved copper in the harbor. In locations where the log K_p values for the sediment were greater than the log K_p values for the overlying waters, the storm runoff from the watershed could be the greater factor contributing to dissolved copper concentrations in the water column. However, the differences between the log K_p were within an order of magnitude. The minimum log K_p for the sediment was 4.48, where the harbor water quality log K_p at-depth was a minimum of 3.77, the minimum at-surface log K_p was 3.79, and the minimum for the stormwater quality was 3.9.

Statistical analyses, including ANOVAs, were performed to determine the spatial and temporal variations within the harbor water quality data. While there is some indication that the data are different (more temporally than spatially), there are still too few data points to fully ascertain if the difference is meaningful.

In other words, the log K_p values calculated in this study do not provide additional information on the relationship between water column discharges and sediment concentrations. This is due to the inherent noisiness demonstrated in the data and the results. The log K_p values are comparable to those found in the literature.

The stormwater suspended particulate copper concentrations compared to the sediment copper concentrations indicates that stormwater discharges may affect sediment copper concentrations.

These insights provide valuable information in terms of potential source identification, such as:

1. Stormwater suspended particulate copper concentrations are higher than background established by natural soils, and are consistent with expected range for urban stormwater.
2. Harbor depth demonstrated a significant effect using ANOVA on dissolved copper concentrations, as the dissolved copper concentrations at-surface are higher than those at-depth. This effect could potentially indicate leaching from boat hulls. Although that cannot be proved from the data in this study alone, considerable amounts of data are available from previous studies of copper leaching from marine-based paints (Sanberg and others, 2007; Schiff and others, 2003) and effects of marine paints on dissolved copper in receiving waters (Schiff and others, 2006). Those previous studies support the concept that elevated dissolved copper concentrations would be correlated with relatively higher density of recreation boats in the water and relatively lower water circulation rates. The elevated concentrations at the surface are not likely due to a salinity effect. Although some salinity stratification is found outside the MdR Harbor mouth in Ballona Creek, within the harbor salinity tends to be relatively uniform with depth (Beaches and Harbors, 2001).
3. Boat hulls with copper based paint could also affect benthic sediment copper concentrations, as previously noted in other reviews (e.g., Srinivasan and Swain, 2007).

5. Limitations

This document was prepared solely for County of Los Angeles Department of Public Works, the City of Los Angeles, Culver City, and California Department of Transportation in accordance with professional standards at the time the services were performed and in accordance with the contract between County of Los Angeles Department of Public Works and Brown and Caldwell dated June 23, 2009. This document is governed by the specific scope of work authorized by County of Los Angeles Department of Public Works; it is not intended to be relied upon by any other party except for regulatory authorities contemplated by the scope of work. We have relied on information or instructions provided by County of Los Angeles Department of Public Works, the City of Los Angeles, Culver City, and California Department of Transportation, unless otherwise expressly indicated, have made no independent investigation as to the validity, completeness, or accuracy of such information.

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Appendix A: Raw Data Tabulated

Harbor Water Quality Data (Raw)										
Date	Location	Total Copper µg/L	Total Lead µg/L	Total Zinc µg/L	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	Suspended Sediment Concentration, Fine mg/L	Suspended Sediment Concentration, Coarse mg/L	Total Suspended Sediment Concentration mg/L
February	B1_AD_022411	4.1	0.56	29	3.1	0.074	26	3	0	3
	B1_AS_022411	6	0.34	43	5.3	0.096	41	1.7	0	1.7
	B2_AD_022411	2.6	0.81	20	1.6	0.054	17	3.9	0	3.9
	B2_AS_022411	6.3	0.39	46	5.6	0.1	44	1.1	0	1.1
	B3_AD_022411	2.4	0.52	17	1.6	0.098	15	2.9	0	2.9
	B3_AS_022411	6.3	0.28	40	5.5	0.11	37	0	0	0
	B4_AD_022411	2.1	0.68	15	1.3	0.089	12	3.3	0	3.3
	B4_AS_022411	6.6	0.32	43	5.6	0.1	39	1.1	0	1.1
	F1_AD_022411	2.1	0.86	14	1.3	0.11	12	2.8	0	2.8
	F1_AS_022411	6.5	0.26	46	5.6	0.14	44	0	0	0
	F2_AD_022411	2.8	0.93	16	1.5	0.095	13	4	0	4
	F2_AS_022411	6.9	0.26	41	5.9	0.11	42	0	0	0
	F3_AD_022411	2.9	0.93	16	1.6	0.049	14	3.8	0	3.8
	F3_AS_022411	7.7	0.26	47	6.6	0.12	47	0	0	0
	F4_AD_022411	2.3	0.56	15	1.5	0.097	14	2	0	2
	F4_AS_022411	6.7	0.24	41	5.7	0.098	41	1	0	1
	F5_AD_022411	3.1	0.53	20	2.2	0.11	19	2	0	2
	F5_AS_022411	4.5	0.33	28	3.7	0.11	27	1	0	1
	MdRH-B-1_022411	5.1	0.45	36	4.1	0.085	33	2.4	0	2.4
	MdRH-B-2_022411	2.8	0.5	24	2.1	0.1	21	2	0	2
	MdRH-B-3_022411	3.6	0.37	26	2.6	0.093	21	1	0	1
	MdRH-B-4_022411	5.2	0.4	37	4.5	0.1	35	1.6	0	1.6
	MdRH-F-1_022411	6.2	0.38	45	4.6	0.13	39	1.2	0	1.2
	MdRH-F-2_022411	6.9	0.27	47	5.8	0.11	42	1.1	0	1.1
	MdRH-F-3_022411	8.5	0.28	54	6.9	0.11	49	1.6	0	1.6
	MdRH-F-4_022411	3.6	0.31	25	2.8	0.098	23	0	0	0
	MdRH-F-5_022411	4.2	0.34	29	3.2	0.1	27	1.7	0	1.7

Harbor Water Quality Data (Raw)										
Date	Location	Total Copper µg/L	Total Lead µg/L	Total Zinc µg/L	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	Suspended Sediment Concentration, Fine mg/L	Suspended Sediment Concentration, Coarse mg/L	Total Suspended Sediment Concentration mg/L
March	B1_AD_022411	1.5	0.68	12	0.94	0.095	12	3.7	0	3.7
	B1_AS_022411	8.6	0.38	54	8.2	0.13	60	1.5	0	1.5
	B2_AD_022411	2.8	1.2	14	1.1	0.1	13	9.5	0	9.5
	B2_AS_022411	11	0.37	62	10	0.14	68	1.4	0	1.4
	B3_AD_022411	1.3	0.79	10	0.71	0.085	9	6	0	6
	B3_AS_022411	6.9	0.38	35	6.5	0.13	38	1.9	0	1.9
	B4_AD_022411	0.85	0.63	6.3	0.45	0.088	5.3	4.9	0	4.9
	B4_AS_022411	6.9	0.35	42	6.2	0.11	44	1.3	0	1.3
	F1_AD_022411	0.98	0.9	8.6	0.56	0.088	7.2	2.9	0	2.9
	F1_AS_022411	7.4	0.41	51	6.2	0.14	49	1.5	0	1.5
	F2_AD_022411	1.2	0.83	8.4	0.72	0.087	8.1	2.9	0	2.9
	F2_AS_022411	8.9	0.36	55	7	0.13	48	2.8	0	2.8
	F3_AD_022411	1.8	0.89	13	0.97	0.082	11	3.6	0	3.6
	F3_AS_022411	8.3	0.39	55	6.5	0.13	50	1.7	0	1.7
	F4_AD_022411	0.78	0.64	6.5	0.4	0.097	4.7	2.9	0	2.9
	F4_AS_022411	6.7	0.31	43	5.7	0.11	40	2	0	2
	F5_AD_022411	0.87	0.76	5.9	0.36	0.078	3.9	3.3	0	3.3
	F5_AS_022411	4.7	0.4	29	4	0.098	30	1.8	0	1.8
	MdRH-B-1_022411	3.1	0.67	27	2.4	0.11	28	2.7	0	2.7
	MdRH-B-2_022411	4	0.93	25	2.7	0.11	25	6.5	0	6.5
	MdRH-B-3_022411	2.8	0.65	20	2.1	0.094	21	2.6	0	2.6
	MdRH-B-4_022411	2.4	0.59	15	1.5	0.092	15	2.6	0	2.6
	MdRH-F-1_022411	1.2	0.89	9.7	0.81	0.13	9	2.7	0	2.7
	MdRH-F-2_022411	2.3	0.72	19	1.6	0.11	19	2.3	0	2.3
	MdRH-F-3_022411	2.9	0.72	26	2.1	0.11	27	1.7	0	1.7
	MdRH-F-4_022411	1.3	0.68	10	0.83	0.092	8.7	2.9	0	2.9
	MdRH-F-5_022411	1.1	0.6	8.6	0.77	0.054	7.6	1.8	0	1.8

Harbor Water Quality Data (Raw)										
Date	Location	Total Copper µg/L	Total Lead µg/L	Total Zinc µg/L	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	Suspended Sediment Concentration, Fine mg/L	Suspended Sediment Concentration, Coarse mg/L	Total Suspended Sediment Concentration mg/L
April	B1_AD_022411	6.2	0.88	42	3.7	0.1	36	5	0	5
	B1_AS_022411	6.3	0.7	41	4.1	0.12	37	3.8	0	3.8
	B2_AD_022411	6.1	0.61	42	3.9	0.099	37	3.6	0	3.6
	B2_AS_022411	6.3	0.45	45	4.2	0.097	41	2.4	0	2.4
	B3_AD_022411	4.9	0.93	32	2.7	0.11	25	4.1	0	4.1
	B3_AS_022411	7.3	0.51	40	4.9	0.13	38	2.1	0	2.1
	B4_AD_022411	4.9	0.89	31	2.7	0.14	24	6.1	0	6.1
	B4_AS_022411	5.9	0.46	38	4	0.12	33	3.1	0	3.1
	F1_AD_022411	5.6	0.6	40	4.1	0.14	36	3.7	0	3.7
	F1_AS_022411	5.2	0.62	34	4.1	0.18	32	2.5	0	2.5
	F2_AD_022411	4.2	0.69	29	3	0.14	25	2.1	0	2.1
	F2_AS_022411	5.9	0.45	35	4.5	0.13	33	2.5	0	2.5
	F3_AD_022411	6	0.45	38	4.5	0.12	37	2.4	0	2.4
	F3_AS_022411	6	0.45	38	4.7	0.12	37	2.5	0	2.5
	F4_AD_022411	3.7	0.76	23	2.5	0.12	20	4.5	0	4.5
	F4_AS_022411	5	0.32	32	4.1	0.11	30	2.5	0	2.5
	F5_AD_022411	3.9	0.78	24	2.6	0.15	21	4.2	0	4.2
	F5_AS_022411	4.2	0.59	26	3.1	0.12	23	2.8	0	2.8
	MdRH-B-1_022411	6.2	0.74	42	3.1	0.12	29	4.2	0	4.2
	MdRH-B-2_022411	6.3	0.43	49	4.6	0.1	41	2.3	0	2.3
	MdRH-B-3_022411	5	0.9	35	3.2	0.11	28	4.4	0	4.4
	MdRH-B-4_022411	4.7	0.65	34	3.4	0.13	28	3.1	0	3.1
	MdRH-F-1_022411	5.7	0.52	41	4.3	0.15	38	2.7	0	2.7
	MdRH-F-2_022411	5.7	0.44	37	4.3	0.14	35	3.4	0	3.4
	MdRH-F-3_022411	6	0.44	41	4.5	0.12	38	2	0	2
	MdRH-F-4_022411	4.1	0.57	28	2.9	0.11	25	2.8	0	2.8
	MdRH-F-5_022411	4.1	0.61	27	2.8	0.12	24	3.2	0	3.2

Harbor Water Quality Data (Raw)										
Date	Location	Total Copper µg/L	Total Lead µg/L	Total Zinc µg/L	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	Suspended Sediment Concentration, Fine mg/L	Suspended Sediment Concentration, Coarse mg/L	Total Suspended Sediment Concentration mg/L
May	B1_AD_022411	11	2.3	37	3.6	0.28	27	16.2	0	16.2
	B1_AS_022411	7.9	1.3	33	4.1	0.28	30	25.2	0	25.2
	B2_AD_022411	10	1.8	38	4.4	0.23	33	32	0	32
	B2_AS_022411	8.4	1	37	5	0.24	38	5.4	0	5.4
	B3_AD_022411	6.3	1.2	25	3.1	0.2	21	21.1	0	21.1
	B3_AS_022411	6.7	0.88	23	4.2	0.2	22	21.7	0	21.7
	B4_AD_022411	4.6	1.4	17	2.2	0.21	15	7.5	0	7.5
	B4_AS_022411	6.4	0.88	26	4.2	0.22	25	4	0	4
	F1_AD_022411	6.3	1.2	28	3.8	0.28	23	13.5	0	13.5
	F1_AS_022411	6.2	0.92	28	4.1	0.28	26	17.2	0	17.2
	F2_AD_022411	7	1.1	28	4.4	0.29	24	16.1	0	16.1
	F2_AS_022411	6.1	0.84	28	4.4	0.27	25	22.4	0	22.4
	F3_AD_022411	6.9	0.96	30	4.6	0.25	26	5.3	0	5.3
	F3_AS_022411	7.5	1	32	4.7	0.28	31	6	0	6
	F4_AD_022411	3.7	1	17	2.1	0.23	13	5	0	5
	F4_AS_022411	5.6	0.59	26	3.9	0.2	22	3.6	0	3.6
	F5_AD_022411	3.4	0.73	16	2	0.22	15	3.6	0	3.6
	F5_AS_022411	4.4	0.68	21	2.8	0.19	18	14.7	0	14.7
	MdRH-B-1_022411	8.2	1.4	34	4	0.19	28	25.2	0	25.2
	MdRH-B-2_022411	9.9	1.6	39	5	0.2	33	10.4	0	10.4
	MdRH-B-3_022411	7.1	1.3	27	3.6	0.21	24	25.8	0	25.8
	MdRH-B-4_022411	6	0.96	27	3.5	0.18	23	18.6	0	18.6
	MdRH-F-1_022411	6.1	1.2	28	3.7	0.21	26	19.9	0	19.9
	MdRH-F-2_022411	6.8	0.87	29	4.3	0.19	26	6.3	0	6.3
	MdRH-F-3_022411	7.4	1	33	4.6	0.21	30	5	0	5
	MdRH-F-4_022411	4.2	0.87	20	2.6	0.16	20	23.8	0	23.8
	MdRH-F-5_022411	4.3	0.8	20	2.5	0.16	18	10.9	0	10.9

Harbor Water Quality Data (Raw)										
Date	Location	Total Copper µg/L	Total Lead µg/L	Total Zinc µg/L	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	Suspended Sediment Concentration, Fine mg/L	Suspended Sediment Concentration, Coarse mg/L	Total Suspended Sediment Concentration mg/L
June	B1_AD_022411	11	0.46	59	7.3	0.1	46	12.1	0	12.1
	B1_AS_022411	12	0.45	61	8.5	0.12	50	24.6	0	24.6
	B2_AD_022411	6	0.79	47	3.9	0.062	39	22.5	0	22.5
	B2_AS_022411	11	0.39	61	7.8	0.081	50	19.7	0	19.7
	B3_AD_022411	7.6	0.88	42	4.5	0.13	33	20.3	0	20.3
	B3_AS_022411	8	0.58	40	7.1	0.13	42	15.6	0	15.6
	B4_AD_022411	6.5	0.64	36	5.2	0.1	37	18.2	0	18.2
	B4_AS_022411	9.6	0.37	50	9	0.11	54	9.7	0	9.7
	F1_AD_022411	7	0.64	44	5.7	0.15	42	30.8	0	30.8
	F1_AS_022411	8.1	0.54	49	6.7	0.21	45	25.7	0	25.7
	F2_AD_022411	7.7	0.56	43	6.5	0.13	41	21.8	0	21.8
	F2_AS_022411	8.3	0.41	43	6.9	0.15	41	18.9	0	18.9
	F3_AD_022411	8.9	0.5	50	8.4	0.16	51	10.2	0	10.2
	F3_AS_022411	8.8	0.37	49	8.2	0.12	49	11.8	0	11.8
	F4_AD_022411	5.9	0.48	34	5.1	0.085	34	26	0	26
	F4_AS_022411	7.8	0.37	43	6.9	0.12	41	16.1	0	16.1
	F5_AD_022411	4.6	0.78	29	3.4	0.14	27	10.9	0	10.9
	F5_AS_022411	6	0.5	38	4.1	0.14	30	17.7	0	17.7
	MdRH-B-1_022411	8.5	0.6	51	7.4	0.082	51	9.2	0	9.2
	MdRH-B-2_022411	8.2	0.44	56	7.2	0.078	54	10.5	0	10.5
	MdRH-B-3_022411	7.4	1.1	43	5.5	0.17	42	12.6	0	12.6
	MdRH-B-4_022411	7.9	0.7	47	6.4	0.13	47	22.8	0	22.8
	MdRH-F-1_022411	7.3	0.4	47	6.5	0.15	46	27.5	0	27.5
	MdRH-F-2_022411	7.2	0.38	43	6.5	0.13	41	25	0	25
	MdRH-F-3_022411	8.8	0.79	52	7.9	0.25	50	19.5	0	19.5
	MdRH-F-4_022411	4.8	0.57	32	3.9	0.059	30	21.1	0	21.1
	MdRH-F-5_022411	4.2	0.63	29	3.4	0.12	27	21.5	0	21.5

Harbor Water Quality Data (Raw)										
Date	Location	Total Copper µg/L	Total Lead µg/L	Total Zinc µg/L	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	Suspended Sediment Concentration, Fine mg/L	Suspended Sediment Concentration, Coarse mg/L	Total Suspended Sediment Concentration mg/L
July	B1_AD_022411	7.7	1	40	3.7	0.11	27	11.1	0	11.1
	B1_AS_022411	7.1	0.56	40	4.7	0.11	31	3.5	0	3.5
	B2_AD_022411	6.1	0.85	37	3.2	0.075	26	6.2	0	6.2
	B2_AS_022411	7.6	0.43	47	5.5	0.1	40	0	0	0
	B3_AD_022411	6.3	0.9	31	3.4	0.12	21	7.3	0	7.3
	B3_AS_022411	6.7	0.51	33	4.3	0.11	24	2	0	2
	B4_AD_022411	4.7	1.5	24	1.8	0.083	13	10.3	0	10.3
	B4_AS_022411	7.4	0.48	41	5.1	0.12	33	3.9	0	3.9
	F1_AD_022411	4.1	0.92	22	2.2	0.22	15	16.1	0	16.1
	F1_AS_022411	6.8	0.43	43	4.8	0.12	33	3.6	0	3.6
	F2_AD_022411	3.9	1.2	22	1.7	0.13	13	5.3	0	5.3
	F2_AS_022411	7.5	0.37	36	4.8	0.12	27	20.5	0	20.5
	F3_AD_022411	4.5	1.7	20	1.5	0.15	10	21.4	0	21.4
	F3_AS_022411	6.6	0.41	38	4.5	0.12	29	1.7	0	1.7
	F4_AD_022411	4.4	1.5	24	1.8	0.18	15	5.2	0	5.2
	F4_AS_022411	5.6	0.47	31	4.4	0.13	27	5.2	0	5.2
	F5_AD_022411	4.3	0.87	24	2.2	0.17	15	6.3	0	6.3
	F5_AS_022411	5.4	1.7	44	3	0.6	33	7.6	0	7.6
	MdRH-B-1_022411	9.7	1.6	47	3.6	0.12	28	9.7	0	9.7
	MdRH-B-2_022411	8.1	0.38	51	5.8	0.11	42	4.3	0	4.3
	MdRH-B-3_022411	7	0.52	35	4.5	0.14	27	2.2	0	2.2
	MdRH-B-4_022411	7.2	0.62	39	4	0.1	28	2.9	0	2.9
	MdRH-F-1_022411	5.5	0.53	33	3.2	0.17	21	17.2	0	17.2
	MdRH-F-2_022411	6.3	0.51	34	4.6	0.12	27	3.9	0	3.9
	MdRH-F-3_022411	6.6	0.81	36	3.7	0.11	26	21.5	0	21.5
	MdRH-F-4_022411	4.9	1.3	27	1.9	0.18	16	2.3	0	2.3
	MdRH-F-5_022411	4.9	0.76	33	2.9	0.16	24	1.5	0	1.5

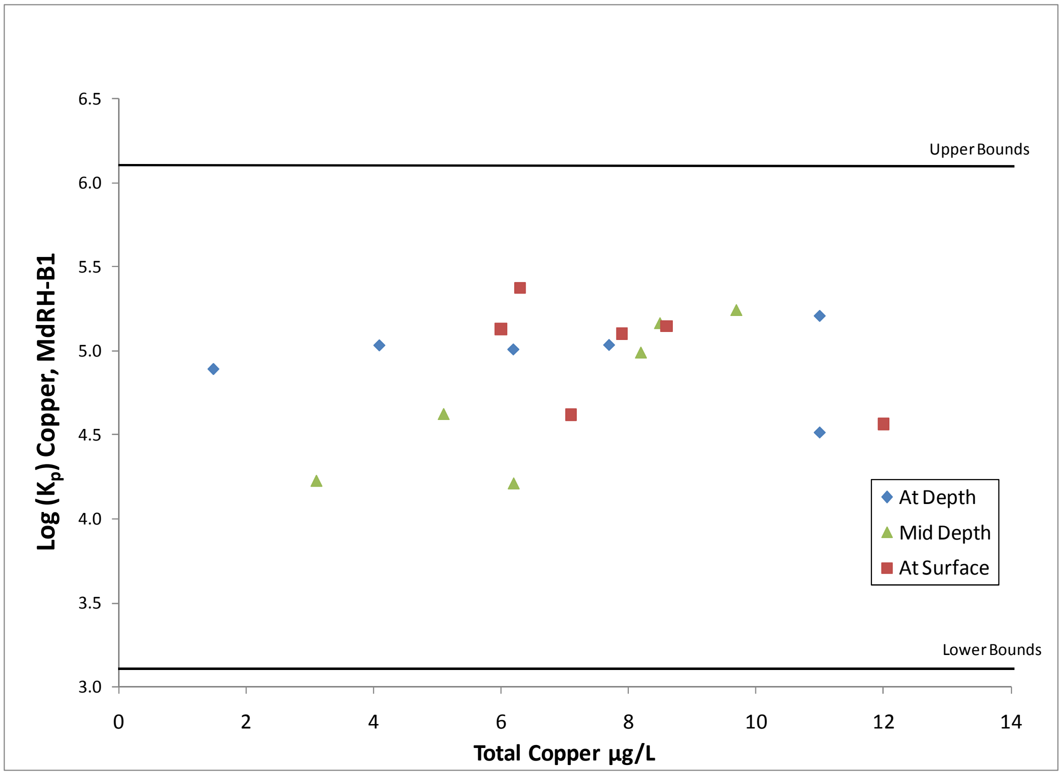
Sediment Pore Water Data (Raw) in µg/L							
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper	Dissolved Lead	Dissolved Zinc
March	MdRH-B1	3.00	0.58	51.00	1.80	0.57	18.00
	MdRH-B2	1.80	0.77	12.00	0.41	0.80	6.60
	MdRH-B3	6.70	0.88	48.00	1.70	0.40	20.00
	MdRH-B4	6.50	0.38	72.00	3.30	0.34	49.00
June	MdRH-B1	7.60	1.10	81.00	0.73	0.19	22.00
	MdRH-B2	3.50	2.40	21.00	1.10	0.12	70.00
	MdRH-B3	7.90	1.40	68.00	12.00	0.42	79.00
	MdRH-B4	3.90	0.91	53.00	1.60	0.29	44.00

Sediment Data (Raw)										
Date	Location	Total Copper mg/Kg	Total Lead mg/Kg	Total Zinc mg/Kg	Percent Moisture %	Percent Solids %	Clay %	Silt %	Sand %	Gravel %
March	MdRH-B1	410	73	360	63.02	36.98	16.09	75.73	8.17	ND
	MdRH-B2	450	92	440	65.54	34.46	21.07	77.43	1.50	ND
	MdRH-B3	390	88	370	64.95	35.05	17.56	77.51	4.93	ND
	MdRH-B4	260	66	290	60.87	39.13	14.78	78.87	6.35	ND
June	MdRH-B1	340	61	300	60.92	39.08	15.48	75.06	9.46	ND
	MdRH-B2	390	80	370	61.41	38.59	23.20	76.79	0.01	ND
	MdRH-B3	360	82	330	63.38	36.62	19.31	80.31	0.38	ND
	MdRH-B4	230	61	250	56.63	43.37	14.80	77.44	7.75	ND

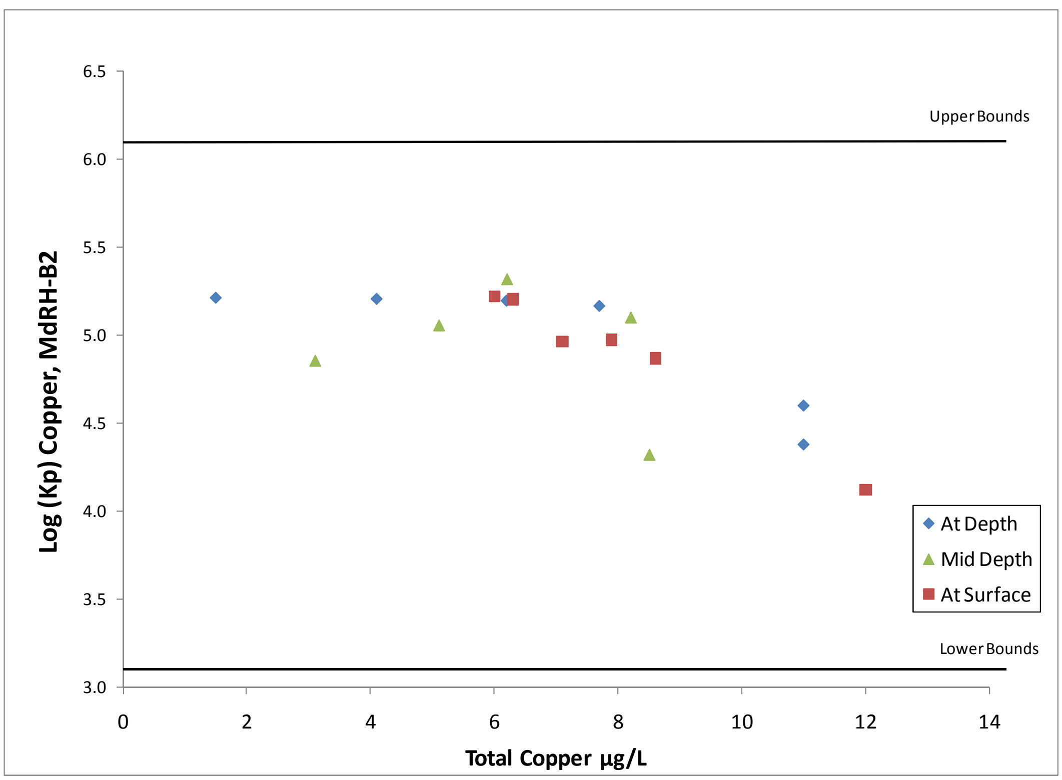
Stormwater Metals Data (Raw) mg/L									
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper	Dissolved Lead	Dissolved Zinc	Suspended Sediment Concentration, Fine	Suspended Sediment Concentration, Coarse
2/15/2011	MdR-3	0.02	-99	0.062	0.017	-99	0.049	5.4	-99
	MdR-4	0.044	-99	0.16	0.02	-99	0.079	9	11
	MdR-5	0.019	-99	0.061	0.017	-99	0.055	1.7	-99
	MdRU-C1	0.03	-99	0.04	0.027	-99	0.026	-99	-99
	MdRU-C2	0.029	-99	0.045	0.026	-99	0.033	1.6	-99
2/17/2011	MdR-3	0.15	0.08	0.89	0.0098	-99	0.092	69	318
	MdR-4	0.01	-99	0.053	0.005	-99	0.039	2.1	-99
	MdR-5	0.028	0.011	0.13	0.01	-99	0.051	27.3	2
	MdRU-C1	0.056	0.021	0.22	0.013	-99	0.073	31.7	36
	MdRU-C2	0.094	0.1	0.24	0.011	-99	0.026	285	79
2/25/2011	MdR-3	0.027	0.016	0.19	0.0065	-99	0.079	33.1	19
	MdR-4	0.012	-99	0.085	0.0042	-99	0.063	10.7	-99
	MdR-5	0.015	-99	0.069	0.0097	-99	0.05	9.3	-99
	MdRU-C1	0.03	0.0083	0.11	0.011	-99	0.061	21	6
	MdRU-C2	0.041	0.049	0.088	0.014	-99	0.035	182	42
3/20/2011	MdR-3	0.045	0.018	0.27	0.02	-99	0.16	32.3	36
	MdR-4	0.016	-99	0.064	0.0053	-99	0.037	5.6	5.6
	MdR-5	0.013	-99	0.074	0.0072	-99	0.05	13.5	2.3
	MdRU-C1	0.041	0.016	0.13	0.01	-99	0.05	24.9	25.8
	MdRU-C2	0.024	0.0098	0.082	0.015	-99	0.048	20	10.2
3/25/2011	MdR-3	0.029	0.02	0.16	0.01	-99	0.073	35.9	25.4
	MdR-4	0.012	-99	0.042	0.0046	-99	0.028	3.1	8.9
	MdR-5	0.011	-99	0.034	0.0071	-99	0.034	4.3	-99
	MdRU-C1	0.037	0.017	0.11	0.01	-99	0.036	28.8	19.7
	MdRU-C2	0.016	0.007	0.044	0.012	-99	0.029	14.2	4.3

Appendix B: Additional Log K_p Plots

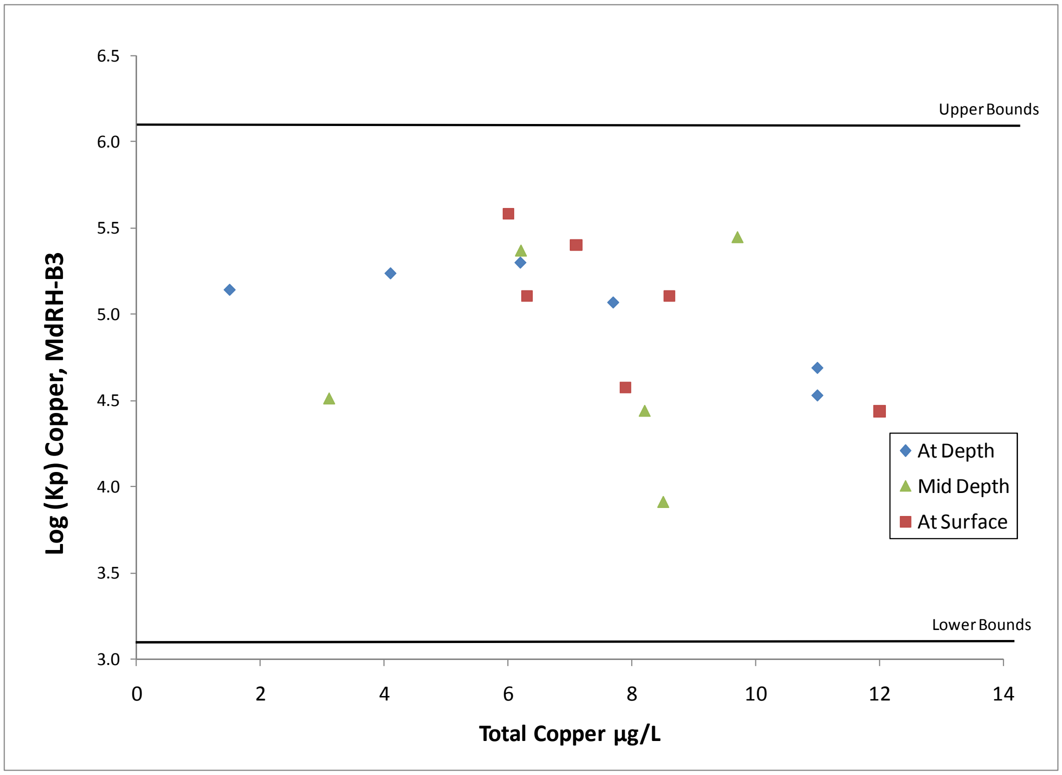
Front Basin Log K_p Plots vs. Time, Front and Back Basin Plots Log K_p vs. Total Copper



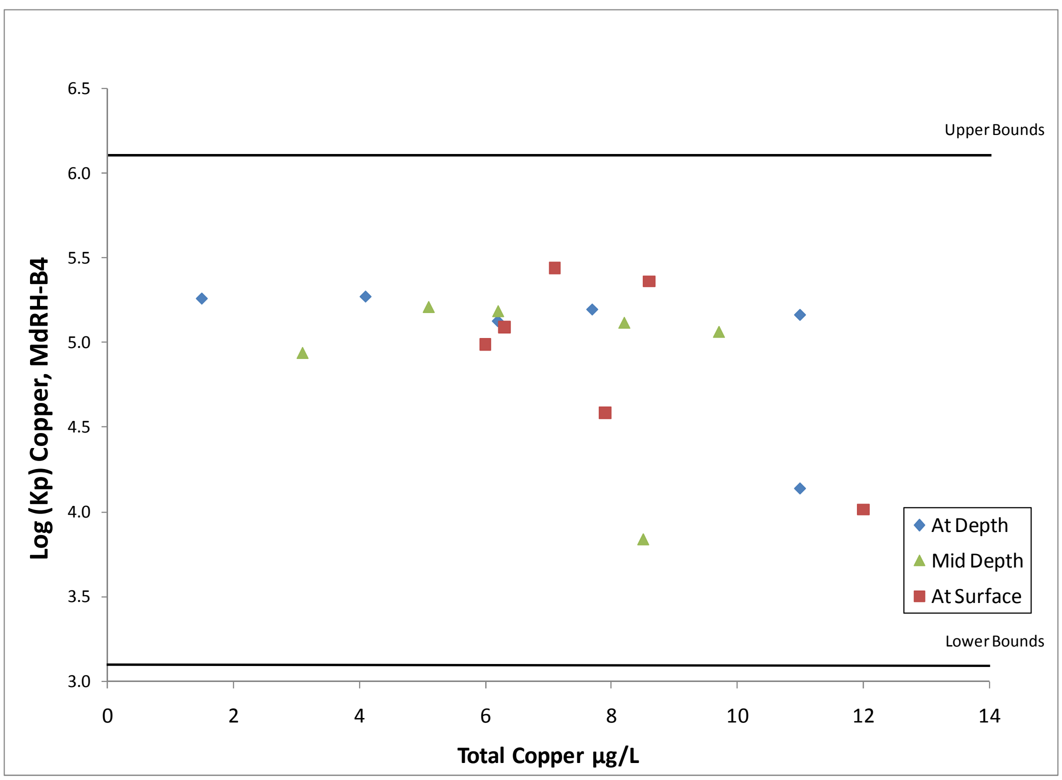
Upper Bounds
Lower Bounds
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
0
2
4
6
8
10
12
14
Log (K_p) Copper, MdRH-B1
Total Copper µg/L
At Depth
Mid Depth
At Surface



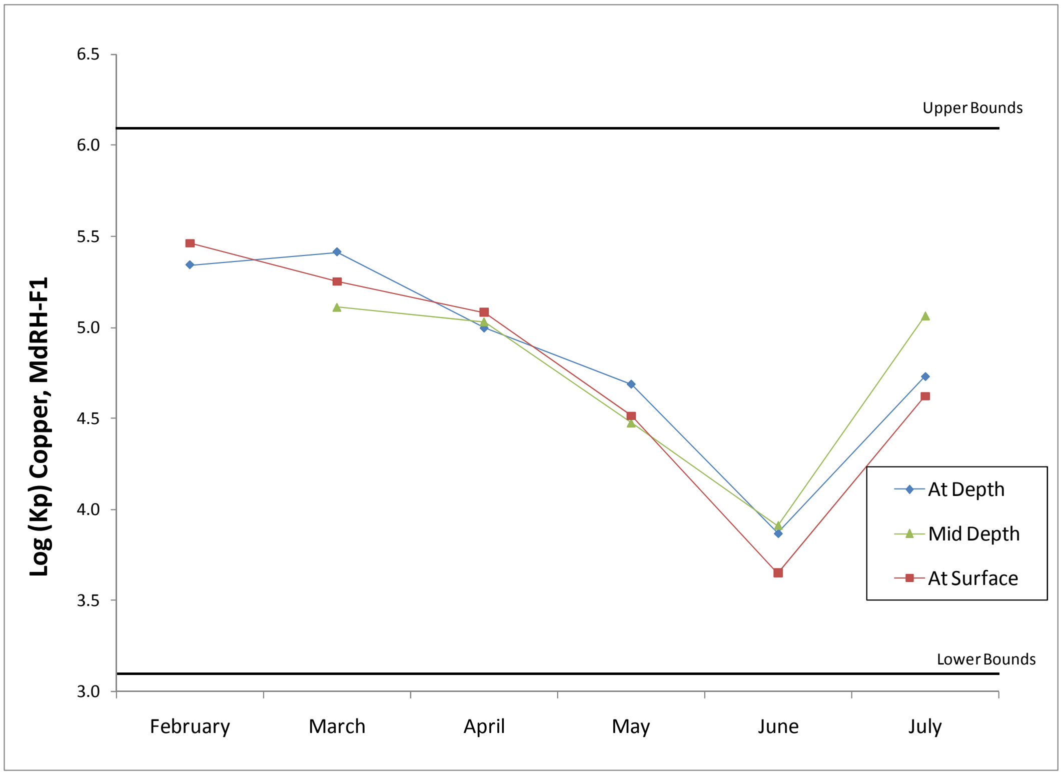
Upper Bounds
Lower Bounds
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
0
2
4
6
8
10
12
14
Log (Kp) Copper, MdRH-B2
Total Copper µg/L
At Depth
Mid Depth
At Surface

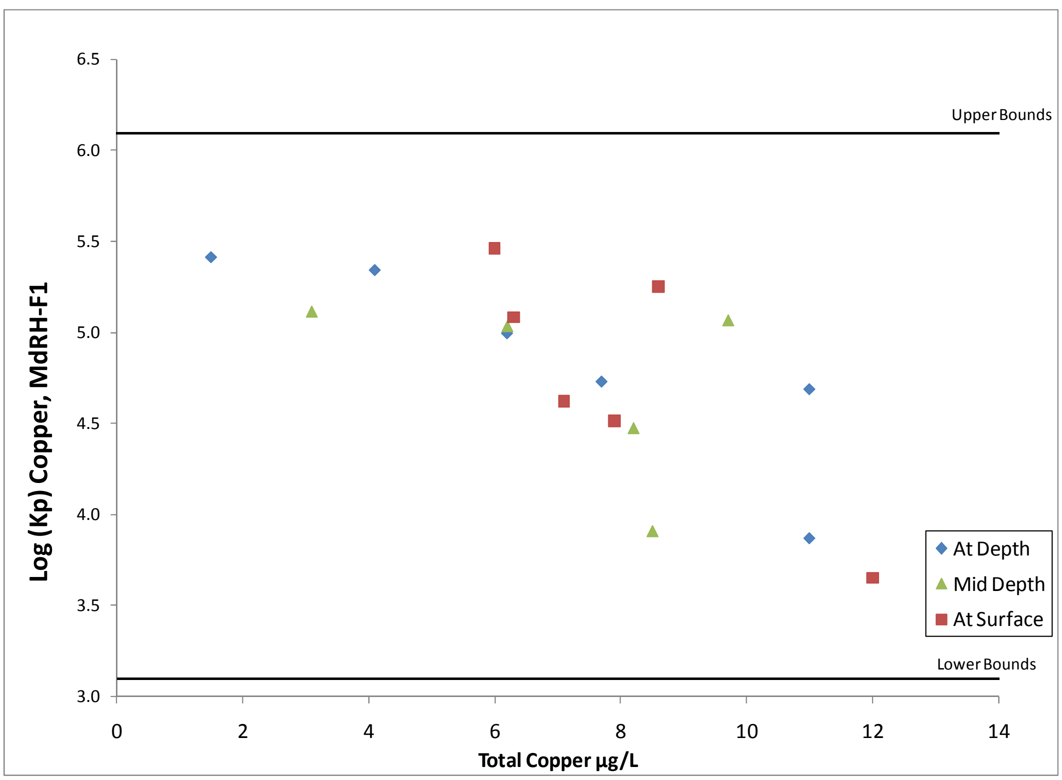


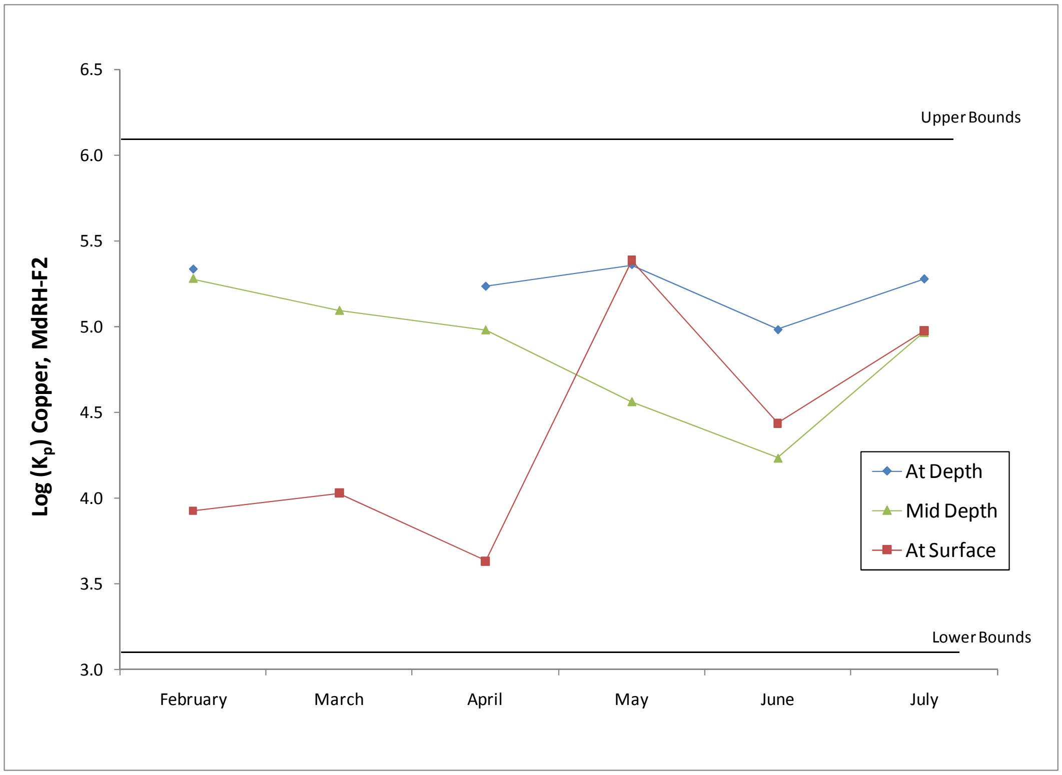
Log (Kp) Copper, MdRH-B3
Total Copper µg/L
Upper Bounds
Lower Bounds
At Depth
Mid Depth
At Surface
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
0
2
4
6
8
10
12
14



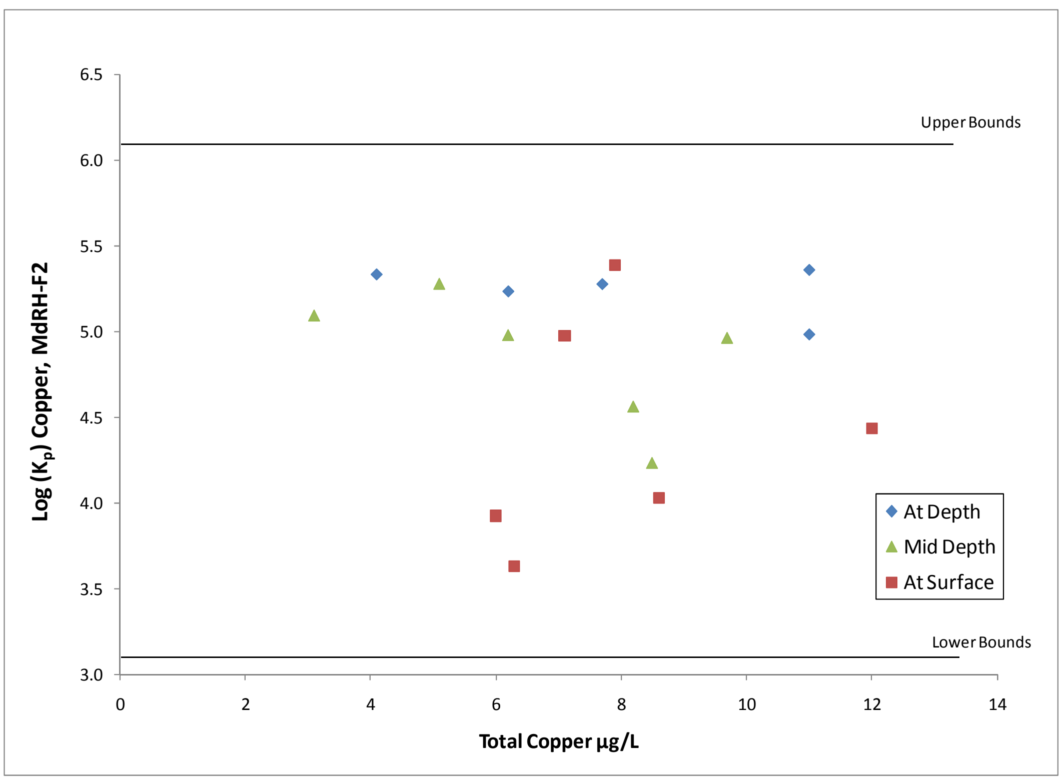
Log (Kp) Copper, MdRH-B4
Total Copper µg/L
Upper Bounds
Lower Bounds
At Depth
Mid Depth
At Surface
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
0
2
4
6
8
10
12
14


6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Upper Bounds
Lower Bounds
Log (Kp) Copper, MdRH-F1
February
March
April
May
June
July
At Depth
Mid Depth
At Surface

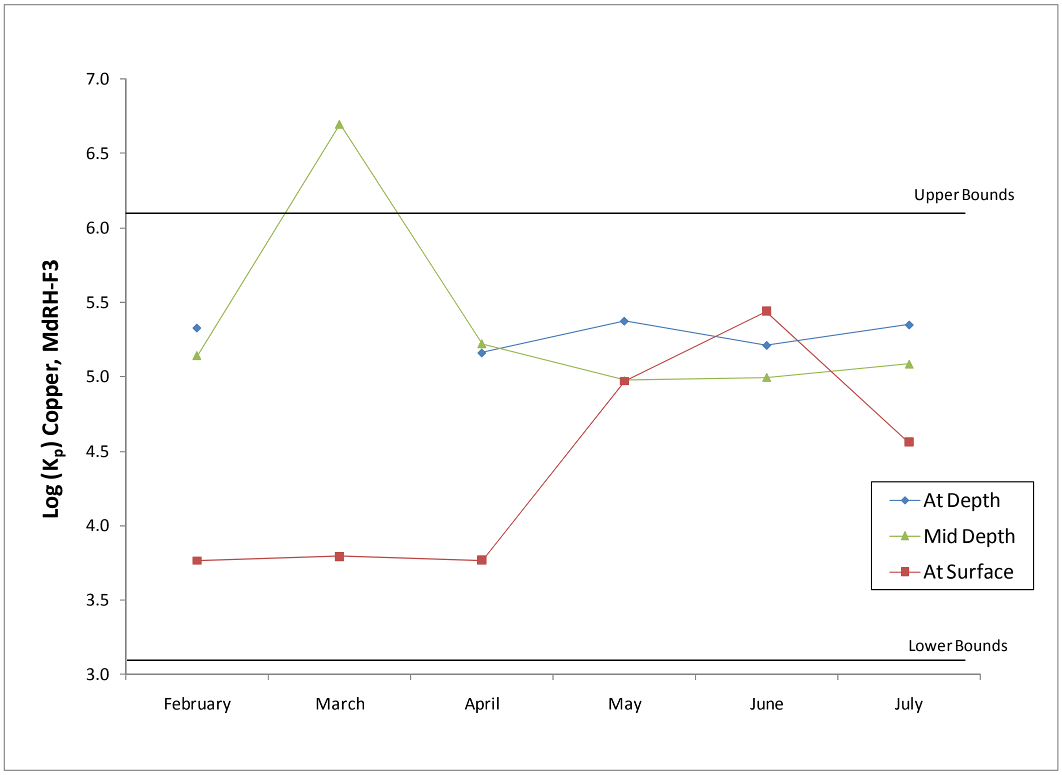

6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Upper Bounds
Lower Bounds
Log (Kp) Copper, MdRH-F1
0
2
4
6
8
10
12
14
Total Copper µg/L
At Depth
Mid Depth
At Surface

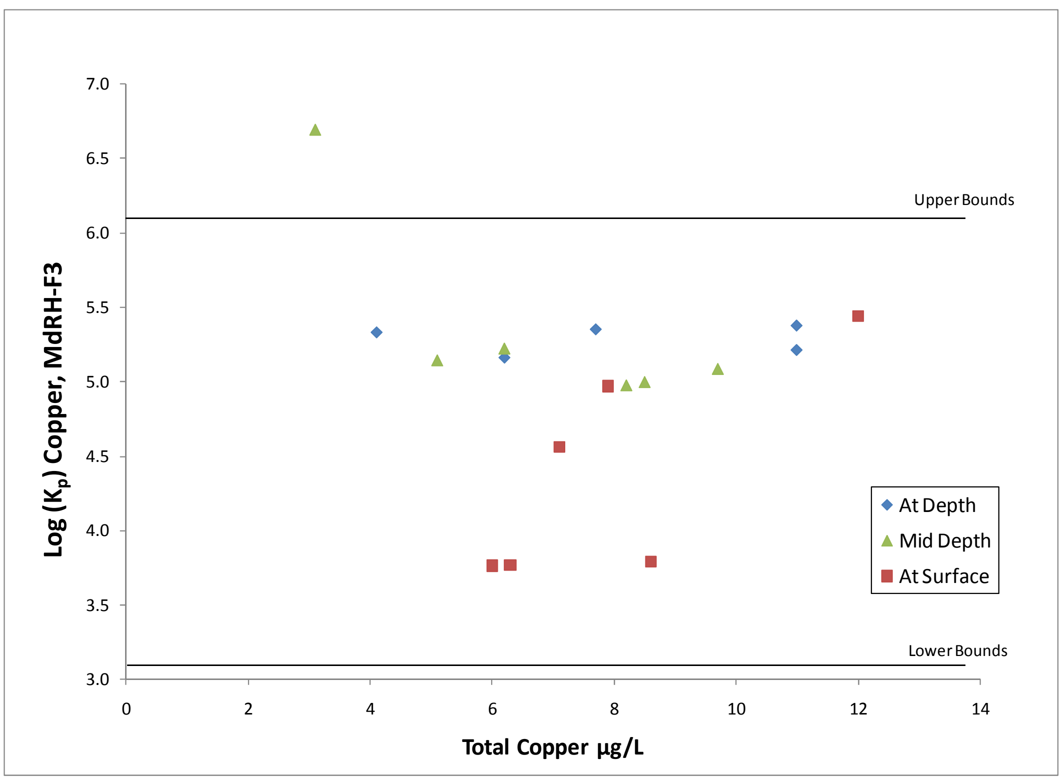


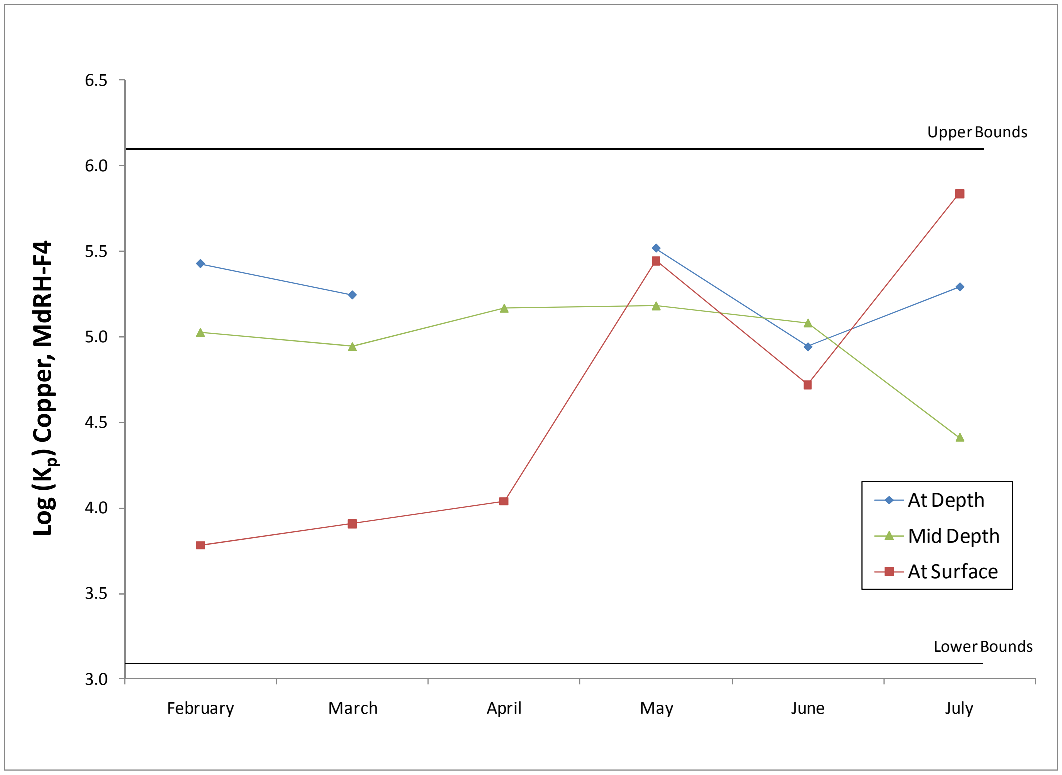
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Upper Bounds
Lower Bounds
Log (K_p) Copper, MdRH-F2
February
March
April
May
June
July
At Depth
Mid Depth
At Surface

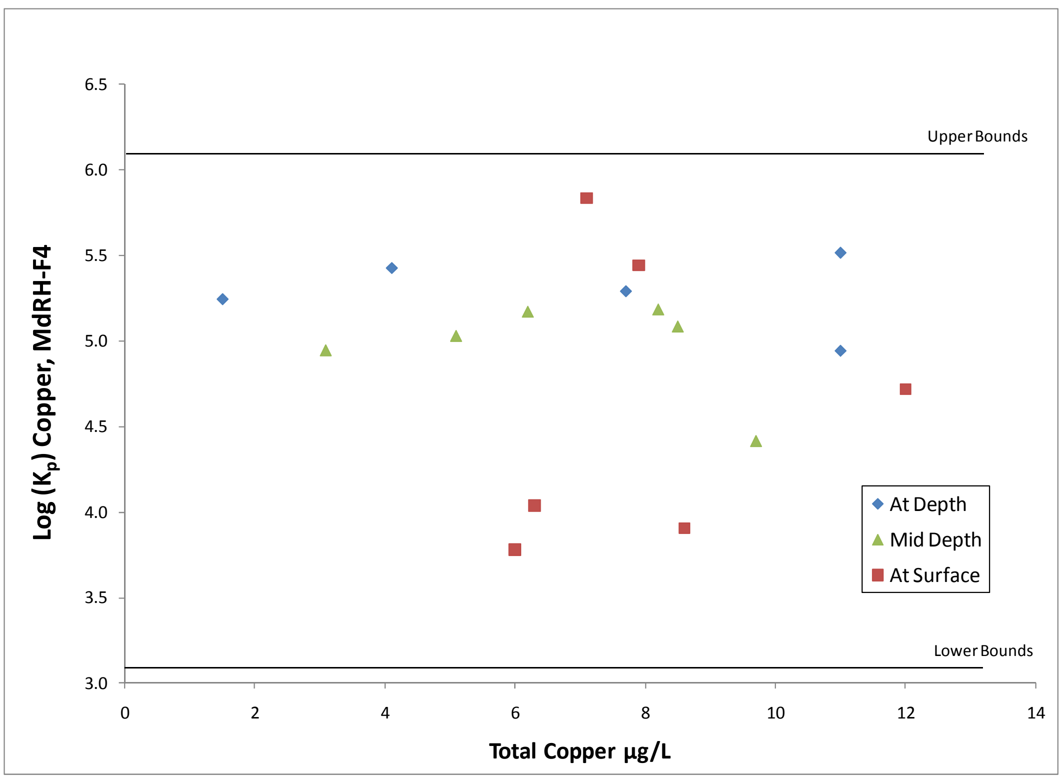


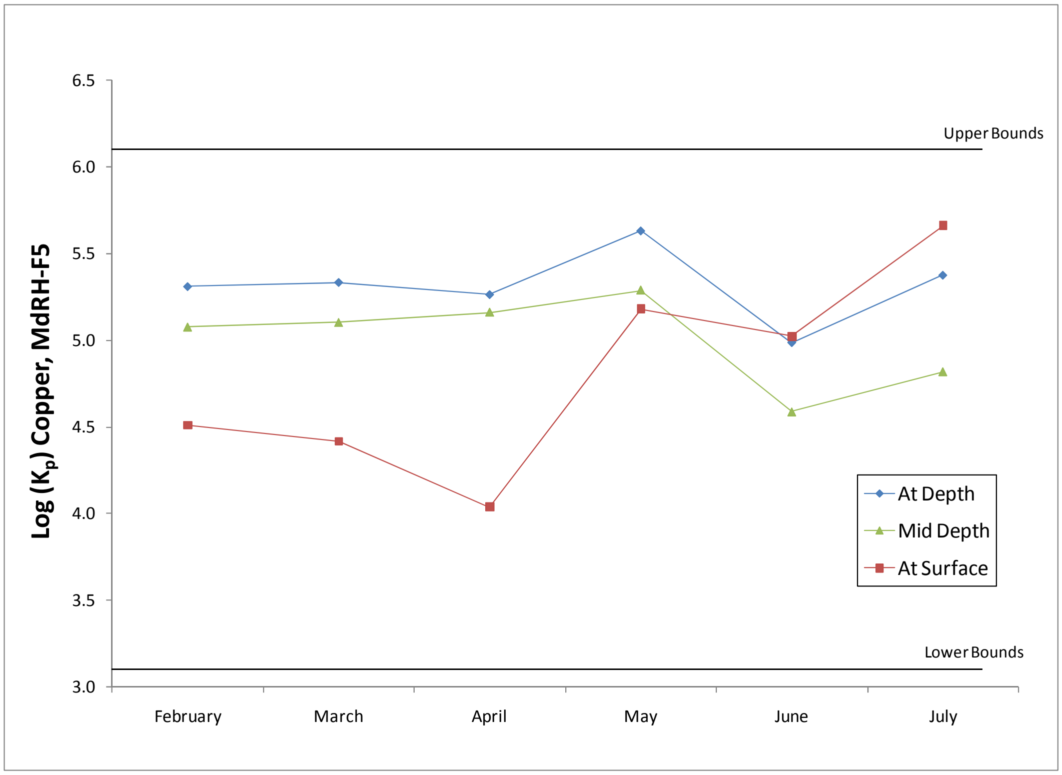
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Upper Bounds
Lower Bounds
Log (K_p) Copper, MdRH-F2
0
2
4
6
8
10
12
14
Total Copper µg/L
At Depth
Mid Depth
At Surface


Log (Kp) Copper, MdRH-F3
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Upper Bounds
Lower Bounds
February
March
April
May
June
July
At Depth
Mid Depth
At Surface

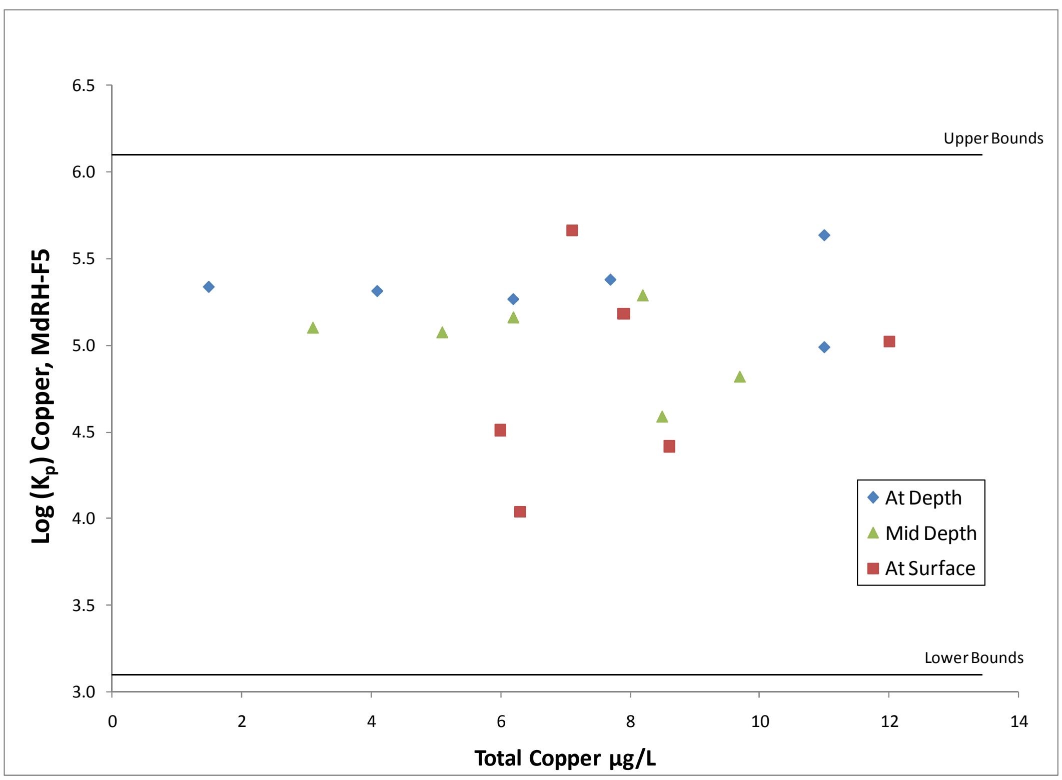

Log (Kp) Copper, MdRH-F3
7.0
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Upper Bounds
Lower Bounds
0
2
4
6
8
10
12
14
Total Copper µg/L
At Depth
Mid Depth
At Surface


Log (Kp) Copper, MdRH-F4
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Upper Bounds
Lower Bounds
February
March
April
May
June
July
At Depth
Mid Depth
At Surface


Log (Kp) Copper, MdRH-F4
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Upper Bounds
Lower Bounds
0
2
4
6
8
10
12
14
Total Copper µg/L
At Depth
Mid Depth
At Surface



Log (Kp) Copper, MdRH-F5
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Upper Bounds
Lower Bounds
February
March
April
May
June
July
At Depth
Mid Depth
At Surface



Log (Kp) Copper, MdRH-F5
6.5
6.0
5.5
5.0
4.5
4.0
3.5
3.0
Upper Bounds
Lower Bounds
0
2
4
6
8
10
12
14
Total Copper µg/L
At Depth
Mid Depth
At Surface

Appendix C: Full ANOVA Results

Dissolved Copper

No Correlation

	February	March	April	May	June	July
B1_AD_022411	3.1	0.94	3.7	3.6	7.3	3.7
B2_AD_022411	1.6	1.1	3.9	4.4	3.9	3.2
B3_AD_022411	1.6	0.71	2.7	3.1	4.5	3.4
B4_AD_022411	1.3	0.45	2.7	2.2	5.2	1.8
F1_AD_022411	1.3	0.56	4.1	3.8	5.7	2.2
F2_AD_022411	1.5	0.72	3	4.4	6.5	1.7
F3_AD_022411	1.6	0.97	4.5	4.6	8.4	1.5
F4_AD_022411	1.5	0.4	2.5	2.1	5.1	1.8
F5_AD_022411	2.2	0.36	2.6	2	3.4	2.2

Anova: Two-Factor Without Replication

SUMMARY	Count	Sum	Average	Variance
B1_AD_022411	6	22.34	3.723333	4.188867
B2_AD_022411	6	18.1	3.016667	1.837667
B3_AD_022411	6	16.01	2.668333	1.810817
B4_AD_022411	6	13.65	2.275	2.64975
F1_AD_022411	6	17.66	2.943333	3.720867
F2_AD_022411	6	17.82	2.97	4.6686
F3_AD_022411	6	21.57	3.595	8.03535
F4_AD_022411	6	13.4	2.233333	2.478667
F5_AD_022411	6	12.76	2.126667	0.998667
February	9	15.7	1.744444	0.327778
March	9	6.21	0.69	0.072225
April	9	29.7	3.3	0.5675
May	9	30.2	3.355556	1.100278
June	9	50	5.555556	2.610278
July	9	21.5	2.388889	0.678611

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	15.808	8	1.976	2.922499	0.011482567	2.18017
Columns	124.9009	5	24.98018	36.94562	5.68056E-14	2.449466
Error	27.04535	40	0.676134			
Total	167.7543	53				

No Correlation

	February	March	April	May	June	July
B1_AS_022411	5.3	8.2	4.1	4.1	8.5	4.7
B2_AS_022411	5.6	10	4.2	5	7.8	5.5
B3_AS_022411	5.5	6.5	4.9	4.2	7.1	4.3
B4_AS_022411	5.6	6.2	4	4.2	9	5.1
F1_AS_022411	5.6	6.2	4.1	4.1	6.7	4.8
F2_AS_022411	5.9	7	4.5	4.4	6.9	4.8
F3_AS_022411	6.6	6.5	4.7	4.7	8.2	4.5
F4_AS_022411	5.7	5.7	4.1	3.9	6.9	4.4
F5_AS_022411	3.7	4	3.1	2.8	4.1	3

Anova: Two-Factor Without Replication

SUMMARY	Count	Sum	Average	Variance
B1_AS_022411	6	34.9	5.816667	4.057667
B2_AS_022411	6	38.1	6.35	4.631
B3_AS_022411	6	32.5	5.416667	1.401667
B4_AS_022411	6	34.1	5.683333	3.329667
F1_AS_022411	6	31.5	5.25	1.195
F2_AS_022411	6	33.5	5.583333	1.405667
F3_AS_022411	6	35.2	5.866667	2.194667
F4_AS_022411	6	30.7	5.116667	1.377667
F5_AS_022411	6	20.7	3.45	0.307
February	9	49.5	5.5	0.59
March	9	60.3	6.7	2.7625
April	9	37.7	4.188889	0.263611
May	9	37.4	4.155556	0.372778
June	9	65.2	7.244444	2.040278
July	9	41.1	4.566667	0.48

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	31.87704	8	3.98463	7.891803	2.64053E-06	2.18017
Columns	79.3037	5	15.86074	31.41317	7.5228E-13	2.449466
Error	20.1963	40	0.504907			
Total	131.377	53				

No Correlation

	February	March	April	May	June	July
MdRH-B-1_022411	4.1	2.4	3.1	4	7.4	3.6
MdRH-B-2_022411	2.1	2.7	4.6	5	7.2	5.8
MdRH-B-3_022411	2.6	2.1	3.2	3.6	5.5	4.5
MdRH-B-4_022411	4.5	1.5	3.4	3.5	6.4	4
MdRH-F-1_022411	4.6	0.81	4.3	3.7	6.5	3.2
MdRH-F-2_022411	5.8	1.6	4.3	4.3	6.5	4.6
MdRH-F-3_022411	6.9	2.1	4.5	4.6	7.9	3.7
MdRH-F-4_022411	2.8	0.83	2.9	2.6	3.9	1.9
MdRH-F-5_022411	3.2	0.77	2.8	2.5	3.4	2.9

Anova: Two-Factor Without Replication

SUMMARY	Count	Sum	Average	Variance
MdRH-B-1_022411	6	24.6	4.1	3.008
MdRH-B-2_022411	6	27.4	4.566667	3.642667
MdRH-B-3_022411	6	21.5	3.583333	1.565667
MdRH-B-4_022411	6	23.3	3.883333	2.557667
MdRH-F-1_022411	6	23.11	3.851667	3.494817
MdRH-F-2_022411	6	27.1	4.516667	2.837667
MdRH-F-3_022411	6	29.7	4.95	4.503
MdRH-F-4_022411	6	14.93	2.488333	1.073617
MdRH-F-5_022411	6	15.57	2.595	0.89775
February	9	36.6	4.066667	2.485
March	9	14.81	1.645556	0.530903
April	9	33.1	3.677778	0.539444
May	9	33.8	3.755556	0.702778
June	9	54.7	6.077778	2.379444
July	9	34.2	3.8	1.25

ANOVA

Source of Variation	SS	df	MS	F	P-value	F crit
Rows	34.38283	8	4.297854	5.986344	4.69961E-05	2.18017
Columns	89.18653	5	17.83731	24.84501	2.67817E-11	2.449466
Error	28.71772	40	0.717943			
Total	152.2871	53				

No Correlation

	February	March	April	May	June	July
B1_AD_022411	3.1	0.94	3.7	3.6	7.3	3.7
B2_AD_022411	1.6	1.1	3.9	4.4	3.9	3.2
B3_AD_022411	1.6	0.71	2.7	3.1	4.5	3.4
B4_AD_022411	1.3	0.45	2.7	2.2	5.2	1.8

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AD_022411	6	22.34	3.723333	4.188867
B2_AD_022411	6	18.1	3.016667	1.837667
B3_AD_022411	6	16.01	2.668333	1.810817
B4_AD_022411	6	13.65	2.275	2.64975
February	4	7.6	1.9	0.66
March	4	3.2	0.8	0.080067
April	4	13	3.25	0.41
May	4	13.3	3.325	0.849167
June	4	20.9	5.225	2.195833
July	4	12.1	3.025	0.709167

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	6.804283	3	2.268094	4.301925	0.022312679	3.287382
Columns	44.52708	5	8.905417	16.89102	1.08252E-05	2.901295
Error	7.908417	15	0.527228			
Total	59.23978	23				

Potential spatial correlation

	February	March	April	May	June	July
F1_AD_022411	1.3	0.56	4.1	3.8	5.7	2.2
F2_AD_022411	1.5	0.72	3	4.4	6.5	1.7
F3_AD_022411	1.6	0.97	4.5	4.6	8.4	1.5
F4_AD_022411	1.5	0.4	2.5	2.1	5.1	1.8
F5_AD_022411	2.2	0.36	2.6	2	3.4	2.2

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F1_AD_022411	6	17.66	2.943333	3.720867
F2_AD_022411	6	17.82	2.97	4.6686
F3_AD_022411	6	21.57	3.595	8.03535
F4_AD_022411	6	13.4	2.233333	2.478667
F5_AD_022411	6	12.76	2.126667	0.998667
February	5	8.1	1.62	0.117
March	5	3.01	0.602	0.06262
April	5	16.7	3.34	0.823
May	5	16.9	3.38	1.562
June	5	29.1	5.82	3.377
July	5	9.4	1.88	0.097

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	8.714947	4	2.178737	2.822283	0.052466	2.866081
Columns	84.07122	5	16.81424	21.78077	1.83E-07	2.71089
Error	15.43953	20	0.771977			
Total	108.2257	29				

Potential spatial correlation

	February	March	April	May	June	July
B1_AS_022411	5.3	8.2	4.1	4.1	8.5	4.7
B2_AS_022411	5.6	10	4.2	5	7.8	5.5
B3_AS_022411	5.5	6.5	4.9	4.2	7.1	4.3
B4_AS_022411	5.6	6.2	4	4.2	9	5.1

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AS_022411	6	34.9	5.816667	4.057667
B2_AS_022411	6	38.1	6.35	4.631
B3_AS_022411	6	32.5	5.416667	1.401667
B4_AS_022411	6	34.1	5.683333	3.329667
February	4	22	5.5	0.02
March	4	30.9	7.725	3.075833
April	4	17.2	4.3	0.166667
May	4	17.5	4.375	0.175833
June	4	32.4	8.1	0.686667
July	4	19.6	4.9	0.266667

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	2.773333	3	0.924444	1.33312	0.30084	3.287382
Columns	56.69833	5	11.33967	16.35267	1.32E-05	2.901295
Error	10.40167	15	0.693444			
Total	69.87333	23				

No Correlation

	February	March	April	May	June	July
F1_AS_022411	5.6	6.2	4.1	4.1	6.7	4.8
F2_AS_022411	5.9	7	4.5	4.4	6.9	4.8
F3_AS_022411	6.6	6.5	4.7	4.7	8.2	4.5
F4_AS_022411	5.7	5.7	4.1	3.9	6.9	4.4
F5_AS_022411	3.7	4	3.1	2.8	4.1	3

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F1_AS_022411	6	31.5	5.25	1.195
F2_AS_022411	6	33.5	5.583333	1.405667
F3_AS_022411	6	35.2	5.866667	2.194667
F4_AS_022411	6	30.7	5.116667	1.377667
F5_AS_022411	6	20.7	3.45	0.307
February	5	27.5	5.5	1.165
March	5	29.4	5.88	1.327
April	5	20.5	4.1	0.38
May	5	19.9	3.98	0.527
June	5	32.8	6.56	2.248
July	5	21.5	4.3	0.56

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	21.33467	4	5.333667	30.53626	2.92E-08	2.866081
Columns	28.90667	5	5.781333	33.09924	5.16E-09	2.71089
Error	3.493333	20	0.174667			
Total	53.73467	29				

Potential spatial correlation

	February	March	April	May	June	July
MdRH-B-1_022411	4.1	2.4	3.1	4	7.4	3.6
MdRH-B-2_022411	2.1	2.7	4.6	5	7.2	5.8
MdRH-B-3_022411	2.6	2.1	3.2	3.6	5.5	4.5
MdRH-B-4_022411	4.5	1.5	3.4	3.5	6.4	4

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
MdRH-B-1_022411	6	24.6	4.1	3.008
MdRH-B-2_022411	6	27.4	4.566667	3.642667
MdRH-B-3_022411	6	21.5	3.583333	1.565667
MdRH-B-4_022411	6	23.3	3.883333	2.557667
February	4	13.3	3.325	1.335833
March	4	8.7	2.175	0.2625
April	4	14.3	3.575	0.4825
May	4	16.1	4.025	0.469167
June	4	26.5	6.625	0.749167
July	4	17.9	4.475	0.915833

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	3.083333	3	1.027778	1.612341	0.228417	3.287382
Columns	44.30833	5	8.861667	13.90187	3.52E-05	2.901295
Error	9.561667	15	0.637444			
Total	56.95333	23				

No Correlation

	February	March	April	May	June	July
MdRH-F-1_022411	4.6	0.81	4.3	3.7	6.5	3.2
MdRH-F-2_022411	5.8	1.6	4.3	4.3	6.5	4.6
MdRH-F-3_022411	6.9	2.1	4.5	4.6	7.9	3.7
MdRH-F-4_022411	2.8	0.83	2.9	2.6	3.9	1.9
MdRH-F-5_022411	3.2	0.77	2.8	2.5	3.4	2.9

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
MdRH-F-1_022411	6	23.11	3.851667	3.494817
MdRH-F-2_022411	6	27.1	4.516667	2.837667
MdRH-F-3_022411	6	29.7	4.95	4.503
MdRH-F-4_022411	6	14.93	2.488333	1.073617
MdRH-F-5_022411	6	15.57	2.595	0.89775
February	5	23.3	4.66	2.978
March	5	6.11	1.222	0.36037
April	5	18.8	3.76	0.698
May	5	17.7	3.54	0.923
June	5	28.2	5.64	3.658
July	5	16.3	3.26	0.993

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	29.63805	4	7.409512	16.83323	3.46E-06	2.866081
Columns	55.23082	5	11.04616	25.09513	5.6E-08	2.71089
Error	8.803433	20	0.440172			
Total	93.6723	29				

B1 — Potential correlation between depths

B1	February	March	April	May	June	July
B1_AD_022411	3.1	0.94	3.7	3.6	7.3	3.7
B1_AS_022411	5.3	8.2	4.1	4.1	8.5	4.7
MdRH-B-1_022411	4.1	2.4	3.1	4	7.4	3.6

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AD_022411	6	22.34	3.723333	4.188867
B1_AS_022411	6	34.9	5.816667	4.057667
MdRH-B-1_022411	6	24.6	4.1	3.008
February	3	12.5	4.166667	1.213333
March	3	11.54	3.846667	14.74653
April	3	10.9	3.633333	0.253333
May	3	11.7	3.9	0.07
June	3	23.2	7.733333	0.443333
July	3	12	4	0.37

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	14.94173	2	7.470867	3.880701	0.056573598	4.102821
Columns	37.02133	5	7.404267	3.846106	0.033284289	3.325835
Error	19.25133	10	1.925133			
Total	71.2144	17				

B2 — Potential correlation between months

B2	February	March	April	May	June	July
B2_AD_022411	1.6	1.1	3.9	4.4	3.9	3.2
B2_AS_022411	5.6	10	4.2	5	7.8	5.5
MdRH-B-2_022411	2.1	2.7	4.6	5	7.2	5.8

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B2_AD_022411	6	18.1	3.016667	1.837667
B2_AS_022411	6	38.1	6.35	4.631
MdRH-B-2_022411	6	27.4	4.566667	3.642667
February	3	9.3	3.1	4.75
March	3	13.8	4.6	22.51
April	3	12.7	4.233333	0.123333
May	3	14.4	4.8	0.12
June	3	18.9	6.3	4.41
July	3	14.5	4.833333	2.023333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	33.38778	2	16.69389	4.840835	0.033860256	4.102821
Columns	16.07111	5	3.214222	0.932049	0.49993875	3.325835
Error	34.48556	10	3.448556			
Total	83.94444	17				

B3 — Potential correlation between months

B3	February	March	April	May	June	July
B3_AD_022411	1.6	0.71	2.7	3.1	4.5	3.4
B3_AS_022411	5.5	6.5	4.9	4.2	7.1	4.3
MdRH-B-3_022411	2.6	2.1	3.2	3.6	5.5	4.5

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B3_AD_022411	6	16.01	2.668333	1.810817
B3_AS_022411	6	32.5	5.416667	1.401667
MdRH-B-3_022411	6	21.5	3.583333	1.565667
February	3	9.7	3.233333	4.103333
March	3	9.31	3.103333	9.136033
April	3	10.8	3.6	1.33
May	3	10.9	3.633333	0.303333
June	3	17.1	5.7	1.72
July	3	12.2	4.066667	0.343333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	23.50334	2	11.75167	11.33377	0.002687929	4.102821
Columns	13.52203	5	2.704406	2.608234	0.092432642	3.325835
Error	10.36872	10	1.036872			
Total	47.39409	17				

B4 — No Correlation

B4	February	March	April	May	June	July
B4_AD_022411	1.3	0.45	2.7	2.2	5.2	1.8
B4_AS_022411	5.6	6.2	4	4.2	9	5.1
MdRH-B-4_022411	4.5	1.5	3.4	3.5	6.4	4

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B4_AD_022411	6	13.65	2.275	2.64975
B4_AS_022411	6	34.1	5.683333	3.329667
MdRH-B-4_022411	6	23.3	3.883333	2.557667
February	3	11.4	3.8	4.99
March	3	8.15	2.716667	9.375833
April	3	10.1	3.366667	0.423333
May	3	9.9	3.3	1.03
June	3	20.6	6.866667	3.773333
July	3	10.9	3.633333	2.823333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	34.88694	2	17.44347	17.54043	0.00053708	4.102821
Columns	32.74069	5	6.548139	6.584537	0.005828171	3.325835
Error	9.944722	10	0.994472			
Total	77.57236	17				

F1 — Potential correlation between months

F1	February	March	April	May	June	July
F1_AD_022411	1.3	0.56	4.1	3.8	5.7	2.2
F1_AS_022411	5.6	6.2	4.1	4.1	6.7	4.8
MdRH-F-1_022411	4.6	0.81	4.3	3.7	6.5	3.2

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F1_AD_022411	6	17.66	2.943333	3.720867
F1_AS_022411	6	31.5	5.25	1.195
MdRH-F-1_022411	6	23.11	3.851667	3.494817
February	3	11.5	3.833333	5.063333
March	3	7.57	2.523333	10.15403
April	3	12.5	4.166667	0.013333
May	3	11.6	3.866667	0.043333
June	3	18.9	6.3	0.28
July	3	10.2	3.4	1.72

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	16.20223	2	8.101117	4.41578	0.042224885	4.102821
Columns	23.70758	5	4.741517	2.58452	0.094436637	3.325835
Error	18.34583	10	1.834583			
Total	58.25565	17				

F2 — Potential correlation between months

F2	February	March	April	May	June	July
F2_AD_022411	1.5	0.72	3	4.4	6.5	1.7
F2_AS_022411	5.9	7	4.5	4.4	6.9	4.8
MdRH-F-2_022411	5.8	1.6	4.3	4.3	6.5	4.6

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F2_AD_022411	6	17.82	2.97	4.6686
F2_AS_022411	6	33.5	5.583333	1.405667
MdRH-F-2_022411	6	27.1	4.516667	2.837667
February	3	13.2	4.4	6.31
March	3	9.32	3.106667	11.56213
April	3	11.8	3.933333	0.663333
May	3	13.1	4.366667	0.003333
June	3	19.9	6.633333	0.053333
July	3	11.1	3.7	3.01

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	20.71893	2	10.35947	4.607211	0.038182421	4.102821
Columns	22.07433	5	4.414867	1.963443	0.17024102	3.325835
Error	22.48533	10	2.248533			
Total	65.2786	17				

F3 — Potential correlation between depths

	February	March	April	May	June	July
F3_AD_022411	1.6	0.97	4.5	4.6	8.4	1.5
F3_AS_022411	6.6	6.5	4.7	4.7	8.2	4.5
MdRH-F-3_022411	6.9	2.1	4.5	4.6	7.9	3.7

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F3_AD_022411	6	21.57	3.595	8.03535
F3_AS_022411	6	35.2	5.866667	2.194667
MdRH-F-3_022411	6	29.7	4.95	4.503
February	3	15.1	5.033333	8.863333
March	3	9.57	3.19	8.5363
April	3	13.7	4.566667	0.013333
May	3	13.9	4.633333	0.003333
June	3	24.5	8.166667	0.063333
July	3	9.7	3.233333	2.413333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	15.67354	2	7.836772	3.250102	0.081762365	4.102821
Columns	49.55269	5	9.910539	4.110144	0.027375498	3.325835
Error	24.11239	10	2.411239			
Total	89.33863	17				

F4 — No Correlation

	February	March	April	May	June	July
F4_AD_022411	1.5	0.4	2.5	2.1	5.1	1.8
F4_AS_022411	5.7	5.7	4.1	3.9	6.9	4.4
MdRH-F-4_022411	2.8	0.83	2.9	2.6	3.9	1.9

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F4_AD_022411	6	13.4	2.233333	2.478667
F4_AS_022411	6	30.7	5.116667	1.377667
MdRH-F-4_022411	6	14.93	2.488333	1.073617
February	3	10	3.333333	4.623333
March	3	6.93	2.31	8.6653
April	3	9.5	3.166667	0.693333
May	3	8.6	2.866667	0.863333
June	3	15.9	5.3	2.28
July	3	8.1	2.7	2.17

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	30.57354	2	15.28677	19.06781	0.000386961	4.102821
Columns	16.63269	5	3.326539	4.149327	0.026608785	3.325835
Error	8.017056	10	0.801706			
Total	55.22329	17				

F5 — Potential correlation between depths

	February	March	April	May	June	July
F5_AD_022411	2.2	0.36	2.6	2	3.4	2.2
F5_AS_022411	3.7	4	3.1	2.8	4.1	3
MdRH-F-5_022411	3.2	0.77	2.8	2.5	3.4	2.9

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F5_AD_022411	6	12.76	2.126667	0.998667
F5_AS_022411	6	20.7	3.45	0.307
MdRH-F-5_022411	6	15.57	2.595	0.89775
February	3	9.1	3.033333	0.583333
March	3	5.13	1.71	3.9751
April	3	8.5	2.833333	0.063333
May	3	7.3	2.433333	0.163333
June	3	10.9	3.633333	0.163333
July	3	8.1	2.7	0.19

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	5.403144	2	2.701572	5.54314	0.023988343	4.102821
Columns	6.143361	5	1.228672	2.521014	0.100057332	3.325835
Error	4.873722	10	0.487372			
Total	16.42023	17				

Total Copper — No correlation

	February	March	April	May	June	July
B1_AD_022411	4.1	1.5	6.2	11	11	7.7
B2_AD_022411	2.6	2.8	6.1	10	6	6.1
B3_AD_022411	2.4	1.3	4.9	6.3	7.6	6.3
B4_AD_022411	2.1	0.85	4.9	4.6	6.5	4.7
F1_AD_022411	2.1	0.98	5.6	6.3	7	4.1
F2_AD_022411	2.8	1.2	4.2	7	7.7	3.9
F3_AD_022411	2.9	1.8	6	6.9	8.9	4.5
F4_AD_022411	2.3	0.78	3.7	3.7	5.9	4.4
F5_AD_022411	3.1	0.87	3.9	3.4	4.6	4.3

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AD_022411	6	41.5	6.916667	14.34967
B2_AD_022411	6	33.6	5.6	7.372
B3_AD_022411	6	28.8	4.8	6.072
B4_AD_022411	6	23.65	3.941667	4.284417
F1_AD_022411	6	26.08	4.346667	5.773867
F2_AD_022411	6	26.8	4.466667	6.142667
F3_AD_022411	6	31	5.166667	6.910667
F4_AD_022411	6	20.78	3.463333	3.096067
F5_AD_022411	6	20.17	3.361667	1.796417
February	9	24.4	2.711111	0.393611
March	9	12.08	1.342222	0.411769
April	9	45.5	5.055556	0.942778
May	9	59.2	6.577778	6.749444
June	9	65.2	7.244444	3.517778
July	9	46	5.111111	1.661111

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	60.12002593	8	7.515003	6.098367	3.92558E-05	2.18017
Columns	229.6969259	5	45.93939	37.27945	4.91014E-14	2.449466
Error	49.29190741	40	1.232298			
Total	339.1088593	53				

No correlation

	February	March	April	May	June	July
B1_AS_022411	6	8.6	6.3	7.9	12	7.1
B2_AS_022411	6.3	11	6.3	8.4	11	7.6
B3_AS_022411	6.3	6.9	7.3	6.7	8	6.7
B4_AS_022411	6.6	6.9	5.9	6.4	9.6	7.4
F1_AS_022411	6.5	7.4	5.2	6.2	8.1	6.8
F2_AS_022411	6.9	8.9	5.9	6.1	8.3	7.5
F3_AS_022411	7.7	8.3	6	7.5	8.8	6.6
F4_AS_022411	6.7	6.7	5	5.6	7.8	5.6
F5_AS_022411	4.5	4.7	4.2	4.4	6	5.4

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AS_022411	6	47.9	7.983333	4.813667
B2_AS_022411	6	50.6	8.433333	4.594667
B3_AS_022411	6	41.9	6.983333	0.353667
B4_AS_022411	6	42.8	7.133333	1.710667
F1_AS_022411	6	40.2	6.7	1
F2_AS_022411	6	43.6	7.266667	1.430667
F3_AS_022411	6	44.9	7.483333	1.085667
F4_AS_022411	6	37.4	6.233333	1.042667
F5_AS_022411	6	29.2	4.866667	0.478667
February	9	57.5	6.388889	0.733611
March	9	69.4	7.711111	3.108611
April	9	52.1	5.788889	0.796111
May	9	59.2	6.577778	1.504444
June	9	79.6	8.844444	3.240278
July	9	60.7	6.744444	0.625278

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	51.4337	8	6.429213	8.981555	5.9537E-07	2.18017
Columns	53.9187	5	10.78374	15.06479	2.56457E-08	2.449466
Error	28.63296	40	0.715824			
Total	133.9854	53				

No correlation

	February	March	April	May	June	July
MdRH-B-1_022411	5.1	3.1	6.2	8.2	8.5	9.7
MdRH-B-2_022411	2.8	4	6.3	9.9	8.2	8.1
MdRH-B-3_022411	3.6	2.8	5	7.1	7.4	7
MdRH-B-4_022411	5.2	2.4	4.7	6	7.9	7.2
MdRH-F-1_022411	6.2	1.2	5.7	6.1	7.3	5.5
MdRH-F-2_022411	6.9	2.3	5.7	6.8	7.2	6.3
MdRH-F-3_022411	8.5	2.9	6	7.4	8.8	6.6
MdRH-F-4_022411	3.6	1.3	4.1	4.2	4.8	4.9
MdRH-F-5_022411	4.2	1.1	4.1	4.3	4.2	4.9

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
MdRH-B-1_022411	6	40.8	6.8	6.04
MdRH-B-2_022411	6	39.3	6.55	7.395
MdRH-B-3_022411	6	32.9	5.483333	3.913667
MdRH-B-4_022411	6	33.4	5.566667	3.842667
MdRH-F-1_022411	6	32	5.333333	4.490667
MdRH-F-2_022411	6	35.2	5.866667	3.330667
MdRH-F-3_022411	6	40.2	6.7	4.616
MdRH-F-4_022411	6	22.9	3.816667	1.749667
MdRH-F-5_022411	6	22.8	3.8	1.832
February	9	46.1	5.122222	3.326944
March	9	21.1	2.344444	0.972778
April	9	47.8	5.311111	0.743611
May	9	60	6.666667	3.25
June	9	64.3	7.144444	2.565278
July	9	60.2	6.688889	2.423611

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	60.62259	8	7.577824	6.642089	1.67167E-05	2.18017
Columns	140.4165	5	28.0833	24.61548	3.07162E-11	2.449466
Error	45.63519	40	1.14088			
Total	246.6743	53				

Total Copper — No correlation

	February	March	April	May	June	July
B1_AD_022411	4.1	1.5	6.2	11	11	7.7
B2_AD_022411	2.6	2.8	6.1	10	6	6.1
B3_AD_022411	2.4	1.3	4.9	6.3	7.6	6.3
B4_AD_022411	2.1	0.85	4.9	4.6	6.5	4.7

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AD_022411	6	41.5	6.916667	14.34967
B2_AD_022411	6	33.6	5.6	7.372
B3_AD_022411	6	28.8	4.8	6.072
B4_AD_022411	6	23.65	3.941667	4.284417
February	4	11.2	2.8	0.793333
March	4	6.45	1.6125	0.700625
April	4	22.1	5.525	0.5225
May	4	31.9	7.975	9.149167
June	4	31.1	7.775	5.069167
July	4	24.8	6.2	1.506667

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	28.78698	3	9.59566	5.889944	0.007282	3.287382
Columns	135.953	5	27.1906	16.68996	1.17E-05	2.901295
Error	24.4374	15	1.62916			
Total	189.1774	23				

Total Copper — No correlation

	February	March	April	May	June	July
F1_AD_022411	2.1	0.98	5.6	6.3	7	4.1
F2_AD_022411	2.8	1.2	4.2	7	7.7	3.9
F3_AD_022411	2.9	1.8	6	6.9	8.9	4.5
F4_AD_022411	2.3	0.78	3.7	3.7	5.9	4.4
F5_AD_022411	3.1	0.87	3.9	3.4	4.6	4.3

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F1_AD_022411	6	26.08	4.346667	5.773867
F2_AD_022411	6	26.8	4.466667	6.142667
F3_AD_022411	6	31	5.166667	6.910667
F4_AD_022411	6	20.78	3.463333	3.096067
F5_AD_022411	6	20.17	3.361667	1.796417
February	5	13.2	2.64	0.178
March	5	5.63	1.126	0.16658
April	5	23.4	4.68	1.097
May	5	27.3	5.46	3.123
June	5	34.1	6.82	2.727
July	5	21.2	4.24	0.058

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	13.58965	4	3.397413	4.298166	0.011367	2.866081
Columns	102.7898	5	20.55795	26.00846	4.14E-08	2.71089
Error	15.80867	20	0.790433			
Total	132.1881	29				

Potential spatial correlation

	February	March	April	May	June	July
B1_AS_022411	6	8.6	6.3	7.9	12	7.1
B2_AS_022411	6.3	11	6.3	8.4	11	7.6
B3_AS_022411	6.3	6.9	7.3	6.7	8	6.7
B4_AS_022411	6.6	6.9	5.9	6.4	9.6	7.4

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AS_022411	6	47.9	7.983333	4.813667
B2_AS_022411	6	50.6	8.433333	4.594667
B3_AS_022411	6	41.9	6.983333	0.353667
B4_AS_022411	6	42.8	7.133333	1.710667
February	4	25.2	6.3	0.06
March	4	33.4	8.35	3.763333
April	4	25.8	6.45	0.356667
May	4	29.4	7.35	0.91
June	4	40.6	10.15	3.023333
July	4	28.8	7.2	0.153333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	8.61	3	2.87	2.659049	0.085926	3.287382
Columns	41.17333	5	8.234667	7.629401	0.00096	2.901295
Error	16.19	15	1.079333			
Total	65.97333	23				

No correlation

	February	March	April	May	June	July
F1_AS_022411	6.5	7.4	5.2	6.2	8.1	6.8
F2_AS_022411	6.9	8.9	5.9	6.1	8.3	7.5
F3_AS_022411	7.7	8.3	6	7.5	8.8	6.6
F4_AS_022411	6.7	6.7	5	5.6	7.8	5.6
F5_AS_022411	4.5	4.7	4.2	4.4	6	5.4

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F1_AS_022411	6	40.2	6.7	1
F2_AS_022411	6	43.6	7.266667	1.430667
F3_AS_022411	6	44.9	7.483333	1.085667
F4_AS_022411	6	37.4	6.233333	1.042667
F5_AS_022411	6	29.2	4.866667	0.478667
February	5	32.3	6.46	1.408
March	5	36	7.2	2.66
April	5	26.3	5.26	0.538
May	5	29.8	5.96	1.253
June	5	39	7.8	1.145
July	5	31.9	6.38	0.762

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	25.99867	4	6.499667	25.66333	1.25E-07	2.866081
Columns	20.123	5	4.0246	15.89076	2.27E-06	2.71089
Error	5.065333	20	0.253267			
Total	51.187	29				

Potential spatial correlation

	February	March	April	May	June	July
MdRH-B-1_022411	5.1	3.1	6.2	8.2	8.5	9.7
MdRH-B-2_022411	2.8	4	6.3	9.9	8.2	8.1
MdRH-B-3_022411	3.6	2.8	5	7.1	7.4	7
MdRH-B-4_022411	5.2	2.4	4.7	6	7.9	7.2

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
MdRH-B-1_022411	6	40.8	6.8	6.04
MdRH-B-2_022411	6	39.3	6.55	7.395
MdRH-B-3_022411	6	32.9	5.483333	3.913667
MdRH-B-4_022411	6	33.4	5.566667	3.842667
February	4	16.7	4.175	1.375833
March	4	12.3	3.075	0.4625
April	4	22.2	5.55	0.67
May	4	31.2	7.8	2.766667
June	4	32	8	0.22
July	4	32	8	1.513333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	8.143333	3	2.714444	3.160823	0.055612	3.287382
Columns	93.075	5	18.615	21.67615	2.25E-06	2.901295
Error	12.88167	15	0.858778			
Total	114.1	23				

No correlation

	February	March	April	May	June	July
MdRH-F-1_022411	6.2	1.2	5.7	6.1	7.3	5.5
MdRH-F-2_022411	6.9	2.3	5.7	6.8	7.2	6.3
MdRH-F-3_022411	8.5	2.9	6	7.4	8.8	6.6
MdRH-F-4_022411	3.6	1.3	4.1	4.2	4.8	4.9
MdRH-F-5_022411	4.2	1.1	4.1	4.3	4.2	4.9

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
MdRH-F-1_022411	6	32	5.333333	4.490667
MdRH-F-2_022411	6	35.2	5.866667	3.330667
MdRH-F-3_022411	6	40.2	6.7	4.616
MdRH-F-4_022411	6	22.9	3.816667	1.749667
MdRH-F-5_022411	6	22.8	3.8	1.832
February	5	29.4	5.88	4.007
March	5	8.8	1.76	0.638
April	5	25.6	5.12	0.882
May	5	28.8	5.76	2.113
June	5	32.3	6.46	3.648
July	5	28.2	5.64	0.618

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	39.23467	4	9.808667	23.38366	2.66E-07	2.866081
Columns	71.70567	5	14.34113	34.18897	3.88E-09	2.71089
Error	8.389333	20	0.419467			
Total	119.3297	29				

B1 Total Copper

Potential correlation between depths

B1 Total Copper	February	March	April	May	June	July
B1_AD_022411	4.1	1.5	6.2	11	11	7.7
B1_AS_022411	6	8.6	6.3	7.9	12	7.1
MdRH-B-1_022411	5.1	3.1	6.2	8.2	8.5	9.7

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AD_022411	6	41.5	6.916667	14.34967
B1_AS_022411	6	47.9	7.983333	4.813667
MdRH-B-1_022411	6	40.8	6.8	6.04
February	3	15.2	5.066667	0.903333
March	3	13.2	4.4	13.87
April	3	18.7	6.233333	0.003333
May	3	27.1	9.033333	2.923333
June	3	31.5	10.5	3.25
July	3	24.5	8.166667	1.853333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	5.103333333	2	2.551667	0.629989	0.552474419	4.102821
Columns	85.51333333	5	17.10267	4.222533	0.025243536	3.325835
Error	40.50333333	10	4.050333			
Total	131.12	17				

B2

Potential correlation between depths and months

B2	February	March	April	May	June	July
B2_AD_022411	2.6	2.8	6.1	10	6	6.1
B2_AS_022411	6.3	11	6.3	8.4	11	7.6
MdRH-B-2_022411	2.8	4	6.3	9.9	8.2	8.1

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B2_AD_022411	6	33.6	5.6	7.372
B2_AS_022411	6	50.6	8.433333	4.594667
MdRH-B-2_022411	6	39.3	6.55	7.395
February	3	11.7	3.9	4.33
March	3	17.8	5.933333	19.61333
April	3	18.7	6.233333	0.013333
May	3	28.3	9.433333	0.803333
June	3	25.2	8.4	6.28
July	3	21.8	7.266667	1.083333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	24.95444	2	12.47722	3.175494	0.085561809	4.102821
Columns	57.51611	5	11.50322	2.927608	0.069749349	3.325835
Error	39.29222	10	3.929222			
Total	121.7628	17				

B3

No correlation

B3	February	March	April	May	June	July
B3_AD_022411	2.4	1.3	4.9	6.3	7.6	6.3
B3_AS_022411	6.3	6.9	7.3	6.7	8	6.7
MdRH-B-3_022411	3.6	2.8	5	7.1	7.4	7

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B3_AD_022411	6	28.8	4.8	6.072
B3_AS_022411	6	41.9	6.983333	0.353667
MdRH-B-3_022411	6	32.9	5.483333	3.913667
February	3	12.3	4.1	3.99
March	3	11	3.666667	8.403333
April	3	17.2	5.733333	1.843333
May	3	20.1	6.7	0.16
June	3	23	7.666667	0.093333
July	3	20	6.666667	0.123333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	14.96778	2	7.483889	5.248578	0.027639615	4.102821
Columns	37.43778	5	7.487556	5.251149	0.012667929	3.325835
Error	14.25889	10	1.425889			
Total	66.66444	17				

B4

No correlation

B4	February	March	April	May	June	July
B4_AD_022411	2.1	0.85	4.9	4.6	6.5	4.7
B4_AS_022411	6.6	6.9	5.9	6.4	9.6	7.4
MdRH-B-4_022411	5.2	2.4	4.7	6	7.9	7.2

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B4_AD_022411	6	23.65	3.941667	4.284417
B4_AS_022411	6	42.8	7.133333	1.710667
MdRH-B-4_022411	6	33.4	5.566667	3.842667
February	3	13.9	4.633333	5.303333
March	3	10.15	3.383333	9.875833
April	3	15.5	5.166667	0.413333
May	3	17	5.666667	0.893333
June	3	24	8	2.41
July	3	19.3	6.433333	2.263333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	30.56361111	2	15.28181	13.00057	0.001653557	4.102821
Columns	37.43402778	5	7.486806	6.36919	0.006556409	3.325835
Error	11.75472222	10	1.175472			
Total	79.75236111	17				

F1

Potential correlation between depths and months

F1	February	March	April	May	June	July
F1_AD_022411	2.1	0.98	5.6	6.3	7	4.1
F1_AS_022411	6.5	7.4	5.2	6.2	8.1	6.8
MdRH-F-1_022411	6.2	1.2	5.7	6.1	7.3	5.5

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F1_AD_022411	6	26.08	4.346667	5.773867
F1_AS_022411	6	40.2	6.7	1
MdRH-F-1_022411	6	32	5.333333	4.490667
February	3	14.8	4.933333	6.043333
March	3	9.58	3.193333	13.28413
April	3	16.5	5.5	0.07
May	3	18.6	6.2	0.01
June	3	22.4	7.466667	0.323333
July	3	16.4	5.466667	1.823333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	16.75893	2	8.379467	3.180144	0.085318921	4.102821
Columns	29.97333	5	5.994667	2.275073	0.125821683	3.325835
Error	26.34933	10	2.634933			
Total	73.0816	17				

F2

Potential correlation between depths and months

F2	February	March	April	May	June	July
F2_AD_022411	2.8	1.2	4.2	7	7.7	3.9
F2_AS_022411	6.9	8.9	5.9	6.1	8.3	7.5
MdRH-F-2_022411	6.9	2.3	5.7	6.8	7.2	6.3

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F2_AD_022411	6	26.8	4.466667	6.142667
F2_AS_022411	6	43.6	7.266667	1.430667
MdRH-F-2_022411	6	35.2	5.866667	3.330667
February	3	16.6	5.533333	5.603333
March	3	12.4	4.133333	17.34333
April	3	15.8	5.266667	0.863333
May	3	19.9	6.633333	0.223333
June	3	23.2	7.733333	0.303333
July	3	17.7	5.9	3.36

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	23.52	2	11.76	3.689605	0.063073935	4.102821
Columns	22.64667	5	4.529333	1.421042	0.296955093	3.325835
Error	31.87333	10	3.187333			
Total	78.04	17				

F3 — Potential correlation between depths and months

F3	February	March	April	May	June	July
F3_AD_022411	2.9	1.8	6	6.9	8.9	4.5
F3_AS_022411	7.7	8.3	6	7.5	8.8	6.6
MdRH-F-3_022411	8.5	2.9	6	7.4	8.8	6.6

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F3_AD_022411	6	31	5.166667	6.910667
F3_AS_022411	6	44.9	7.483333	1.085667
MdRH-F-3_022411	6	40.2	6.7	4.616
February	3	19.1	6.366667	9.173333
March	3	13	4.333333	12.10333
April	3	18	6	0
May	3	21.8	7.266667	0.103333
June	3	26.5	8.833333	0.003333
July	3	17.7	5.9	1.47

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	16.66333333	2	8.331667	2.868702	0.103593987	4.102821
Columns	34.01833333	5	6.803667	2.342592	0.11805285	3.325835
Error	29.04333333	10	2.904333			
Total	79.725	17				

F4 — Potential correlation between months

F4	February	March	April	May	June	July
F4_AD_022411	2.3	0.78	3.7	3.7	5.9	4.4
F4_AS_022411	6.7	6.7	5	5.6	7.8	5.6
MdRH-F-4_022411	3.6	1.3	4.1	4.2	4.8	4.9

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F4_AD_022411	6	20.78	3.463333	3.096067
F4_AS_022411	6	37.4	6.233333	1.042667
MdRH-F-4_022411	6	22.9	3.816667	1.749667
February	3	12.6	4.2	5.11
March	3	8.78	2.926667	10.74613
April	3	12.8	4.266667	0.443333
May	3	13.5	4.5	0.97
June	3	18.5	6.166667	2.303333
July	3	14.9	4.966667	0.363333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	27.27604	2	13.63802	10.82707	0.003146639	4.102821
Columns	16.84578	5	3.369156	2.674735	0.087072135	3.325835
Error	12.59622	10	1.259622			
Total	56.71804	17				

F5 — No correlation

F5	February	March	April	May	June	July
F5_AD_022411	3.1	0.87	3.9	3.4	4.6	4.3
F5_AS_022411	4.5	4.7	4.2	4.4	6	5.4
MdRH-F-5_022411	4.2	1.1	4.1	4.3	4.2	4.9

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F5_AD_022411	6	20.17	3.361667	1.796417
F5_AS_022411	6	29.2	4.866667	0.478667
MdRH-F-5_022411	6	22.8	3.8	1.832
February	3	11.8	3.933333	0.543333
March	3	6.67	2.223333	4.613633
April	3	12.2	4.066667	0.023333
May	3	12.1	4.033333	0.303333
June	3	14.8	4.933333	0.893333
July	3	14.6	4.866667	0.303333

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	7.189878	2	3.594939	5.825799	0.021016006	4.102821
Columns	14.36469	5	2.872939	4.655758	0.018673566	3.325835
Error	6.170722	10	0.617072			
Total	27.72529	17				

Copper Translator

Potential spatial correlation

	February	March	April	May	June	July
B1_AD_022411	0.756	0.627	0.597	0.327	0.664	0.481
B2_AD_022411	0.615	0.393	0.639	0.440	0.650	0.525
B3_AD_022411	0.667	0.546	0.551	0.492	0.592	0.540
B4_AD_022411	0.619	0.529	0.551	0.478	0.800	0.383
F1_AD_022411	0.619	0.571	0.732	0.603	0.814	0.537
F2_AD_022411	0.536	0.600	0.714	0.629	0.844	0.436
F3_AD_022411	0.552	0.539	0.750	0.667	0.944	0.333
F4_AD_022411	0.652	0.513	0.676	0.568	0.864	0.409
F5_AD_022411	0.710	0.414	0.667	0.588	0.739	0.512

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AD_022411	6	3.450967	0.5751612	0.0228183
B2_AD_022411	6	3.2621762	0.543696	0.0118917
B3_AD_022411	6	3.3876922	0.5646154	0.0035162
B4_AD_022411	6	3.3607194	0.5601199	0.0200241
F1_AD_022411	6	3.8766647	0.6461108	0.0111667
F2_AD_022411	6	3.7586247	0.6264375	0.0200717
F3_AD_022411	6	3.7844333	0.6307389	0.0433328
F4_AD_022411	6	3.6817354	0.6136226	0.024469
F5_AD_022411	6	3.6291308	0.6048551	0.0156621
February	9	5.7255338	0.6361704	0.0049016
March	9	4.7320205	0.5257801	0.0060935
April	9	5.8769302	0.6529922	0.0055346
May	9	4.7918126	0.5324236	0.0114766
June	9	6.9115406	0.767949	0.0132202
July	9	4.1543059	0.4615895	0.005575

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.062852529	8	0.0078566	1.0086766	0.4449991	2.1801705
Columns	0.553203488	5	0.1106407	14.204765	5.328E-08	2.4494664
Error	0.311559382	40	0.007789			
Total	0.927615399	53				

Potential spatial correlation

	February	March	April	May	June	July
B1_AS_022411	0.883	0.953	0.651	0.519	0.708	0.662
B2_AS_022411	0.889	0.909	0.667	0.595	0.709	1.000
B3_AS_022411	1.000	0.942	0.671	0.627	0.888	0.642
B4_AS_022411	0.848	0.899	0.678	0.656	0.938	0.689
F1_AS_022411	1.000	0.838	0.788	0.661	0.827	0.706
F2_AS_022411	1.000	0.787	0.763	0.721	0.831	0.640
F3_AS_022411	1.000	0.783	0.783	0.627	0.932	0.682
F4_AS_022411	0.851	0.851	0.820	0.696	0.885	0.786
F5_AS_022411	0.822	0.851	0.738	0.636	0.683	0.556

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AS_022411	6	4.376908	0.729485	0.025871
B2_AS_022411	6	4.768975	0.794829	0.025522
B3_AS_022411	6	4.769419	0.794903	0.027852
B4_AS_022411	6	4.707941	0.784657	0.015478
F1_AS_022411	6	4.820633	0.803439	0.014066
F2_AS_022411	6	4.741865	0.790311	0.014756
F3_AS_022411	6	4.806769	0.801128	0.020388
F4_AS_022411	6	4.888251	0.814708	0.004469
F5_AS_022411	6	4.286634	0.714439	0.01263
February	9	8.293676	0.92152	0.00592
March	9	7.812456	0.868051	0.003843
April	9	6.559261	0.728807	0.003991
May	9	5.739402	0.637711	0.003435
June	9	7.400677	0.822297	0.009828
July	9	6.361922	0.70688	0.015838

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.05768147	8	0.00721	1.011394	0.443081	2.18017
Columns	0.52000612	5	0.104001	14.58856	3.83E-08	2.449466
Error	0.28515828	40	0.007129			
Total	0.86284587	53				

Potential spatial correlation

	February	March	April	May	June	July
MdRH-B-1_022411	0.804	0.774	0.500	0.488	0.871	0.371
MdRH-B-2_022411	0.750	0.675	0.730	0.505	0.878	0.716
MdRH-B-3_022411	0.722	0.750	0.640	0.507	0.743	0.643
MdRH-B-4_022411	0.865	0.625	0.723	0.583	0.810	0.556
MdRH-F-1_022411	0.742	0.675	0.754	0.607	0.890	0.582
MdRH-F-2_022411	0.841	0.696	0.754	0.632	0.903	0.730
MdRH-F-3_022411	0.812	0.724	0.750	0.622	0.898	0.561
MdRH-F-4_022411	1.000	0.638	0.707	0.619	0.813	0.388
MdRH-F-5_022411	0.762	0.700	0.683	0.581	0.810	0.592

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
MdRH-B-1_022411	6	3.807642	0.634607	0.042585
MdRH-B-2_022411	6	4.254307	0.709051	0.014701
MdRH-B-3_022411	6	4.005365	0.667561	0.00853
MdRH-B-4_022411	6	4.162804	0.693801	0.015979
MdRH-F-1_022411	6	4.250108	0.708351	0.012776
MdRH-F-2_022411	6	4.555907	0.759318	0.009646
MdRH-F-3_022411	6	4.365858	0.727643	0.015132
MdRH-F-4_022411	6	4.165081	0.69418	0.042069
MdRH-F-5_022411	6	4.127587	0.687931	0.008202
February	9	7.297713	0.810857	0.007298
March	9	6.257445	0.695272	0.002383
April	9	6.242579	0.69362	0.006681
May	9	5.144206	0.571578	0.00319
June	9	7.614947	0.846105	0.002975
July	9	5.137771	0.570863	0.015745

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.05967996	8	0.00746	1.210534	0.317751	2.18017
Columns	0.60160126	5	0.12032	19.52437	8.39E-10	2.449466
Error	0.24650269	40	0.006163			
Total	0.90778391	53				

Potential spatial correlation

	February	March	April	May	June	July
B1_AD_022411	0.7560976	0.626667	0.596774	0.327273	0.663636	0.480519
B2_AD_022411	0.6153846	0.392857	0.639344	0.44	0.65	0.52459
B3_AD_022411	0.6666667	0.546154	0.55102	0.492063	0.592105	0.539683
B4_AD_022411	0.6190476	0.529412	0.55102	0.478261	0.8	0.382979

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AD_022411	6	3.450967	0.575161	0.022818
B2_AD_022411	6	3.262176	0.543696	0.011892
B3_AD_022411	6	3.387692	0.564615	0.003516
B4_AD_022411	6	3.360719	0.56012	0.020024
February	4	2.657196	0.664299	0.004291
March	4	2.095089	0.523772	0.00942
April	4	2.338159	0.58454	0.0018
May	4	1.737597	0.434399	0.005585
June	4	2.705742	0.676435	0.007747
July	4	1.927771	0.481943	0.004983

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.0030826	3	0.001028	0.156642	0.923766	3.287382
Columns	0.1928552	5	0.038571	5.879921	0.003343	2.901295
Error	0.0983968	15	0.00656			
Total	0.2943346	23				

Potential spatial correlation

	February	March	April	May	June	July
F1_AD_022411	0.61904762	0.571429	0.732143	0.603175	0.814285714	0.536585
F2_AD_022411	0.53571429	0.6	0.714286	0.628571	0.844155844	0.435897
F3_AD_022411	0.55172414	0.538889	0.75	0.666667	0.943820225	0.333333
F4_AD_022411	0.65217391	0.512821	0.675676	0.567568	0.86440678	0.409091
F5_AD_022411	0.70967742	0.413793	0.666667	0.588235	0.739130435	0.511628

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F1_AD_022411	6	3.876665	0.646111	0.011167
F2_AD_022411	6	3.758625	0.626437	0.020072
F3_AD_022411	6	3.784433	0.630739	0.043333
F4_AD_022411	6	3.681735	0.613623	0.024469
F5_AD_022411	6	3.629131	0.604855	0.015662
February	5	3.068337	0.613667	0.005161
March	5	2.636931	0.527386	0.005115
April	5	3.538771	0.707754	0.001285
May	5	3.054216	0.610843	0.001468
June	5	4.205799	0.84116	0.005555
July	5	2.226535	0.445307	0.006667

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.00608301	4	0.001521	0.32042	0.860934413	2.866081
Columns	0.47858837	5	0.095718	20.16754	3.427E-07	2.71089
Error	0.09492249	20	0.004746			
Total	0.57959387	29				

Potential spatial correlation

	February	March	April	May	June	July
B1_AS_022411	0.883	0.953	0.651	0.519	0.708	0.66
B2_AS_022411	0.889	0.909	0.667	0.595	0.709	1.00
B3_AS_022411	1.000	0.942	0.671	0.627	0.888	0.64
B4_AS_022411	0.848	0.899	0.678	0.656	0.938	0.69

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AS_022411	6	4.3769079	0.7294846	0.0258708
B2_AS_022411	6	4.7689755	0.7948292	0.0255223
B3_AS_022411	6	4.7694186	0.7949031	0.0278518
B4_AS_022411	6	4.7079409	0.7846568	0.0154784
February	4	3.6207071	0.9051768	0.0043159
March	4	3.703159	0.9257897	0.0006839
April	4	2.6666593	0.6666648	0.0001335
May	4	2.3973411	0.5993353	0.0034899
June	4	3.2424242	0.8106061	0.0142599
July	4	2.9929521	0.748238	0.0285479

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.017702894	3	0.005901	0.6480284	0.5962503	3.287382
Columns	0.337026048	5	0.0674052	7.4022623	0.0011165	2.901295
Error	0.136590424	15	0.009106			
Total	0.491319366	23				

Potential spatial correlation

	February	March	April	May	June	July
F1_AS_022411	1.000	0.838	0.788	0.661	0.827	0.706
F2_AS_022411	1.000	0.787	0.763	0.721	0.831	0.640
F3_AS_022411	1.000	0.783	0.783	0.627	0.932	0.682
F4_AS_022411	0.851	0.851	0.820	0.696	0.885	0.786
F5_AS_022411	0.822	0.851	0.738	0.636	0.683	0.556

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F1_AS_022411	6	4.820633	0.803439	0.014066
F2_AS_022411	6	4.741865	0.790311	0.014756
F3_AS_022411	6	4.806769	0.801128	0.020388
F4_AS_022411	6	4.888251	0.814708	0.004469
F5_AS_022411	6	4.286634	0.714439	0.01263
February	5	4.672968	0.934594	0.008123
March	5	4.109297	0.821859	0.001173
April	5	3.892602	0.77852	0.000932
May	5	3.342061	0.668412	0.001601
June	5	4.158253	0.831651	0.008714
July	5	3.36897	0.673794	0.007186

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.038937	4	0.009734	2.704895	0.059740484	2.866081
Columns	0.259572	5	0.051914	14.42551	4.74348E-06	2.71089
Error	0.071976	20	0.003599			
Total	0.370485	29				

Potential spatial correlation

	February	March	April	May	June	July
MdRH-B-1_022411	0.803922	0.774194	0.5	0.487805	0.870588	0.371134
MdRH-B-2_022411	0.75	0.675	0.730159	0.505051	0.878049	0.716049
MdRH-B-3_022411	0.722222	0.75	0.64	0.507042	0.743243	0.642857
MdRH-B-4_022411	0.865385	0.625	0.723404	0.583333	0.810127	0.555556

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
MdRH-B-1_022411	6	3.807642	0.634607	0.042585
MdRH-B-2_022411	6	4.254307	0.709051	0.014701
MdRH-B-3_022411	6	4.005365	0.667561	0.00853
MdRH-B-4_022411	6	4.162804	0.693801	0.015979
February	4	3.141528	0.785382	0.003995
March	4	2.824194	0.706048	0.004703
April	4	2.593563	0.648391	0.011468
May	4	2.083231	0.520808	0.001812
June	4	3.302007	0.825502	0.003932
July	4	2.285596	0.571399	0.022129

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.019162	3	0.006387	0.766733	0.530259	3.287382
Columns	0.284024	5	0.056805	6.818998	0.001669	2.901295
Error	0.124956	15	0.00833			
Total	0.428141	23				

Potential spatial correlation

	February	March	April	May	June	July
MdRH-F-1_022411	0.741935	0.675	0.754386	0.606557	0.890411	0.581818
MdRH-F-2_022411	0.84058	0.695652	0.754386	0.632353	0.902778	0.730159
MdRH-F-3_022411	0.811765	0.724138	0.75	0.621622	0.897727	0.560606
MdRH-F-4_022411	1	0.638462	0.707317	0.619048	0.8125	0.387755
MdRH-F-5_022411	0.761905	0.7	0.682927	0.581395	0.809524	0.591837

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
MdRH-F-1_022411	6	4.250108	0.708351	0.012776
MdRH-F-2_022411	6	4.555907	0.759318	0.009646
MdRH-F-3_022411	6	4.365858	0.727643	0.015132
MdRH-F-4_022411	6	4.165081	0.69418	0.042069
MdRH-F-5_022411	6	4.127587	0.687931	0.008202
February	5	4.156185	0.831237	0.010432
March	5	3.433252	0.68665	0.001031
April	5	3.649016	0.729803	0.00108
May	5	3.060975	0.612195	0.000381
June	5	4.31294	0.862588	0.002237
July	5	2.852175	0.570435	0.014892

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.019999	4	0.005	0.997828	0.431754	2.866081
Columns	0.338913	5	0.067783	13.52791	7.67E-06	2.71089
Error	0.100211	20	0.005011			
Total	0.459123	29				

B1 — Potential depth correlation

	February	March	April	May	June	July
B1_AD_022411	0.756097561	0.6266667	0.5967742	0.3272727	0.6636364	0.4805195
B1_AS_022411	0.883333333	0.9534884	0.6507937	0.5189873	0.7083333	0.6619718
MdRH-B-1_022411	0.803921569	0.7741935	0.5	0.4878049	0.8705882	0.371134

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B1_AD_022411	6	3.450967	0.5751612	0.0228183
B1_AS_022411	6	4.3769079	0.7294846	0.0258708
MdRH-B-1_022411	6	3.8076423	0.634607	0.0425854
February	3	2.4433525	0.8144508	0.0041304
March	3	2.3543486	0.7847829	0.0267872
April	3	1.7475678	0.5825226	0.005837
May	3	1.3340649	0.4446883	0.0105829
June	3	2.2425579	0.7475193	0.0118589
July	3	1.5136253	0.5045418	0.0215795

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.072702615	2	0.0363513	4.0913504	0.0503162	4.102821
Columns	0.367523062	5	0.0735046	8.2729659	0.0025168	3.3258345
Error	0.088849167	10	0.0088849			
Total	0.529074844	17				

B2 — Potential month correlation

	February	March	April	May	June	July
B2_AD_022411	0.61538462	0.392857	0.639344	0.44	0.65	0.52459
B2_AS_022411	0.88888889	0.909091	0.666667	0.595238	0.709091	1
MdRH-B-2_022411	0.75	0.675	0.730159	0.505051	0.878049	0.716049

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B2_AD_022411	6	3.262176	0.543696	0.011892
B2_AS_022411	6	4.768975	0.794829	0.025522
MdRH-B-2_022411	6	4.254307	0.709051	0.014701
February	3	2.254274	0.751425	0.018703
March	3	1.976948	0.658983	0.066817
April	3	2.03617	0.678723	0.002171
May	3	1.540289	0.51343	0.006077
June	3	2.23714	0.745713	0.014007
July	3	2.24064	0.74688	0.057217

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.1955362	2	0.097768	7.27187	0.011228	4.102821
Columns	0.12613023	5	0.025226	1.876282	0.185705	3.325835
Error	0.13444698	10	0.013445			
Total	0.45611342	17				

B4 — No Correlation

	February	March	April	May	June	July
B4_AD_022411	0.619047619	0.5294118	0.5510204	0.4782609	0.8	0.3829787
B4_AS_022411	0.848484848	0.8985507	0.6779661	0.65625	0.9375	0.6891892
MdRH-B-4_022411	0.865384615	0.625	0.7234043	0.5833333	0.8101266	0.5555556

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B4_AD_022411	6	3.3607194	0.5601199	0.0200241
B4_AS_022411	6	4.7079409	0.7846568	0.0154784
MdRH-B-4_022411	6	4.1628043	0.6938007	0.0159795
February	3	2.3329171	0.777639	0.0189348
March	3	2.0529625	0.6843208	0.0367051
April	3	1.9523908	0.6507969	0.0079827
May	3	1.7178442	0.5726147	0.0080062
June	3	2.5476266	0.8492089	0.0058721
July	3	1.6277235	0.5425745	0.0235676

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.153084434	2	0.0765422	15.604099	0.0008416	4.102821
Columns	0.208357574	5	0.0416715	8.4952654	0.0022752	3.3258345
Error	0.049052634	10	0.0049053			
Total	0.410494643	17				

F1 — No Correlation

	February	March	April	May	June	July
F1_AD_022411	0.61904762	0.571429	0.732143	0.603175	0.814286	0.536585
F1_AS_022411	1	0.837838	0.788462	0.66129	0.82716	0.705882
MdRH-F-1_022411	0.74193548	0.675	0.754386	0.606557	0.890411	0.581818

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F1_AD_022411	6	3.876665	0.646111	0.011167
F1_AS_022411	6	4.820633	0.803439	0.014066
MdRH-F-1_022411	6	4.250108	0.708351	0.012776
February	3	2.360983	0.786994	0.037804
March	3	2.084266	0.694755	0.018036
April	3	2.27499	0.75833	0.000805
May	3	1.871022	0.623674	0.001064
June	3	2.531857	0.843952	0.00166
July	3	1.824286	0.608095	0.007683

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.07533519	2	0.037668	6.409393	0.016164	4.102821
Columns	0.13127198	5	0.026254	4.467361	0.021245	3.325835
Error	0.05876936	10	0.005877			
Total	0.26537653	17				

B3	No Correlation					
	February	March	April	May	June	July
B3_AD_022411	0.67	0.55	0.55	0.49	0.59	0.54
B3_AS_022411	1.00	0.94	0.67	0.63	0.89	0.64
MdRH-B-3_022411	0.72	0.75	0.64	0.51	0.74	0.64

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
B3_AD_022411	6	3.387692	0.564615	0.003516
B3_AS_022411	6	4.769419	0.794903	0.027852
MdRH-B-3_022411	6	4.005365	0.667561	0.00853
February	3	2.388889	0.796296	0.031893
March	3	2.238183	0.746061	0.039191
April	3	1.862253	0.620751	0.003891
May	3	1.625971	0.54199	0.005459
June	3	2.222849	0.74095	0.021818
July	3	1.824331	0.60811	0.003512

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.15969252	2	0.079846	15.40377	0.000884	4.102821
Columns	0.14765286	5	0.029531	5.696976	0.009644	3.325835
Error	0.05183552	10	0.005184			
Total	0.3591809	17				

F2	Potential month correlation					
	February	March	April	May	June	July
F2_AD_022411	0.53571429	0.6	0.714286	0.628571	0.844156	0.435897
F2_AS_022411	1	0.786517	0.762712	0.721311	0.831325	0.64
MdRH-F-2_022411	0.84057971	0.695652	0.754386	0.632353	0.902778	0.730159

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F2_AD_022411	6	3.758625	0.626437	0.020072
F2_AS_022411	6	4.741865	0.790311	0.014756
MdRH-F-2_022411	6	4.555907	0.759318	0.009646
February	3	2.376294	0.792098	0.055653
March	3	2.082169	0.694056	0.008699
April	3	2.231384	0.743795	0.00067
May	3	1.982236	0.660745	0.002755
June	3	2.578259	0.85942	0.001451
July	3	1.806056	0.602019	0.022729

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.09094458	2	0.045472	4.891012	0.03301	4.102821
Columns	0.12940149	5	0.02588	2.783692	0.079054	3.325835
Error	0.09297112	10	0.009297			
Total	0.31331719	17				

F3	Potential depth correlation					
	February	March	April	May	June	July
F3_AD_022411	0.551724138	0.5388889	0.75	0.6666667	0.9438202	0.3333333
F3_AS_022411	1	0.7831325	0.7833333	0.6266667	0.9318182	0.6818182
MdRH-F-3_022411	0.811764706	0.7241379	0.75	0.6216216	0.8977273	0.5606061

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F3_AD_022411	6	3.7844333	0.6307389	0.0433328
F3_AS_022411	6	4.8067689	0.8011281	0.0203884
MdRH-F-3_022411	6	4.3658576	0.7276429	0.0151318
February	3	2.3634888	0.7878296	0.0506675
March	3	2.0461594	0.6820531	0.0162421
April	3	2.2833333	0.7611111	0.0003704
May	3	1.914955	0.6383183	0.0006091
June	3	2.7733657	0.9244552	0.0005718
July	3	1.5757576	0.5252525	0.0312978

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.087645956	2	0.043823	3.9172658	0.0554232	4.102821
Columns	0.282393605	5	0.0564787	5.0485424	0.0144099	3.3258345
Error	0.11187134	10	0.0111871			
Total	0.481910901	17				

F4	No Correlation					
	February	March	April	May	June	July
F4_AD_022411	0.65217391	0.512821	0.675676	0.567568	0.864407	0.409091
F4_AS_022411	0.85074627	0.850746	0.82	0.696429	0.884615	0.785714
MdRH-F-4_022411	1	0.638462	0.707317	0.619048	0.8125	0.387755

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F4_AD_022411	6	3.681735	0.613623	0.024469
F4_AS_022411	6	4.888251	0.814708	0.004469
MdRH-F-4_022411	6	4.165081	0.69418	0.042069
February	3	2.50292	0.834307	0.030448
March	3	2.002028	0.667343	0.029174
April	3	2.202993	0.734331	0.005755
May	3	1.883044	0.627681	0.004207
June	3	2.561522	0.853841	0.001384
July	3	1.58256	0.52752	0.050112

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.12290427	2	0.061452	5.15295	0.028966	4.102821
Columns	0.23577555	5	0.047155	3.954101	0.030701	3.325835
Error	0.11925622	10	0.011926			
Total	0.47793604	17				

F5 Potential depth and month correlation

	February	March	April	May	June	July
F5_AD_022411	0.70967742	0.413793	0.666667	0.588235	0.73913	0.511628
F5_AS_022411	0.82222222	0.851064	0.738095	0.636364	0.683333	0.555556
MdRH-F-5_022411	0.76190476	0.7	0.682927	0.581395	0.809524	0.591837

Anova: Two-Factor Without Replication

SUMMARY	*Count*	*Sum*	*Average*	*Variance*
F5_AD_022411	6	3.629131	0.604855	0.015662
F5_AS_022411	6	4.286634	0.714439	0.01263
MdRH-F-5_022411	6	4.127587	0.687931	0.008202
February	3	2.293804	0.764601	0.003172
March	3	1.964857	0.654952	0.049323
April	3	2.087689	0.695896	0.001402
May	3	1.805994	0.601998	0.000897
June	3	2.231988	0.743996	0.003999
July	3	1.65902	0.553007	0.001613

ANOVA

Source of Variation	*SS*	*df*	*MS*	*F*	*P-value*	*F crit*
Rows	0.03922583	2	0.019613	2.40392	0.140456	4.102821
Columns	0.10088527	5	0.020177	2.473065	0.10456	3.325835
Error	0.08158724	10	0.008159			
Total	0.22169834	17				

Appendix D: Additional Stats on All Data

Appendix D

To determine the correlations between the total and dissolved metal (copper, lead, and zinc) concentrations and the SSC total Concentrations, several statistical analyses were performed. These include the mean and standard deviation, median, direct correlation, Pearson correlation, Poisson distribution, Spearman's rank, and a 95% confidence interval. Correlations were calculated between the total and dissolved metals concentrations and the SSC concentrations. Spearman's Rank and Pearson's correlation do not include data in the SSC (Total) column because the strength of the correlation is presented in the total and dissolved metal columns (copper, lead, and zinc).

The Pearson correlation measures the correlation or strength of linear dependence between two variables X and Y; +1 implies that Y increases as X increases; 0 implies that there is no linear correlation between the variables; and -1 implies that Y decreases as X increases. For −1 and 1, a linear equation exists that describes the relationship between X and Y perfectly.

A Poisson experiment examines the number of times an event occurs during a specified interval. The number of successes in a Poisson experiment is referred to as a Poisson random variable. A Poisson distribution is a probability distribution of a Poisson random variable, and returns a p value that is the probability of the data set or event repeating itself. A p value of 1 indicates that data or event will probably repeat itself.

Spearman's rank correlation coefficient assesses how well the relationship between two variables can be described using a monotonic function. If there are no repeated data values, a perfect Spearman correlation of +1 or −1 occurs when each of the variables is a perfect monotone function of the other.

MdR-3								
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper	Dissolved Lead	Dissolved Zinc	SSC (Total)
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
2/15/2011	MdR-3	0.02	0	0.062	0.017	0	0.049	5.4
2/17/2011	MdR-3	0.15	0.08	0.89	0.0098	0	0.092	387
2/25/2011	MdR-3	0.027	0.016	0.19	0.0065	0	0.079	52.1
3/20/2011	MdR-3	0.045	0.018	0.27	0.02	0	0.16	68.3
3/25/2011	MdR-3	0.029	0.02	0.16	0.01	0	0.073	61.3
Mean		0.05	0.03	0.31	0.01	0.00	0.09	114.82
Standard Deviation		0.05	0.03	0.33	0.01	0.00	0.04	154.12
Median		0.03	0.02	0.19	0.01	0.00	0.08	61.30
Maximum		0.15	0.08	0.89	0.02	0.00	0.16	387.00
Minimum		0.02	0.00	0.06	0.01	0.00	0.05	5.40
Spearman's Rank		1.00	0.90	0.90	0.000	#DIV/0!	0.80	
Pearson		0.99	0.99	0.99	-0.31	#DIV/0!	0.13	
Poisson		1.00	1.00	1.00	1.00	1.00	1.00	
Correlation		0.99	0.99	0.99	-0.31	#DIV/0!	0.13	
95 % CI		0.05	0.03	0.29	0.005	#NUM!	0.04	
ttest		0.171	0.171	0.172	0.171	0.171	0.171	

MdR-4								
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper	Dissolved Lead	Dissolved Zinc	SSC (Total)
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
2/15/2011	MdR-4	0.044	0	0.16	0.02	0	0.079	20
2/17/2011	MdR-4	0.01	0	0.053	0.005	0	0.039	2.1
2/25/2011	MdR-4	0.012	0	0.085	0.0042	0	0.063	10.7
3/20/2011	MdR-4	0.016	0	0.064	0.0053	0	0.037	11.2
3/25/2011	MdR-4	0.012	0	0.042	0.0046	0	0.028	12
Mean		0.02	0.00	0.08	0.01	0.00	0.05	11.20
Standard Deviation		0.01	0.00	0.05	0.01	0.00	0.02	6.35
Median		0.01	0.00	0.06	0.01	0.00	0.04	11.20
Maximum		0.04	0.00	0.16	0.02	0.00	0.08	20.00
Minimum		0.01	0.00	0.04	0.00	0.00	0.03	2.10
Spearman's Rank		0.85	#DIV/0!	0.30	0.500	#DIV/0!	0.10	
Pearson		0.83	#DIV/0!	0.77	0.76	#DIV/0!	0.62	
Poisson		1.00	1.00	1.00	1.00	1.00	1.00	
Correlation		0.83	#DIV/0!	0.77	0.76	#DIV/0!	0.62	
95 % CI		0.01	#NUM!	0.04	0.006	#NUM!	0.02	
ttest		0.017	0.017	0.017	0.017	0.017	0.017	

MdR-5								
Date	Location	Total Copper mg/L	Total Lead mg/L	Total Zinc mg/L	Dissolved Copper mg/L	Dissolved Lead mg/L	Dissolved Zinc mg/L	SSC (Total) mg/L
2/15/2011	MdR-5	0.019	0	0.061	0.017	0	0.055	1.7
2/17/2011	MdR-5	0.028	0.011	0.13	0.01	0	0.051	29.3
2/25/2011	MdR-5	0.015	0	0.069	0.0097	0	0.05	9.3
3/20/2011	MdR-5	0.013	0	0.074	0.0072	0	0.05	15.8
3/25/2011	MdR-5	0.011	0	0.034	0.0071	0	0.034	4.3
Mean		0.02	0.00	0.07	0.01	0.00	0.05	12.08
Standard Deviation		0.01	0.00	0.04	0.00	0.00	0.01	11.03
Median		0.02	0.00	0.07	0.01	0.00	0.05	9.30
Maximum		0.03	0.01	0.13	0.02	0.00	0.06	29.30
Minimum		0.01	0.00	0.03	0.01	0.00	0.03	1.70
Spearman's Rank		0.30	0.71	0.90	-0.100	#DIV/0!	0.00	
Pearson		0.69	0.87	0.92	-0.34	#DIV/0!	0.25	
Poisson		1.00	1.00	1.00	1.00	1.00	1.00	
Correlation		0.69	0.87	0.92	-0.34	#DIV/0!	0.25	
95 % CI		0.01	0.00	0.03	0.004	#NUM!	0.01	
ttest		0.071	0.071	0.072	0.071	0.070	0.071	

MdRU-C1								
Date	Location	Total Copper mg/L	Total Lead mg/L	Total Zinc mg/L	Dissolved Copper mg/L	Dissolved Lead mg/L	Dissolved Zinc mg/L	SSC (Total) mg/L
2/15/2011	MdRU-C1	0.03	0	0.04	0.027	0	0.026	0
2/17/2011	MdRU-C1	0.056	0.021	0.22	0.013	0	0.073	67.7
2/25/2011	MdRU-C1	0.03	0.0083	0.11	0.011	0	0.061	27
3/20/2011	MdRU-C1	0.041	0.016	0.13	0.01	0	0.05	50.7
3/25/2011	MdRU-C1	0.037	0.017	0.11	0.01	0	0.036	48.5
Mean		0.04	0.01	0.12	0.01	0.00	0.05	38.78
Standard Deviation		0.01	0.01	0.06	0.01	0.00	0.02	26.06
Median		0.04	0.02	0.11	0.01	0.00	0.05	48.50
Maximum		0.06	0.02	0.22	0.03	0.00	0.07	67.70
Minimum		0.03	0.00	0.04	0.01	0.00	0.03	0.00
Spearman's Rank		0.97	0.90	0.96	-0.364	#DIV/0!	0.70	
Pearson		0.85	0.99	0.91	-0.77	#DIV/0!	0.68	
Poisson		1.00	1.00	1.00	1.00	1.00	1.00	
Correlation		0.85	0.99	0.91	-0.77	#DIV/0!	0.68	
95 % CI		0.01	0.01	0.06	0.006	#NUM!	0.02	
ttest		0.029	0.029	0.029	0.029	0.029	0.029	

MdRU-C2								
Date	Location	Total Copper mg/L	Total Lead mg/L	Total Zinc mg/L	Dissolved Copper mg/L	Dissolved Lead mg/L	Dissolved Zinc mg/L	SSC (Total) mg/L
2/15/2011	MdRU-C2	0.029	0	0.045	0.026	0	0.033	1.6
2/17/2011	MdRU-C2	0.094	0.1	0.24	0.011	0	0.026	364
2/25/2011	MdRU-C2	0.041	0.049	0.088	0.014	0	0.035	224
3/20/2011	MdRU-C2	0.024	0.0098	0.082	0.015	0	0.048	30.2
3/25/2011	MdRU-C2	0.016	0.007	0.044	0.012	0	0.029	18.5
Mean		0.04	0.03	0.10	0.02	0.00	0.03	127.66
Standard Deviation		0.03	0.04	0.08	0.01	0.00	0.01	160.03
Median		0.03	0.01	0.08	0.01	0.00	0.03	30.20
Maximum		0.09	0.10	0.24	0.03	0.00	0.05	364.00
Minimum		0.02	0.00	0.04	0.01	0.00	0.03	1.60
Spearman's Rank		0.70	1.00	0.90	-0.700	#DIV/0!	-0.20	
Pearson		0.93	0.99	0.90	-0.54	#DIV/0!	-0.46	
Poisson		1.00	1.00	1.00	1.00	1.00	1.00	
Correlation		0.93	0.99	0.90	-0.54	#DIV/0!	-0.46	
95 % CI		0.03	0.04	0.07	0.005	#NUM!	0.01	
ttest		0.149	0.149	0.149	0.149	0.149	0.149	

Harbor Water Quality Statistical Analysis, All Data														
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper	Dissolved Lead	Dissolved Zinc	Total Suspended Sediment Concentration	Kp copper	Kp lead	Kp zinc	log Kp copper	log Kp lead	log Kp zinc
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L						
	B1_AD_022411	4.1	0.56	29	3.1	0.074	26	3	107527	2189189	38462	5.03	6.34	4.59
	B1_AS_022411	6	0.34	43	5.3	0.096	41	1.7	77691	1495098	28694	4.89	6.17	4.46
	B2_AD_022411	2.6	0.81	20	1.6	0.054	17	3.9	160256	3589744	45249	5.20	6.56	4.66
	B2_AS_022411	6.3	0.39	46	5.6	0.1	44	1.1	113636	2636364	41322	5.06	6.42	4.62
	B3_AD_022411	2.4	0.52	17	1.6	0.098	15	2.9	172414	1484870	45977	5.24	6.17	4.66
	B3_AS_022411	6.3	0.28	40	5.5	0.11	37	0		#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!
	B4_AD_022411	2.1	0.68	15	1.3	0.089	12	3.3	186480	2012257	75758	5.27	6.30	4.88
	B4_AS_022411	6.6	0.32	43	5.6	0.1	39	1.1	162338	2000000	93240	5.21	6.30	4.97
	F1_AD_022411	2.1	0.86	14	1.3	0.11	12	2.8	219780	2435065	59524	5.34	6.39	4.77
	F1_AS_022411	6.5	0.26	46	5.6	0.14	44	0		#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!
	F2_AD_022411	2.8	0.93	16	1.5	0.095	13	4	216667	2197368	57692	5.34	6.34	4.76
	F2_AS_022411	6.9	0.26	41	5.9	0.11	42	0		#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!
	F3_AD_022411	2.9	0.93	16	1.6	0.049	14	3.8	213816	4731472	37594	5.33	6.67	4.58
February	F3_AS_022411	7.7	0.26	47	6.6	0.12	47	0		#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!
	F4_AD_022411	2.3	0.56	15	1.5	0.097	14	2	266667	2386598	35714	5.43	6.38	4.55
	F4_AS_022411	6.7	0.24	41	5.7	0.098	41	1	175439	1448980	0	5.24	6.16	#NUM!
	F5_AD_022411	3.1	0.53	20	2.2	0.11	19	2	204545	1909091	26316	5.31	6.28	4.42
	F5_AS_022411	4.5	0.33	28	3.7	0.11	27	1	216216	2000000	37037	5.33	6.30	4.57
	MdRH-B-1_022411	5.1	0.45	36	4.1	0.085	33	2.4	101626	1789216	37879	5.01	6.25	4.58
	MdRH-B-2_022411	2.8	0.5	24	2.1	0.1	21	2	166667	2000000	71429	5.22	6.30	4.85
	MdRH-B-3_022411	3.6	0.37	26	2.6	0.093	21	1	384615	2978495	238095	5.59	6.47	5.38
	MdRH-B-4_022411	5.2	0.4	37	4.5	0.1	35	1.6	97222	1875000	35714	4.99	6.27	4.55
	MdRH-F-1_022411	6.2	0.38	45	4.6	0.13	39	1.2	289855	1602564	128205	5.46	6.20	5.11
	MdRH-F-2_022411	6.9	0.27	47	5.8	0.11	42	1.1	172414	1322314	108225	5.24	6.12	5.03
	MdRH-F-3_022411	8.5	0.28	54	6.9	0.11	49	1.6	144928	965909	63776	5.16	5.98	4.80
	MdRH-F-4_022411	3.6	0.31	25	2.8	0.098	23	0		#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!
	MdRH-F-5_022411	4.2	0.34	29	3.2	0.1	27	1.7	183824	1411765	43573	5.26	6.15	4.64
	B1_AD_022411	1.5	0.68	12	0.94	0.095	12	3.7	161012	1664296	0	5.21	6.22	#NUM!
	B1_AS_022411	8.6	0.38	54	8.2	0.13	60	1.5	32520	1282051	-66667	4.51	6.11	#NUM!
	B2_AD_022411	2.8	1.2	14	1.1	0.1	13	9.5	162679	1157895	8097	5.21	6.06	3.91
	B2_AS_022411	11	0.37	62	10	0.14	68	1.4	71429	1173469	-63025	4.85	6.07	#NUM!
	B3_AD_022411	1.3	0.79	10	0.71	0.085	9	6	138498	1382353	18519	5.14	6.14	4.27
	B3_AS_022411	6.9	0.38	35	6.5	0.13	38	1.9	32389	1012146	-41551	4.51	6.01	#NUM!
	B4_AD_022411	0.85	0.63	6.3	0.45	0.088	5.3	4.9	181406	1256957	38506	5.26	6.10	4.59
	B4_AS_022411	6.9	0.35	42	6.2	0.11	44	1.3	86849	1678322	-34965	4.94	6.22	#NUM!
	F1_AD_022411	0.98	0.9	8.6	0.56	0.088	7.2	2.9	258621	3181818	67050	5.41	6.50	4.83
	F1_AS_022411	7.4	0.41	51	6.2	0.14	49	1.5	129032	1285714	27211	5.11	6.11	4.43
	F2_AD_022411	1.2	0.83	8.4	0.72	0.087	8.1	2.9	229885	2944907	12771	5.36	6.47	4.11
	F2_AS_022411	8.9	0.36	55	7	0.13	48	2.8	96939	631868	52083	4.99	5.80	4.72
	F3_AD_022411	1.8	0.89	13	0.97	0.082	11	3.6	237686	2737127	50505	5.38	6.44	4.70
March	F3_AS_022411	8.3	0.39	55	6.5	0.13	50	1.7	162896	1176471	58824	5.21	6.07	4.77
	F4_AD_022411	0.78	0.64	6.5	0.4	0.097	4.7	2.9	327586	1930323	132062	5.52	6.29	5.12
	F4_AS_022411	6.7	0.31	43	5.7	0.11	40	2	87719	909091	37500	4.94	5.96	4.57
	F5_AD_022411	0.87	0.76	5.9	0.36	0.078	3.9	3.3	429293	2649573	155400	5.63	6.42	5.19
	F5_AS_022411	4.7	0.4	29	4	0.098	30	1.8	97222	1712018	-18519	4.99	6.23	#NUM!
	MdRH-B-1_022411	3.1	0.67	27	2.4	0.11	28	2.7	108025	1885522	-13228	5.03	6.28	#NUM!
	MdRH-B-2_022411	4	0.93	25	2.7	0.11	25	6.5	74074	1146853	0	4.87	6.06	#NUM!
	MdRH-B-3_022411	2.8	0.65	20	2.1	0.094	21	2.6	128205	2274959	-18315	5.11	6.36	#NUM!
	MdRH-B-4_022411	2.4	0.59	15	1.5	0.092	15	2.6	230769	2081940	0	5.36	6.32	#NUM!
	MdRH-F-1_022411	1.2	0.89	9.7	0.81	0.13	9	2.7	178326	2165242	28807	5.25	6.34	4.46
	MdRH-F-2_022411	2.3	0.72	19	1.6	0.11	19	2.3	190217	2411067	0	5.28	6.38	#NUM!
	MdRH-F-3_022411	2.9	0.72	26	2.1	0.11	27	1.7	224090	3262032	-21786	5.35	6.51	#NUM!
	MdRH-F-4_022411	1.3	0.68	10	0.83	0.092	8.7	2.9	195264	2203898	51526	5.29	6.34	4.71
	MdRH-F-5_022411	1.1	0.6	8.6	0.77	0.054	7.6	1.8	238095	5617284	73099	5.38	6.75	4.86

Harbor Water Quality Statistical Analysis, All Data															
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper	Dissolved Lead	Dissolved Zinc	Total Suspended Sediment Concentration	Kp copper	Kp lead	Kp zinc	log Kp copper	log Kp lead	log Kp zinc
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L						
April	B1_AD_022411	6.2	0.88	42	3.7	0.1	36	5	135135	1560000	33333	5.13	6.19	4.52
	B1_AS_022411	6.3	0.7	41	4.1	0.12	37	3.8	141207	1271930	28450	5.15	6.10	4.45
	B2_AD_022411	6.1	0.61	42	3.9	0.099	37	3.6	156695	1433782	37538	5.20	6.16	4.57
	B2_AS_022411	6.3	0.45	45	4.2	0.097	41	2.4	208333	1516323	40650	5.32	6.18	4.61
	B3_AD_022411	4.9	0.93	32	2.7	0.11	25	4.1	198735	1818182	68293	5.30	6.26	4.83
	B3_AS_022411	7.3	0.51	40	4.9	0.13	38	2.1	233236	1391941	25063	5.37	6.14	4.40
	B4_AD_022411	4.9	0.89	31	2.7	0.14	24	6.1	133576	878220	47814	5.13	5.94	4.68
	B4_AS_022411	5.9	0.46	38	4	0.12	33	3.1	153226	913978	48876	5.19	5.96	4.69
	F1_AD_022411	5.6	0.6	40	4.1	0.14	36	3.7	98879	888031	30030	5.00	5.95	4.48
	F1_AS_022411	5.2	0.62	34	4.1	0.18	32	2.5	107317	977778	25000	5.03	5.99	4.40
	F2_AD_022411	4.2	0.69	29	3	0.14	25	2.1	190476	1870748	76190	5.28	6.27	4.88
	F2_AS_022411	5.9	0.45	35	4.5	0.13	33	2.5	124444	984615	24242	5.09	5.99	4.38
	F3_AD_022411	6	0.45	38	4.5	0.12	37	2.4	138889	1145833	11261	5.14	6.06	4.05
	F3_AS_022411	6	0.45	38	4.7	0.12	37	2.5	110638	1100000	10811	5.04	6.04	4.03
	F4_AD_022411	3.7	0.76	23	2.5	0.12	20	4.5	106667	1185185	33333	5.03	6.07	4.52
	F4_AS_022411	5	0.32	32	4.1	0.11	30	2.5	87805	763636	26667	4.94	5.88	4.43
	F5_AD_022411	3.9	0.78	24	2.6	0.15	21	4.2	119048	1000000	34014	5.08	6.00	4.53
	F5_AS_022411	4.2	0.59	26	3.1	0.12	23	2.8	126728	1398810	46584	5.10	6.15	4.67
	MdRH-B-1_022411	6.2	0.74	42	3.1	0.12	29	4.2	238095	1230159	106732	5.38	6.09	5.03
	MdRH-B-2_022411	6.3	0.43	49	4.6	0.1	41	2.3	160681	1434783	84836	5.21	6.16	4.93
	MdRH-B-3_022411	5	0.9	35	3.2	0.11	28	4.4	127841	1632231	56818	5.11	6.21	4.75
	MdRH-B-4_022411	4.7	0.65	34	3.4	0.13	28	3.1	123340	1290323	69124	5.09	6.11	4.84
	MdRH-F-1_022411	5.7	0.52	41	4.3	0.15	38	2.7	120586	913580	29240	5.08	5.96	4.47
	MdRH-F-2_022411	5.7	0.44	37	4.3	0.14	35	3.4	95759	630252	16807	4.98	5.80	4.23
	MdRH-F-3_022411	6	0.44	41	4.5	0.12	38	2	166667	1333333	39474	5.22	6.12	4.60
	MdRH-F-4_022411	4.1	0.57	28	2.9	0.11	25	2.8	147783	1493506	42857	5.17	6.17	4.63
	MdRH-F-5_022411	4.1	0.61	27	2.8	0.12	24	3.2	145089	1276042	39063	5.16	6.11	4.59
May	B1_AD_022411	11	2.3	37	3.6	0.28	27	16.2	126886	445326	22862	5.10	5.65	4.36
	B1_AS_022411	7.9	1.3	33	4.1	0.28	30	25.2	36779	144558	3968	4.57	5.16	3.60
	B2_AD_022411	10	1.8	38	4.4	0.23	33	32	39773	213315	4735	4.60	5.33	3.68
	B2_AS_022411	8.4	1	37	5	0.24	38	5.4	125926	586420	-4873	5.10	5.77	#NUM!
	B3_AD_022411	6.3	1.2	25	3.1	0.2	21	21.1	48922	236967	9027	4.69	5.37	3.96
	B3_AS_022411	6.7	0.88	23	4.2	0.2	22	21.7	27430	156682	2095	4.44	5.20	3.32
	B4_AD_022411	4.6	1.4	17	2.2	0.21	15	7.5	145455	755556	17778	5.16	5.88	4.25
	B4_AS_022411	6.4	0.88	26	4.2	0.22	25	4	130952	750000	10000	5.12	5.88	4.00
	F1_AD_022411	6.3	1.2	28	3.8	0.28	23	13.5	48733	243386	16103	4.69	5.39	4.21
	F1_AS_022411	6.2	0.92	28	4.1	0.28	26	17.2	29779	132890	4472	4.47	5.12	3.65
	F2_AD_022411	7	1.1	28	4.4	0.29	24	16.1	36702	173485	10352	4.56	5.24	4.02
	F2_AS_022411	6.1	0.84	28	4.4	0.27	25	22.4	17248	94246	5357	4.24	4.97	3.73
	F3_AD_022411	6.9	0.96	30	4.6	0.25	26	5.3	94340	535849	29028	4.97	5.73	4.46
	F3_AS_022411	7.5	1	32	4.7	0.28	31	6	99291	428571	5376	5.00	5.63	3.73
	F4_AD_022411	3.7	1	17	2.1	0.23	13	5	152381	669565	61538	5.18	5.83	4.79
	F4_AS_022411	5.6	0.59	26	3.9	0.2	22	3.6	121083	541667	50505	5.08	5.73	4.70
	F5_AD_022411	3.4	0.73	16	2	0.22	15	3.6	194444	643939	18519	5.29	5.81	4.27
	F5_AS_022411	4.4	0.68	21	2.8	0.19	18	14.7	38873	175439	11338	4.59	5.24	4.05
	MdRH-B-1_022411	8.2	1.4	34	4	0.19	28	25.2	41667	252715	8503	4.62	5.40	3.93
	MdRH-B-2_022411	9.9	1.6	39	5	0.2	33	10.4	94231	673077	17483	4.97	5.83	4.24
	MdRH-B-3_022411	7.1	1.3	27	3.6	0.21	24	25.8	37683	201181	4845	4.58	5.30	3.69
	MdRH-B-4_022411	6	0.96	27	3.5	0.18	23	18.6	38402	232975	9350	4.58	5.37	3.97
	MdRH-F-1_022411	6.1	1.2	28	3.7	0.21	26	19.9	32595	236899	3865	4.51	5.37	3.59
	MdRH-F-2_022411	6.8	0.87	29	4.3	0.19	26	6.3	92285	568087	18315	4.97	5.75	4.26
	MdRH-F-3_022411	7.4	1	33	4.6	0.21	30	5	121739	752381	20000	5.09	5.88	4.30
	MdRH-F-4_022411	4.2	0.87	20	2.6	0.16	20	23.8	25856	186450	0	4.41	5.27	#NUM!
	MdRH-F-5_022411	4.3	0.8	20	2.5	0.16	18	10.9	66055	366972	10194	4.82	5.56	4.01

Harbor Water Quality Statistical Analysis, All Data

Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper	Dissolved Lead	Dissolved Zinc	Total Suspended Sediment Concentration	Kp copper	Kp lead	Kp zinc	log Kp copper	log Kp lead	log Kp zinc
		µg/L	µg/L	µg/L	µg/L	µg/L	µg/L	mg/L						
	B1_AD_022411	11	0.46	59	7.3	0.1	46	12.1	41888	297521	23356	4.62	5.47	4.37
	B1_AS_022411	12	0.45	61	8.5	0.12	50	24.6	16738	111789	8943	4.22	5.05	3.95
	B2_AD_022411	6	0.79	47	3.9	0.062	39	22.5	23932	521864	9117	4.38	5.72	3.96
	B2_AS_022411	11	0.39	61	7.8	0.081	50	19.7	20825	193645	11168	4.32	5.29	4.05
	B3_AD_022411	7.6	0.88	42	4.5	0.13	33	20.3	33935	284199	13435	4.53	5.45	4.13
	B3_AS_022411	8	0.58	40	7.1	0.13	42	15.6	8126	221893	-3053	3.91	5.35	#NUM!
	B4_AD_022411	6.5	0.64	36	5.2	0.1	37	18.2	13736	296703	-1485	4.14	5.47	#NUM!
	B4_AS_022411	9.6	0.37	50	9	0.11	54	9.7	6873	243674	-7637	3.84	5.39	#NUM!
	F1_AD_022411	7	0.64	44	5.7	0.15	42	30.8	7405	106061	1546	3.87	5.03	3.19
	F1_AS_022411	8.1	0.54	49	6.7	0.21	45	25.7	8131	61145	3459	3.91	4.79	3.54
	F2_AD_022411	7.7	0.56	43	6.5	0.13	41	21.8	8469	151729	2238	3.93	5.18	3.35
	F2_AS_022411	8.3	0.41	43	6.9	0.15	41	18.9	10735	91711	2581	4.03	4.96	3.41
	F3_AD_022411	8.9	0.5	50	8.4	0.16	51	10.2	5836	208333	-1922	3.77	5.32	#NUM!
June	F3_AS_022411	8.8	0.37	49	8.2	0.12	49	11.8	6201	176554	0	3.79	5.25	#NUM!
	F4_AD_022411	5.9	0.48	34	5.1	0.085	34	26	6033	178733	0	3.78	5.25	#NUM!
	F4_AS_022411	7.8	0.37	43	6.9	0.12	41	16.1	8102	129400	3030	3.91	5.11	3.48
	F5_AD_022411	4.6	0.78	29	3.4	0.14	27	10.9	32380	419397	6796	4.51	5.62	3.83
	F5_AS_022411	6	0.5	38	4.1	0.14	30	17.7	26182	145278	15066	4.42	5.16	4.18
	MdRH-B-1_022411	8.5	0.6	51	7.4	0.082	51	9.2	16157	686638	0	4.21	5.84	#NUM!
	MdRH-B-2_022411	8.2	0.44	56	7.2	0.078	54	10.5	13228	442002	3527	4.12	5.65	3.55
	MdRH-B-3_022411	7.4	1.1	43	5.5	0.17	42	12.6	27417	434174	1890	4.44	5.64	3.28
	MdRH-B-4_022411	7.9	0.7	47	6.4	0.13	47	22.8	10280	192308	0	4.01	5.28	#NUM!
	MdRH-F-1_022411	7.3	0.4	47	6.5	0.15	46	27.5	4476	60606	791	3.65	4.78	2.90
	MdRH-F-2_022411	7.2	0.38	43	6.5	0.13	41	25	4308	76923	1951	3.63	4.89	3.29
	MdRH-F-3_022411	8.8	0.79	52	7.9	0.25	50	19.5	5842	110769	2051	3.77	5.04	3.31
	MdRH-F-4_022411	4.8	0.57	32	3.9	0.059	30	21.1	10937	410475	3160	4.04	5.61	3.50
	MdRH-F-5_022411	4.2	0.63	29	3.4	0.12	27	21.5	10944	197674	3445	4.04	5.30	3.54
	B1_AD_022411	7.7	1	40	3.7	0.11	27	11.1	97395	728911	43377	4.99	5.86	4.64
	B1_AS_022411	7.1	0.56	40	4.7	0.11	31	3.5	145897	1168831	82949	5.16	6.07	4.92
	B2_AD_022411	6.1	0.85	37	3.2	0.075	26	6.2	146169	1666667	68238	5.16	6.22	4.83
	B2_AS_022411	7.6	0.43	47	5.5	0.1	40	0		#DIV/0!	#DIV/0!	#NUM!	#DIV/0!	#DIV/0!
	B3_AD_022411	6.3	0.9	31	3.4	0.12	21	7.3	116841	890411	65232	5.07	5.95	4.81
	B3_AS_022411	6.7	0.51	33	4.3	0.11	24	2	279070	1818182	187500	5.45	6.26	5.27
	B4_AD_022411	4.7	1.5	24	1.8	0.083	13	10.3	156419	1657504	82151	5.19	6.22	4.91
	B4_AS_022411	7.4	0.48	41	5.1	0.12	33	3.9	115636	769231	62160	5.06	5.89	4.79
	F1_AD_022411	4.1	0.92	22	2.2	0.22	15	16.1	53642	197628	28986	4.73	5.30	4.46
	F1_AS_022411	6.8	0.43	43	4.8	0.12	33	3.6	115741	717593	84175	5.06	5.86	4.93
	F2_AD_022411	3.9	1.2	22	1.7	0.13	13	5.3	244173	1552975	130624	5.39	6.19	5.12
	F2_AS_022411	7.5	0.37	36	4.8	0.12	27	20.5	27439	101626	16260	4.44	5.01	4.21
	F3_AD_022411	4.5	1.7	20	1.5	0.15	10	21.4	93458	482866	46729	4.97	5.68	4.67
July	F3_AS_022411	6.6	0.41	38	4.5	0.12	29	1.7	274510	1421569	182556	5.44	6.15	5.26
	F4_AD_022411	4.4	1.5	24	1.8	0.18	15	5.2	277778	1410256	115385	5.44	6.15	5.06
	F4_AS_022411	5.6	0.47	31	4.4	0.13	27	5.2	52448	502959	28490	4.72	5.70	4.45
	F5_AD_022411	4.3	0.87	24	2.2	0.17	15	6.3	151515	653595	95238	5.18	5.82	4.98
	F5_AS_022411	5.4	1.7	44	3	0.6	33	7.6	105263	241228	43860	5.02	5.38	4.64
	MdRH-B-1_022411	9.7	1.6	47	3.6	0.12	28	9.7	174685	1271478	69956	5.24	6.10	4.84
	MdRH-B-2_022411	8.1	0.38	51	5.8	0.11	42	4.3	92221	570825	49834	4.96	5.76	4.70
	MdRH-B-3_022411	7	0.52	35	4.5	0.14	27	2.2	252525	1233766	134680	5.40	6.09	5.13
	MdRH-B-4_022411	7.2	0.62	39	4	0.1	28	2.9	275862	1793103	135468	5.44	6.25	5.13
	MdRH-F-1_022411	5.5	0.53	33	3.2	0.17	21	17.2	41788	123119	33223	4.62	5.09	4.52
	MdRH-F-2_022411	6.3	0.51	34	4.6	0.12	27	3.9	94760	833333	66477	4.98	5.92	4.82
	MdRH-F-3_022411	6.6	0.81	36	3.7	0.11	26	21.5	36455	295983	17889	4.56	5.47	4.25
	MdRH-F-4_022411	4.9	1.3	27	1.9	0.18	16	2.3	686499	2705314	298913	5.84	6.43	5.48
	MdRH-F-5_022411	4.9	0.76	33	2.9	0.16	24	1.5	459770	2500000	250000	5.66	6.40	5.40
Mean		5.74	0.70	33.28	4.02	0.14	29.50	8.07	124646	1133131	37891	4.91	5.87	4.43
Standard Deviation		2.32	0.35	12.60	1.98	0.06	12.46	8.09	99594	933880	51630	0.48	0.45	0.52
Median		6.05	0.62	34.00	4.05	0.12	28.00	3.90	116291	981197	27830	5.07	5.99	4.55
Maximum		12.00	2.30	62.00	10.00	0.60	68.00	32.00	686499	5617284	298913	5.84	6.75	5.48
Minimum		0.78	0.24	5.90	0.36	0.05	3.90	0.00	4308	60606	-66667	3.63	4.78	2.90

At Depth															
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	B1_AD_022411	4.1	0.56	29	3.1	0.074	26	3	107527	2189189	38462	5.03	6.34	4.59
March	B1_AD_022411	1.5	0.68	12	0.94	0.095	12	3.7	161012	1664296	0	5.21	6.22	#NUM!
April	B1_AD_022411	6.2	0.88	42	3.7	0.1	36	5	135135	1560000	33333	5.13	6.19	4.52
May	B1_AD_022411	11	2.3	37	3.6	0.28	27	16.2	126886	445326	22862	5.10	5.65	4.36
June	B1_AD_022411	11	0.46	59	7.3	0.1	46	12.1	41888	297521	23356	4.62	5.47	4.37
July	B1_AD_022411	7.7	1.0	40	3.7	0.11	27	11.1	97395	728911	43377	4.99	5.86	4.64
	Mean	6.92	0.98	36.50	3.72	0.13	29.00	8.52	111640.55	1147540.46	26898.34	5.01	5.96	4.49
	Standard Deviation	3.79	0.68	15.53	2.05	0.08	11.35	5.38	40760.78	763292.92	15485.55	0.21	0.35	0.13
	Median	6.95	0.78	38.50	3.65	0.10	27.00	8.05	117206.51	1144455.36	28344.71	5.07	6.03	4.52
	Maximum	11.00	2.30	59.00	7.30	0.28	46.00	16.20	161012.08	2189189.19	43376.71	5.21	6.34	4.64
	Minimum	1.50	0.46	12.00	0.94	0.07	12.00	3.00	41888.37	297520.66	0.00	4.62	5.47	4.36
	Spearman's Rank	0.93	0.43	0.54	0.54	0.92	0.69							
	Pearson	0.91	0.68	0.56	0.52	0.77	0.37							
	Poisson	0.46	1.00	0.00	0.92	1.00	0.00							
	Correlation	0.91	0.68	0.56	0.52	0.77	0.37							
	95 % CI	3.03	0.54	12.42	1.64	0.06	9.08							
	Variance	20.36	28.84	336.30	21.31	32.34	186.11							
	ttest	0.57	0.02	0.01	0.08	0.01	0.01							

At Surface

Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	B1_AS_022411	6	0.34	43	5.3	0.096	41	1.7	77691	1495098	28694	4.89	6.17	4.46
March	B1_AS_022411	8.6	0.38	54	8.2	0.13	60	1.5	32520	1282051	-66667	4.51	6.11	#NUM!
April	B1_AS_022411	6.3	0.7	41	4.1	0.12	37	3.8	141207	1271930	28450	5.15	6.10	4.45
May	B1_AS_022411	7.9	1.3	33	4.1	0.28	30	25.2	36779	144558	3968	4.57	5.16	3.60
June	B1_AS_022411	12	0.45	61	8.5	0.12	50	24.6	16738	111789	8943	4.22	5.05	3.95
July	B1_AS_022411	7.1	0.6	40	4.7	0.11	31	3.5	145897	1168831	82949	5.16	6.07	4.92
	Mean	7.98	0.62	45.33	5.82	0.14	41.50	10.05	75138.74	912376.13	14389.65	4.75	5.78	4.28
	Standard Deviation	2.19	0.36	10.25	2.01	0.07	11.64	11.54	56703.75	616726.50	48602.73	0.38	0.52	0.51
	Median	7.50	0.51	42.00	5.00	0.12	39.00	3.65	57235.20	1220380.50	18696.30	4.73	6.09	4.45
	Maximum	12.00	1.30	61.00	8.50	0.28	60.00	25.20	145896.66	1495098.04	82949.31	5.16	6.17	4.92
	Minimum	6.00	0.34	33.00	4.10	0.10	30.00	1.50	16738.40	111788.62	-66666.67	4.22	5.05	3.60
	Spearman's Rank	0.26	0.77	-0.37	-0.33	0.46	-0.60							
	Pearson	0.67	0.59	0.08	0.13	0.66	-0.16							
	Poisson	0.32	1.00	0.00	0.64	1.00	0.00							
	Correlation	0.67	0.59	0.08	0.13	0.66	-0.16							
	95 % CI	1.76	0.29	8.20	1.61	0.05	9.31							
	Variance	63.90	84.85	447.83	67.28	87.32	391.89							
	ttest	0.68	0.10	0.00	0.41	0.09	0.00							

Mid Depth															
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	MdRH-B-1_022411	5.1	0.45	36	4.1	0.085	33	2.4	101626	1789216	37879	5.01	6.25	4.58
March	MdRH-B-1_022411	3.1	0.67	27	2.4	0.11	28	2.7	108025	1885522	-13228	5.03	6.28	#NUM!
April	MdRH-B-1_022411	6.2	0.74	42	3.1	0.12	29	4.2	238095	1230159	106732	5.38	6.09	5.03
May	MdRH-B-1_022411	8.2	1.4	34	4	0.19	28	25.2	41667	252715	8503	4.62	5.40	3.93
June	MdRH-B-1_022411	8.5	0.6	51	7.4	0.082	51	9.2	16157	686638	0	4.21	5.84	#NUM!
July	MdRH-B-1_022411	9.7	1.6	47	3.6	0.12	28	9.7	174685	1271478	69956	5.24	6.10	4.84
	Mean	6.80	0.91	39.50	4.10	0.12	32.83	8.90	113375.84	1185954.58	34973.81	4.91	5.99	4.60
	Standard Deviation	2.46	0.47	8.87	1.73	0.04	9.11	8.59	82551.87	629736.31	46105.72	0.43	0.33	0.48
	Median	7.20	0.71	39.00	3.80	0.12	28.50	6.70	104825.35	1250818.20	23191.09	5.02	6.10	4.71
	Maximum	9.70	1.60	51.00	7.40	0.19	51.00	25.20	238095.24	1885521.89	106732.35	5.38	6.28	5.03
	Minimum	3.10	0.45	27.00	2.40	0.08	28.00	2.40	16157.46	252715.12	-13227.51	4.21	5.40	3.93
	Spearman's Rank	0.77	0.77	0.26	0.14	0.60	-0.34							
	Pearson	0.59	0.68	0.02	0.19	0.84	-0.08							
	Poisson	0.48	1.00	0.00	0.88	1.00	0.00							
	Correlation	0.59	0.68	0.02	0.19	0.84	-0.08							
	95 % CI	1.97	0.38	7.10	1.39	0.03	7.29							
	Variance	37.51	51.08	324.71	41.21	54.60	227.50							
	ttest	0.59	0.07	0.00	0.23	0.05	0.00							

At Depth

Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	B2_AD_022411	2.6	0.81	20	1.6	0.054	17	3.9	160256	3589744	45249	5.20	6.56	4.66
March	B2_AD_022411	2.8	1.2	14	1.1	0.1	13	9.5	162679	1157895	8097	5.21	6.06	3.91
April	B2_AD_022411	6.1	0.61	42	3.9	0.099	37	3.6	156695	1433782	37538	5.20	6.16	4.57
May	B2_AD_022411	10	1.8	38	4.4	0.23	33	32	39773	213315	4735	4.60	5.33	3.68
June	B2_AD_022411	6	0.79	47	3.9	0.062	39	22.5	23932	521864	9117	4.38	5.72	3.96
July	B2_AD_022411	6.1	0.9	37	3.2	0.075	26	6.2	146169	1666667	68238	5.16	6.22	4.83
	Mean	5.60	1.01	33.00	3.02	0.10	27.50	12.95	114917.45	1430544.38	28828.91	4.96	6.01	4.27
	Standard Deviation	2.72	0.43	13.02	1.36	0.06	10.73	11.67	64782.77	1191603.16	25680.52	0.37	0.43	0.48
	Median	6.05	0.83	37.50	3.55	0.09	29.50	7.85	151432.26	1295838.50	23327.17	5.18	6.11	4.27
	Maximum	10.00	1.80	47.00	4.40	0.23	39.00	32.00	162679.43	3589743.59	68238.21	5.21	6.56	4.83
	Minimum	2.60	0.61	14.00	1.10	0.05	13.00	3.60	23931.62	213315.22	4734.85	4.38	5.33	3.68
	Spearman's Rank	0.22	0.66	0.14	0.33	0.43	0.14							
	Pearson	0.73	0.75	0.40	0.57	0.72	0.45							
	Poisson	0.67	1.00	0.00	0.97	1.00	0.00							
	Correlation	0.73	0.75	0.40	0.57	0.72	0.45							
	95 % CI	2.17	0.35	10.42	1.08	0.05	8.58							
	Variance	79.98	100.87	248.63	89.65	106.91	171.95							
	ttest	0.19	0.05	0.02	0.09	0.04	0.05							

At Surface															
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	B2_AS_022411	6.3	0.39	46	5.6	0.1	44	1.1	113636	2636364	41322	5.06	6.42	4.62
March	B2_AS_022411	11	0.37	62	10	0.14	68	1.4	71429	1173469	-63025	4.85	6.07	#NUM!
April	B2_AS_022411	6.3	0.45	45	4.2	0.097	41	2.4	208333	1516323	40650	5.32	6.18	4.61
May	B2_AS_022411	8.4	1	37	5	0.24	38	5.4	125926	586420	-4873	5.10	5.77	#NUM!
June	B2_AS_022411	11	0.39	61	7.8	0.081	50	19.7	20825	193645	11168	4.32	5.29	4.05
July	B2_AS_022411	7.6	0.4	47	5.5	0.1	40	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
	Mean	8.43	0.51	49.67	6.35	0.13	46.83	5.00	108029.88	1221244.24	5048.35	4.93	5.95	4.42
	Standard Deviation	2.14	0.24	9.83	2.15	0.06	11.18	7.43	69564.35	942188.71	42875.40	0.38	0.44	0.33
	Median	8.00	0.41	46.50	5.55	0.10	42.50	1.90	113636.36	1173469.39	11167.51	5.06	6.07	4.61
	Maximum	11.00	1.00	62.00	10.00	0.24	68.00	19.70	208333.33	2636363.64	41322.31	5.32	6.42	4.62
	Minimum	6.30	0.37	37.00	4.20	0.08	38.00	0.00	20825.20	193645.42	-63025.21	4.32	5.29	4.05
	Spearman's Rank	0.50	0.24	-0.14	-0.03	-0.34	0.09							
	Pearson	0.58	0.00	0.43	0.26	-0.16	0.07							
	Poisson	0.26	1.00	0.00	0.55	1.00	0.00							
	Correlation	0.58	0.00	0.43	0.26	-0.16	0.07							
	95 % CI	1.72	0.20	7.87	1.72	0.05	8.94							
	Variance	30.41	30.64	613.17	27.71	31.59	559.19							
	ttest	0.32	0.20	0.00	0.68	0.17	0.00							

Mid Depth														
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	MdRH-B-2_022411	2.8	0.5	24	2.1	0.1	21	2	166667	2000000	71429	5.22	6.30	4.85
March	MdRH-B-2_022411	4	0.93	25	2.7	0.11	25	6.5	74074	1146853	0	4.87	6.06	#NUM!
April	MdRH-B-2_022411	6.3	0.43	49	4.6	0.1	41	2.3	160681	1434783	84836	5.21	6.16	4.93
May	MdRH-B-2_022411	9.9	1.6	39	5	0.2	33	10.4	94231	673077	17483	4.97	5.83	4.24
June	MdRH-B-2_022411	8.2	0.44	56	7.2	0.078	54	10.5	13228	442002	3527	4.12	5.65	3.55
July	MdRH-B-2_022411	8.1	0.4	51	5.8	0.11	42	4.3	92221	570825	49834	4.96	5.76	4.70
	Mean	6.55	0.71	40.67	4.57	0.12	36.00	6.00	100183.48	1044589.94	37851.32	4.89	5.96	4.45
	Standard Deviation	2.72	0.48	13.69	1.91	0.04	12.17	3.81	57309.30	600183.93	36067.40	0.40	0.25	0.57
	Median	7.20	0.47	44.00	4.80	0.11	37.00	5.40	93226.05	909965.03	33658.20	4.97	5.94	4.70
	Maximum	9.90	1.60	56.00	7.20	0.20	54.00	10.50	166666.67	2000000.00	84835.63	5.22	6.30	4.93
	Minimum	2.80	0.38	24.00	2.10	0.08	21.00	2.00	13227.51	442002.44	0.00	4.12	5.65	3.55
	Spearman's Rank	0.77	0.31	0.54	0.71	-0.03	0.54							
	Pearson	0.66	0.58	0.28	0.56	0.41	0.40							
	Poisson	0.52	1.00	0.00	0.82	1.00	0.00							
	Correlation	0.66	0.58	0.28	0.56	0.41	0.40							
	95 % CI	2.18	0.38	10.96	1.53	0.03	9.73							
	Variance	10.03	14.31	419.56	8.80	16.03	319.31							
	ttest	0.78	0.02	0.00	0.44	0.01	0.00							

At Depth

Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	B3_AD_022411	2.4	0.52	17	1.6	0.098	15	2.9	172414	1484870	45977	5.24	6.17	4.66
March	B3_AD_022411	1.3	0.79	10	0.71	0.085	9	6	138498	1382353	18519	5.14	6.14	4.27
April	B3_AD_022411	4.9	0.93	32	2.7	0.11	25	4.1	198735	1818182	68293	5.30	6.26	4.83
May	B3_AD_022411	6.3	1.2	25	3.1	0.2	21	21.1	48922	236967	9027	4.69	5.37	3.96
June	B3_AD_022411	7.6	0.88	42	4.5	0.13	33	20.3	33935	284199	13435	4.53	5.45	4.13
July	B3_AD_022411	6.3	0.9	31	3.4	0.12	21	7.3	116841	890411	65232	5.07	5.95	4.81
	Mean	4.80	0.87	26.17	2.67	0.12	20.67	10.28	118224.27	1016163.49	36746.99	4.99	5.89	4.44
	Standard Deviation	2.46	0.22	11.44	1.35	0.04	8.24	8.21	65937.62	656619.76	26592.52	0.31	0.38	0.38
	Median	5.60	0.89	28.00	2.90	0.12	21.00	6.65	127669.45	1136381.95	32247.77	5.10	6.05	4.47
	Maximum	7.60	1.20	42.00	4.50	0.20	33.00	21.10	198735.32	1818181.82	68292.68	5.30	6.26	4.83
	Minimum	1.30	0.52	10.00	0.71	0.09	9.00	2.90	33935.41	236966.82	9027.31	4.53	5.37	3.96
	Spearman's Rank	0.76	0.60	0.31	0.66	0.83	0.46							
	Pearson	0.71	0.68	0.49	0.67	0.80	0.57							
	Poisson	0.79	1.00	0.00	0.98	1.00	0.00							
	Correlation	0.71	0.68	0.49	0.67	0.80	0.57							
	95 % CI	1.97	0.18	9.16	1.08	0.03	6.59							
	Variance	41.63	54.85	159.00	47.30	58.82	90.92							
	ttest	0.17	0.04	0.02	0.07	0.03	0.05							

At Surface														
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	B3_AS_022411	6.3	0.28	40	5.5	0.11	37	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
March	B3_AS_022411	6.9	0.38	35	6.5	0.13	38	1.9	32389	1012146	-41551	4.51	6.01	#NUM!
April	B3_AS_022411	7.3	0.51	40	4.9	0.13	38	2.1	233236	1391941	25063	5.37	6.14	4.40
May	B3_AS_022411	6.7	0.88	23	4.2	0.2	22	21.7	27430	156682	2095	4.44	5.20	3.32
June	B3_AS_022411	8	0.58	40	7.1	0.13	42	15.6	8126	221893	-3053	3.91	5.35	#NUM!
July	B3_AS_022411	6.7	0.5	33	4.3	0.11	24	2	279070	1818182	187500	5.45	6.26	5.27
	Mean	6.98	0.52	35.17	5.42	0.14	33.50	7.22	116050.12	920168.90	34010.72	4.79	5.74	#NUM!
	Standard Deviation	0.59	0.21	6.68	1.18	0.03	8.34	9.10	129236.57	725940.25	89079.96	0.74	0.54	#NUM!
	Median	6.80	0.51	37.50	5.20	0.13	37.50	2.05	32388.66	1012145.75	2094.68	4.90	5.74	#NUM!
	Maximum	8.00	0.88	40.00	7.10	0.20	42.00	21.70	279069.77	1818181.82	187500.00	5.45	6.26	#NUM!
	Minimum	6.30	0.28	23.00	4.20	0.11	22.00	0.00	8125.68	156682.03	-41551.25	3.91	5.20	#NUM!
	Spearman's Rank	0.55	0.98	-0.28	-0.31	0.71	-0.11							
	Pearson	0.36	0.89	-0.60	-0.03	0.83	-0.31							
	Poisson	0.45	1.00	0.00	0.70	1.00	0.00							
	Correlation	0.36	0.89	-0.60	-0.03	0.83	-0.31							
	95 % CI	0.48	0.16	5.34	0.95	0.03	6.67							
	Variance	37.79	49.85	270.93	39.14	51.29	257.61							
	ttest	0.95	0.13	0.00	0.65	0.11	0.00							

Mid Depth														
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	MdRH-B-3_022411	3.6	0.37	26	2.6	0.093	21	1	384615	2978495	238095	5.59	6.47	5.38
March	MdRH-B-3_022411	2.8	0.65	20	2.1	0.094	21	2.6	128205	2274959	-18315	5.11	6.36	#NUM!
April	MdRH-B-3_022411	5	0.9	35	3.2	0.11	28	4.4	127841	1632231	56818	5.11	6.21	4.75
May	MdRH-B-3_022411	7.1	1.3	27	3.6	0.21	24	25.8	37683	201181	4845	4.58	5.30	3.69
June	MdRH-B-3_022411	7.4	1.1	43	5.5	0.17	42	12.6	27417	434174	1890	4.44	5.64	3.28
July	MdRH-B-3_022411	7	0.5	35	4.5	0.14	27	2.2	252525	1233766	134680	5.40	6.09	5.13
	Mean	5.48	0.81	31.00	3.58	0.14	27.17	8.10	159714.46	1459134.38	69668.86	4.93	5.92	4.44
	Standard Deviation	1.98	0.36	8.22	1.25	0.05	7.83	9.62	136819.09	1066561.71	99293.88	0.40	0.44	0.92
	Median	6.00	0.78	31.00	3.40	0.13	25.50	3.50	128023.02	1432998.82	30831.57	5.11	6.09	4.75
	Maximum	7.40	1.30	43.00	5.50	0.21	42.00	25.80	384615.38	2978494.62	238095.24	5.40	6.36	5.38
	Minimum	2.80	0.37	20.00	2.10	0.09	21.00	1.00	27417.03	201181.25	-18315.02	4.44	5.30	3.28
	Spearman's Rank	0.66	1.00	0.33	0.43	0.83	0.46							
	Pearson	0.61	0.90	0.10	0.33	0.92	0.23							
	Poisson	0.69	1.00	0.00	0.93	1.00	0.00							
	Correlation	0.61	0.90	0.10	0.33	0.92	0.23							
	95 % CI	1.58	0.29	6.58	1.00	0.04	6.27							
	Variance	45.71	56.63	215.81	48.34	59.36	169.10							
	ttest	0.54	0.12	0.00	0.30	0.10	0.00							

At Depth															
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	B4_AD_022411	2.1	0.68	15	1.3	0.089	12	3.3	186480	2012257	75758	5.27	6.30	4.88
March	B4_AD_022411	0.85	0.63	6.3	0.45	0.088	5.3	4.9	181406	1256957	38506	5.26	6.10	4.59
April	B4_AD_022411	4.9	0.89	31	2.7	0.14	24	6.1	133576	878220	47814	5.13	5.94	4.68
May	B4_AD_022411	4.6	1.4	17	2.2	0.21	15	7.5	145455	755556	17778	5.16	5.88	4.25
June	B4_AD_022411	6.5	0.64	36	5.2	0.1	37	18.2	13736	296703	-1485	4.14	5.47	#NUM!
July	B4_AD_022411	4.7	1.5	24	1.8	0.083	13	10.3	156419	1657504	82151	5.19	6.22	4.91
	Mean	3.94	0.96	21.55	2.28	0.12	17.72	8.38	136178.61	1142866.25	43420.23	5.02	5.99	4.66
	Standard Deviation	2.07	0.39	10.96	1.63	0.05	11.21	5.37	63356.70	627654.12	32444.53	0.44	0.30	0.27
	Median	4.65	0.79	20.50	2.00	0.09	14.00	6.80	150936.55	1067588.73	43160.09	5.18	6.02	4.68
	Maximum	6.50	1.50	36.00	5.20	0.21	37.00	18.20	186480.19	2012257.41	82150.86	5.27	6.30	4.91
	Minimum	0.85	0.63	6.30	0.45	0.08	5.30	3.30	13736.26	296703.30	-1485.00	4.14	5.47	4.25
	Spearman's Rank	0.77	0.31	0.77	0.71	0.09	0.71							
	Pearson	0.79	0.02	0.73	0.87	-0.09	0.80							
	Poisson	0.90	1.00	0.00	0.99	1.00	0.00							
	Correlation	0.79	0.02	0.73	0.87	-0.09	0.80							
	95 % CI	1.66	0.32	8.77	1.30	0.04	8.97							
	Variance	20.42	28.20	114.94	24.47	31.72	93.92							
	ttest	0.10	0.02	0.03	0.04	0.01	0.11							

At Surface															
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	B4_AS_022411	6.6	0.32	43	5.6	0.1	39	1.1	162338	2000000	93240	5.21	6.30	4.97
March	B4_AS_022411	6.9	0.35	42	6.2	0.11	44	1.3	86849	1678322	-34965	4.94	6.22	#NUM!
April	B4_AS_022411	5.9	0.46	38	4	0.12	33	3.1	153226	913978	48876	5.19	5.96	4.69
May	B4_AS_022411	6.4	0.88	26	4.2	0.22	25	4	130952	750000	10000	5.12	5.88	4.00
June	B4_AS_022411	9.6	0.37	50	9	0.11	54	9.7	6873	243674	-7637	3.84	5.39	#NUM!
July	B4_AS_022411	7.4	0.5	41	5.1	0.12	33	3.9	115636	769231	62160	5.06	5.89	4.79
	Mean	7.13	0.48	40.00	5.68	0.13	38.00	3.85	109312.22	1059200.80	28612.41	4.89	5.94	4.61
	Standard Deviation	1.31	0.21	7.92	1.82	0.04	10.12	3.13	57003.20	653341.45	47781.35	0.53	0.32	0.42
	Median	6.75	0.42	41.50	5.35	0.12	36.00	3.50	123294.19	841604.63	29437.93	5.09	5.92	4.74
	Maximum	9.60	0.88	50.00	9.00	0.22	54.00	9.70	162337.66	2000000.00	93240.09	5.21	6.30	4.97
	Minimum	5.90	0.32	26.00	4.00	0.10	25.00	1.10	6872.85	243673.85	-34965.03	3.84	5.39	4.00
	Spearman's Rank	0.37	0.66	-0.09	0.09	0.55	-0.06							
	Pearson	0.85	0.06	0.36	0.68	0.05	0.49							
	Poisson	0.43	1.00	0.00	0.66	1.00	0.00							
	Correlation	0.85	0.06	0.36	0.68	0.05	0.49							
	95 % CI	1.05	0.17	6.34	1.46	0.04	8.10							
	Variance	8.16	7.57	389.39	6.87	8.22	369.05							
	ttest	0.05	0.05	0.00	0.25	0.03	0.00							

Mid Depth															
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	MdRH-B-4_022411	5.2	0.4	37	4.5	0.1	35	1.6	97222	1875000	35714	4.99	6.27	4.55
March	MdRH-B-4_022411	2.4	0.59	15	1.5	0.092	15	2.6	230769	2081940	0	5.36	6.32	#NUM!
April	MdRH-B-4_022411	4.7	0.65	34	3.4	0.13	28	3.1	123340	1290323	69124	5.09	6.11	4.84
May	MdRH-B-4_022411	6	0.96	27	3.5	0.18	23	18.6	38402	232975	9350	4.58	5.37	3.97
June	MdRH-B-4_022411	7.9	0.7	47	6.4	0.13	47	22.8	10280	192308	0	4.01	5.28	#NUM!
July	MdRH-B-4_022411	7.2	0.6	39	4	0.1	28	2.9	275862	1793103	135468	5.44	6.25	5.13
	Mean	5.57	0.65	33.17	3.88	0.12	29.33	8.60	129312.54	1244274.74	41609.48	4.91	5.93	4.62
	Standard Deviation	1.96	0.18	11.03	1.60	0.03	10.89	9.48	105137.22	840498.96	53112.34	0.54	0.48	0.50
	Median	5.60	0.64	35.50	3.75	0.12	28.00	3.00	110280.94	1541713.01	22532.22	5.04	6.18	4.70
	Maximum	7.90	0.96	47.00	6.40	0.18	47.00	22.80	275862.07	2081939.80	135467.98	5.44	6.32	5.13
	Minimum	2.40	0.40	15.00	1.50	0.09	15.00	1.60	10279.61	192307.69	0.00	4.01	5.28	3.97
	Spearman's Rank	0.60	0.94	0.31	0.26	0.79	0.23							
	Pearson	0.59	0.71	0.34	0.58	0.71	0.48							
	Poisson	0.68	1.00	0.00	0.90	1.00	0.00							
	Correlation	0.59	0.71	0.34	0.58	0.71	0.48							
	95 % CI	1.57	0.15	8.83	1.28	0.03	8.72							
	Variance	45.11	58.09	260.80	48.08	60.46	212.03							
	ttest	0.47	0.10	0.00	0.28	0.08	0.01							

At Depth														
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	F1_AD_022411	2.1	0.86	14	1.3	0.11	12	2.8	219780	2435065	59524	5.34	6.39	4.77
March	F1_AD_022411	0.98	0.9	8.6	0.56	0.088	7.2	2.9	258621	3181818	67050	5.41	6.50	4.83
April	F1_AD_022411	5.6	0.6	40	4.1	0.14	36	3.7	98879	888031	30030	5.00	5.95	4.48
May	F1_AD_022411	6.3	1.2	28	3.8	0.28	23	13.5	48733	243386	16103	4.69	5.39	4.21
June	F1_AD_022411	7	0.64	44	5.7	0.15	42	30.8	7405	106061	1546	3.87	5.03	3.19
July	F1_AD_022411	4.1	0.9	22	2.2	0.22	15	16.1	53642	197628	28986	4.73	5.30	4.46
	Mean	4.35	0.85	26.10	2.94	0.16	22.53	11.63	114510.02	1175331.55	33873.05	4.84	5.76	4.32
	Standard Deviation	2.40	0.22	14.05	1.93	0.07	13.88	11.03	101584.51	1316299.68	25132.14	0.56	0.61	0.60
	Median	4.85	0.88	25.00	3.00	0.15	19.00	8.60	76260.69	565708.57	29507.77	4.86	5.67	4.47
	Maximum	7.00	1.20	44.00	5.70	0.28	42.00	30.80	258620.69	3181818.18	67049.81	5.41	6.50	4.83
	Minimum	0.98	0.60	8.60	0.56	0.09	7.20	2.80	7404.88	106060.61	1546.07	3.87	5.03	3.19
	Spearman's Rank	0.77	0.09	0.71	0.71	0.71	0.71							
	Pearson	0.70	-0.13	0.62	0.73	0.38	0.60							
	Poisson	0.85	1.00	0.00	0.97	1.00	0.00							
	Correlation	0.70	-0.13	0.62	0.73	0.38	0.60							
	95 % CI	1.92	0.17	11.24	1.54	0.06	11.11							
	Variance	72.38	86.99	202.05	77.56	91.15	175.25							
	ttest	0.17	0.06	0.08	0.11	0.05	0.16							

At Surface															
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	F1_AS_022411	6.5	0.26	46	5.6	0.14	44	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
March	F1_AS_022411	7.4	0.41	51	6.2	0.14	49	1.5	129032	1285714	27211	5.11	6.11	4.43
April	F1_AS_022411	5.2	0.62	34	4.1	0.18	32	2.5	107317	977778	25000	5.03	5.99	4.40
May	F1_AS_022411	6.2	0.92	28	4.1	0.28	26	17.2	29779	132890	4472	4.47	5.12	3.65
June	F1_AS_022411	8.1	0.54	49	6.7	0.21	45	25.7	8131	61145	3459	3.91	4.79	3.54
July	F1_AS_022411	6.8	0.4	43	4.8	0.12	33	3.6	115741	717593	84175	5.06	5.86	4.93
	Mean	6.70	0.53	41.83	5.25	0.18	38.17	8.42	77999.88	635024.02	28863.39	4.72	5.57	4.19
	Standard Deviation	1.00	0.23	9.02	1.09	0.06	9.06	10.51	54989.02	531312.24	32853.33	0.52	0.58	0.58
	Median	6.65	0.49	44.50	5.20	0.16	38.50	3.05	107317.07	717592.59	25000.00	5.03	5.86	4.40
	Maximum	8.10	0.92	51.00	6.70	0.28	49.00	25.70	129032.26	1285714.29	84175.08	5.11	6.11	4.93
	Minimum	5.20	0.26	28.00	4.10	0.12	26.00	0.00	8130.55	61145.08	3458.71	3.91	4.79	3.54
	Spearman's Rank	0.26	0.71	-0.26	0.07	0.49	-0.26							
	Pearson	0.48	0.56	-0.12	0.25	0.74	-0.11							
	Poisson	0.50	1.00	0.00	0.72	1.00	0.00							
	Correlation	0.48	0.56	-0.12	0.25	0.74	-0.11							
	95 % CI	0.80	0.18	7.22	0.87	0.05	7.25							
	Variance	51.51	67.24	391.78	53.53	68.76	328.98							
	ttest	0.71	0.13	0.00	0.50	0.11	0.00							

Mid Depth															
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	MdRH-F-1_022411	6.2	0.38	45	4.6	0.13	39	1.2	289855	1602564	128205	5.46	6.20	5.11
March	MdRH-F-1_022411	1.2	0.89	9.7	0.81	0.13	9	2.7	178326	2165242	28807	5.25	6.34	4.46
April	MdRH-F-1_022411	5.7	0.52	41	4.3	0.15	38	2.7	120586	913580	29240	5.08	5.96	4.47
May	MdRH-F-1_022411	6.1	1.2	28	3.7	0.21	26	19.9	32595	236899	3865	4.51	5.37	3.59
June	MdRH-F-1_022411	7.3	0.4	47	6.5	0.15	46	27.5	4476	60606	791	3.65	4.78	2.90
July	MdRH-F-1_022411	5.5	0.5	33	3.2	0.17	21	17.2	41788	123119	33223	4.62	5.09	4.52
	Mean	5.33	0.65	33.95	3.85	0.16	29.83	11.87	111271.00	850335.06	37355.01	4.76	5.62	4.17
	Standard Deviation	2.12	0.32	13.90	1.87	0.03	13.70	11.13	108534.34	874945.52	46622.45	0.66	0.63	0.79
	Median	5.90	0.53	37.00	4.00	0.15	32.00	9.95	81186.75	575239.51	29023.18	4.85	5.67	4.46
	Maximum	7.30	1.20	47.00	6.50	0.21	46.00	27.50	289855.07	2165242.17	128205.13	5.46	6.34	5.11
	Minimum	1.20	0.38	9.70	0.81	0.13	9.00	1.20	4475.52	60606.06	790.51	3.65	4.78	2.90
	Spearman's Rank	0.24	0.37	0.06	0.12	0.69	0.12							
	Pearson	0.53	0.10	0.25	0.50	0.59	0.25							
	Poisson	0.71	1.00	0.00	0.90	1.00	0.00							
	Correlation	0.53	0.10	0.25	0.50	0.59	0.25							
	95 % CI	1.70	0.26	11.12	1.50	0.02	10.96							
	Variance	69.97	90.63	277.16	75.40	93.69	229.68							
	ttest	0.21	0.06	0.01	0.14	0.05	0.03							

At Depth															
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	F2_AD_022411	2.8	0.93	16	1.5	0.095	13	4	216667	2197368	57692	5.34	6.34	4.76
March	F2_AD_022411	1.2	0.83	8.4	0.72	0.087	8.1	2.9	229885	2944907	12771	5.36	6.47	4.11
April	F2_AD_022411	4.2	0.69	29	3	0.14	25	2.1	190476	1870748	76190	5.28	6.27	4.88
May	F2_AD_022411	7	1.1	28	4.4	0.29	24	16.1	36702	173485	10352	4.56	5.24	4.02
June	F2_AD_022411	7.7	0.56	43	6.5	0.13	41	21.8	8469	151729	2238	3.93	5.18	3.35
July	F2_AD_022411	3.9	1.2	22	1.7	0.13	13	5.3	244173	1552975	130624	5.39	6.19	5.12
	Mean	4.47	0.89	24.40	2.97	0.15	20.68	8.70	154395.35	1481868.77	48311.31	4.98	5.95	4.37
	Standard Deviation	2.48	0.24	11.94	2.16	0.07	11.99	8.21	104004.36	1121592.11	49934.81	0.60	0.58	0.66
	Median	4.05	0.88	25.00	2.35	0.13	18.50	4.65	203571.43	1711861.81	35231.85	5.31	6.23	4.43
	Maximum	7.70	1.20	43.00	6.50	0.29	41.00	21.80	244173.14	2944906.86	130624.09	5.39	6.47	5.12
	Minimum	1.20	0.56	8.40	0.72	0.09	8.10	2.10	8468.60	151729.00	2237.64	3.93	5.18	3.35
	Spearman's Rank	0.66	0.09	0.43	0.66	0.34	0.43							
	Pearson	0.90	-0.24	0.78	0.91	0.50	0.81							
	Poisson	0.84	1.00	0.00	0.97	1.00	0.00							
	Correlation	0.90	-0.24	0.78	0.91	0.50	0.81							
	95 % CI	1.98	0.19	9.55	1.73	0.06	9.59							
	Variance	38.34	47.34	162.64	41.73	50.62	135.17							
	ttest	0.27	0.07	0.03	0.15	0.05	0.07							

At Surface															
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	F2_AS_022411	6.9	0.26	41	5.9	0.11	42	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
March	F2_AS_022411	8.9	0.36	55	7	0.13	48	2.8	96939	631868	52083	4.99	5.80	4.72
April	F2_AS_022411	5.9	0.45	35	4.5	0.13	33	2.5	124444	984615	24242	5.09	5.99	4.38
May	F2_AS_022411	6.1	0.84	28	4.4	0.27	25	22.4	17248	94246	5357	4.24	4.97	3.73
June	F2_AS_022411	8.3	0.41	43	6.9	0.15	41	18.9	10735	91711	2581	4.03	4.96	3.41
July	F2_AS_022411	7.5	0.4	36	4.8	0.12	27	20.5	27439	101626	16260	4.44	5.01	4.21
	Mean	7.27	0.45	39.67	5.58	0.15	36.00	11.18	55361.20	380813.26	20104.81	4.56	5.35	4.09
	Standard Deviation	1.20	0.20	9.16	1.19	0.06	9.12	10.42	51780.52	409649.88	19868.98	0.47	0.51	0.52
	Median	7.20	0.39	38.50	5.35	0.13	37.00	10.85	27439.02	101626.02	16260.16	4.44	5.01	4.21
	Maximum	8.90	0.84	55.00	7.00	0.27	48.00	22.40	124444.44	984615.38	52083.33	5.09	5.99	4.72
	Minimum	5.90	0.26	28.00	4.40	0.11	25.00	0.00	10735.37	91710.76	2580.98	4.03	4.96	3.41
	Spearman's Rank	0.09	0.60	-0.37	-0.37	0.57	-0.71							
	Pearson	-0.01	0.59	-0.51	-0.27	0.60	-0.65							
	Poisson	0.41	1.00	0.00	0.67	1.00	0.00							
	Correlation	-0.01	0.59	-0.51	-0.27	0.60	-0.65							
	95 % CI	0.96	0.16	7.33	0.95	0.05	7.30							
	Variance	54.19	80.80	308.74	58.55	82.55	255.14							
	ttest	0.40	0.05	0.00	0.25	0.05	0.00							

Mid Depth														
Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	MdRH-F-2_022411	6.9	0.27	47	5.8	0.11	42	1.1	172414	1322314	108225	5.24	6.12	5.03
March	MdRH-F-2_022411	2.3	0.72	19	1.6	0.11	19	2.3	190217	2411067	0	5.28	6.38	#NUM!
April	MdRH-F-2_022411	5.7	0.44	37	4.3	0.14	35	3.4	95759	630252	16807	4.98	5.80	4.23
May	MdRH-F-2_022411	6.8	0.87	29	4.3	0.19	26	6.3	92285	568087	18315	4.97	5.75	4.26
June	MdRH-F-2_022411	7.2	0.38	43	6.5	0.13	41	25	4308	76923	1951	3.63	4.89	3.29
July	MdRH-F-2_022411	6.3	0.5	34	4.6	0.12	27	3.9	94760	833333	66477	4.98	5.92	4.82
	Mean	5.87	0.53	34.83	4.52	0.13	31.67	7.00	108290.57	973662.77	35295.80	4.85	5.81	4.33
	Standard Deviation	1.83	0.22	10.05	1.68	0.03	9.16	8.99	66682.10	811658.34	43078.49	0.61	0.51	0.68
	Median	6.55	0.48	35.50	4.45	0.13	31.00	3.65	95259.77	731792.72	17560.87	4.98	5.86	4.26
	Maximum	7.20	0.87	47.00	6.50	0.19	42.00	25.00	190217.39	2411067.19	108225.11	5.28	6.38	5.03
	Minimum	2.30	0.27	19.00	1.60	0.11	19.00	1.10	4307.69	76923.08	0.00	3.63	4.89	3.29
	Spearman's Rank	0.43	0.26	-0.09	0.37	0.65	-0.09							
	Pearson	0.41	-0.19	0.33	0.56	0.12	0.42							
	Poisson	0.63	1.00	0.00	0.83	1.00	0.00							
	Correlation	0.41	-0.19	0.33	0.56	0.12	0.42							
	95 % CI	1.46	0.18	8.04	1.35	0.02	7.33							
	Variance	38.59	48.16	293.90	39.70	49.58	240.78							
	ttest	0.77	0.14	0.00	0.53	0.12	0.00							

At Depth														
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	F3_AD_022411	2.9	0.93	16	1.6	0.049	14	3.8	213816	4731472	37594	5.33	6.67	4.58
March	F3_AD_022411	1.8	0.89	13	0.97	0.082	11	3.6	237686	2737127	50505	5.38	6.44	4.70
April	F3_AD_022411	6	0.45	38	4.5	0.12	37	2.4	138889	1145833	11261	5.14	6.06	4.05
May	F3_AD_022411	6.9	0.96	30	4.6	0.25	26	5.3	94340	535849	29028	4.97	5.73	4.46
June	F3_AD_022411	8.9	0.5	50	8.4	0.16	51	10.2	5836	208333	-1922	3.77	5.32	#NUM!
July	F3_AD_022411	4.5	1.7	20	1.5	0.15	10	21.4	93458	482866	46729	4.97	5.68	4.67
	Mean	5.17	0.91	27.83	3.60	0.14	24.83	7.78	130670.68	1640246.78	28865.75	4.93	5.98	4.49
	Standard Deviation	2.63	0.45	14.29	2.83	0.07	16.51	7.21	85698.86	1767080.24	20597.99	0.59	0.51	0.26
	Median	5.25	0.91	25.00	3.05	0.14	20.00	4.55	116614.26	840841.19	33310.78	5.06	5.89	4.58
	Maximum	8.90	1.70	50.00	8.40	0.25	51.00	21.40	237686.14	4731471.54	50505.05	5.38	6.67	4.70
	Minimum	1.80	0.45	13.00	0.97	0.05	10.00	2.40	5835.67	208333.33	-1922.34	3.77	5.32	4.05
	Spearman's Rank	0.37	0.66	0.20	0.20	0.54	-0.20							
	Pearson	0.15	0.75	-0.01	-0.05	0.25	-0.18							
	Poisson	0.74	1.00	0.00	0.93	1.00	0.00							
	Correlation	0.15	0.75	-0.01	-0.05	0.25	-0.18							
	95 % CI	2.10	0.36	11.43	2.27	0.06	13.21							
	Variance	28.62	36.61	226.06	32.05	39.57	226.79							
	ttest	0.43	0.07	0.02	0.23	0.05	0.05							

At Surface														
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	F3_AS_022411	7.7	0.26	47	6.6	0.12	47	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
March	F3_AS_022411	8.3	0.39	55	6.5	0.13	50	1.7	162896	1176471	58824	5.21	6.07	4.77
April	F3_AS_022411	6	0.45	38	4.7	0.12	37	2.5	110638	1100000	10811	5.04	6.04	4.03
May	F3_AS_022411	7.5	1	32	4.7	0.28	31	6	99291	428571	5376	5.00	5.63	3.73
June	F3_AS_022411	8.8	0.37	49	8.2	0.12	49	11.8	6201	176554	0	3.79	5.25	#NUM!
July	F3_AS_022411	6.6	0.4	38	4.5	0.12	29	1.7	274510	1421569	182556	5.44	6.15	5.26
	Mean	7.48	0.48	43.17	5.87	0.15	40.50	3.95	130707.14	860632.86	51513.29	4.90	5.83	4.59
	Standard Deviation	1.04	0.26	8.57	1.48	0.06	9.38	4.33	98243.16	530645.94	76916.36	0.64	0.38	0.78
	Median	7.60	0.40	42.50	5.60	0.12	42.00	2.10	110638.30	1100000.00	10810.81	5.04	6.04	4.77
	Maximum	8.80	1.00	55.00	8.20	0.28	50.00	11.80	274509.80	1421568.63	182555.78	5.44	6.15	5.26
	Minimum	6.00	0.26	32.00	4.50	0.12	29.00	0.00	6200.91	176553.67	0.00	3.79	5.25	3.73
	Spearman's Rank	0.18	0.43	-0.17	0.15	0.27	0.00							
	Pearson	0.52	0.26	0.00	0.51	0.22	0.15							
	Poisson	0.38	1.00	0.00	0.63	1.00	0.00							
	Correlation	0.52	0.26	0.00	0.51	0.22	0.15							
	95 % CI	0.83	0.21	6.85	1.19	0.05	7.50							
	Variance	12.41	11.83	461.30	10.51	12.46	412.81							
	ttest	0.10	0.11	0.00	0.34	0.08	0.00							

Mid Depth															
Date	**Location**	**Total Copper**	**Total Lead**	**Total Zinc**	**Dissolved Copper µg/L**	**Dissolved Lead µg/L**	**Dissolved Zinc µg/L**	**SSC Total µg/L**	**Kp copper mg/L**	**Kp lead mg/L**	**Kp zinc mg/L**	**log Kp copper**	**log Kp lead**	**log Kp zinc**
February	MdRH-F-3_022411	8.5	0.28	54	6.9	0.11	49	1.6	144928	965909	63776	5.16	5.98	4.80
March	MdRH-F-3_022411	2.9	0.72	26	2.1	0.11	27	1.7	224090	3262032	-21786	5.35	6.51	#NUM!
April	MdRH-F-3_022411	6	0.44	41	4.5	0.12	38	2	166667	1333333	39474	5.22	6.12	4.60
May	MdRH-F-3_022411	7.4	1	33	4.6	0.21	30	5	121739	752381	20000	5.09	5.88	4.30
June	MdRH-F-3_022411	8.8	0.79	52	7.9	0.25	50	19.5	5842	110769	2051	3.77	5.04	3.31
July	MdRH-F-3_022411	6.6	0.8	36	3.7	0.11	26	21.5	36455	295983	17889	4.56	5.47	4.25
	Mean	6.70	0.67	40.33	4.95	0.15	36.67	8.55	116620.05	1120067.96	20233.85	4.86	5.84	4.25
	Standard Deviation	2.15	0.26	10.97	2.12	0.06	10.80	9.36	81951.25	1139320.05	29556.44	0.60	0.51	0.57
	Median	7.00	0.76	38.50	4.55	0.12	34.00	3.50	133333.33	859145.02	18944.54	5.12	5.93	4.30
	Maximum	8.80	1.00	54.00	7.90	0.25	50.00	21.50	224089.64	3262032.09	63775.51	5.35	6.51	4.80
	Minimum	2.90	0.28	26.00	2.10	0.11	26.00	1.60	5842.26	110769.23	-21786.49	3.77	5.04	3.31
	Spearman's Rank	0.20	0.77	-0.14	0.03	0.42	-0.26							
	Pearson	0.37	0.47	0.19	0.26	0.38	0.01							
	Poisson	0.50	1.00	0.00	0.77	1.00	0.00							
	Correlation	0.37	0.47	0.19	0.26	0.38	0.01							
	95 % CI	1.72	0.21	8.77	1.70	0.05	8.64							
	Variance	42.88	56.80	370.02	45.43	59.09	308.48							
	ttest	0.66	0.09	0.00	0.40	0.08	0.00							

At Depth

Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	F4_AD_022411	2.3	0.56	15	1.5	0.097	14	2	266667	2386598	35714	5.43	6.38	4.55
March	F4_AD_022411	0.78	0.64	6.5	0.4	0.097	4.7	2.9	327586	1930323	132062	5.52	6.29	5.12
April	F4_AD_022411	3.7	0.76	23	2.5	0.12	20	4.5	106667	1185185	33333	5.03	6.07	4.52
May	F4_AD_022411	3.7	1	17	2.1	0.23	13	5	152381	669565	61538	5.18	5.83	4.79
June	F4_AD_022411	5.9	0.48	34	5.1	0.085	34	26	6033	178733	0	3.78	5.25	#NUM!
July	F4_AD_022411	4.4	1.5	24	1.8	0.18	15	5.2	277778	1410256	115385	5.44	6.15	5.06
	Mean	3.46	0.82	19.92	2.23	0.13	16.78	7.60	189518.58	1293443.55	63005.39	5.06	5.99	4.88
	Standard Deviation	1.76	0.38	9.35	1.57	0.06	9.78	9.10	122241.33	807189.12	51204.32	0.65	0.41	0.26
	Median	3.70	0.70	20.00	1.95	0.11	14.50	4.75	209523.81	1297720.80	48626.37	5.30	6.11	4.93
	Maximum	5.90	1.50	34.00	5.10	0.23	34.00	26.00	327586.21	2386597.94	132061.63	5.52	6.38	5.12
	Minimum	0.78	0.48	6.50	0.40	0.09	4.70	2.00	6033.18	178733.03	0.00	3.78	5.25	4.55
	Spearman's Rank	0.92	0.14	0.89	0.71	-0.06	0.60							
	Pearson	0.75	-0.34	0.79	0.92	-0.32	0.88							
	Poisson	0.94	1.00	0.00	0.99	1.00	0.00							
	Correlation	0.75	-0.34	0.79	0.92	-0.32	0.88							
	95 % CI	1.41	0.30	7.48	1.26	0.05	7.82							
	Variance	43.72	50.24	118.77	46.63	52.85	104.10							
	ttest	0.32	0.13	0.04	0.21	0.10	0.12							
February	F5_AD_022411	3.1	0.53	20	2.2	0.11	19	2	204545	1909091	26316	5.31	6.28	4.42
March	F5_AD_022411	0.87	0.76	5.9	0.36	0.078	3.9	3.3	429293	2649573	155400	5.63	6.42	5.19
April	F5_AD_022411	3.9	0.78	24	2.6	0.15	21	4.2	119048	1000000	34014	5.08	6.00	4.53
May	F5_AD_022411	3.4	0.73	16	2	0.22	15	3.6	194444	643939	18519	5.29	5.81	4.27
June	F5_AD_022411	4.6	0.78	29	3.4	0.14	27	10.9	32380	419397	6796	4.51	5.62	3.83
July	F5_AD_022411	4.3	0.9	24	2.2	0.17	15	6.3	151515	653595	95238	5.18	5.82	4.98
	Mean	3.36	0.74	19.82	2.13	0.14	16.82	5.05	188537.59	1212599.14	56046.99	5.17	5.99	4.54
	Standard Deviation	1.34	0.11	8.09	1.00	0.05	7.74	3.19	133295.92	878660.49	57637.62	0.37	0.31	0.49
	Median	3.65	0.77	22.00	2.20	0.15	17.00	3.90	172979.80	826797.39	30164.70	5.23	5.91	4.48
	Maximum	4.60	0.87	29.00	3.40	0.22	27.00	10.90	429292.93	2649572.65	155400.16	5.63	6.42	5.19
	Minimum	0.87	0.53	5.90	0.36	0.08	3.90	2.00	32379.92	419397.12	6795.79	4.51	5.62	3.83
	Spearman's Rank	0.94	0.87	0.82	0.63	0.43	0.55							
	Pearson	0.61	0.54	0.66	0.64	0.14	0.59							
	Poisson	0.94	1.00	0.00	0.99	1.00	0.00							
	Correlation	0.61	0.54	0.66	0.64	0.14	0.59							
	95 % CI	1.07	0.09	6.48	0.80	0.04	6.19							
	Variance	6.23	9.70	93.89	7.42	11.20	69.61							
	ttest	0.27	0.02	0.00	0.08	0.01	0.01							

At Surface

Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	F4_AS_022411	6.7	0.24	41	5.7	0.098	41	1	175439	1448980	0	5.24	6.16	#NUM!
March	F4_AS_022411	6.7	0.31	43	5.7	0.11	40	2	87719	909091	37500	4.94	5.96	4.57
April	F4_AS_022411	5	0.32	32	4.1	0.11	30	2.5	87805	763636	26667	4.94	5.88	4.43
May	F4_AS_022411	5.6	0.59	26	3.9	0.2	22	3.6	121083	541667	50505	5.08	5.73	4.70
June	F4_AS_022411	7.8	0.37	43	6.9	0.12	41	16.1	8102	129400	3030	3.91	5.11	3.48
July	F4_AS_022411	5.6	0.5	31	4.4	0.13	27	5.2	52448	502959	28490	4.72	5.70	4.45
	Mean	6.23	0.38	36.00	5.12	0.13	33.50	5.07	88765.75	715955.28	24365.26	4.81	5.76	4.30
	Standard Deviation	1.02	0.13	7.27	1.17	0.04	8.26	5.59	57243.88	446473.11	19631.54	0.47	0.36	0.56
	Median	6.15	0.35	36.50	5.05	0.12	35.00	3.05	87762.09	652651.52	27578.35	4.94	5.81	4.51
	Maximum	7.80	0.59	43.00	6.90	0.20	41.00	16.10	175438.60	1448979.59	50505.05	5.24	6.16	4.70
	Minimum	5.00	0.24	26.00	3.90	0.10	22.00	1.00	8101.54	129399.59	0.00	3.91	5.11	3.48
	Spearman's Rank	0.03	0.77	-0.10	-0.05	0.73	-0.21							
	Pearson	0.63	0.15	0.29	0.60	0.03	0.25							
	Poisson	0.57	1.00	0.00	0.74	1.00	0.00							
	Correlation	0.63	0.15	0.29	0.60	0.03	0.25							
	95 % CI	0.82	0.10	5.81	0.94	0.03	6.61							
	Variance	15.07	20.21	299.19	14.85	20.87	265.75							
	ttest	0.64	0.10	0.00	0.98	0.08	0.00							
February	F5_AS_022411	4.5	0.33	28	3.7	0.11	27	1	216216	2000000	37037	5.33	6.30	4.57
March	F5_AS_022411	4.7	0.4	29	4	0.098	30	1.8	97222	1712018	-18519	4.99	6.23	#NUM!
April	F5_AS_022411	4.2	0.59	26	3.1	0.12	23	2.8	126728	1398810	46584	5.10	6.15	4.67
May	F5_AS_022411	4.4	0.68	21	2.8	0.19	18	14.7	38873	175439	11338	4.59	5.24	4.05
June	F5_AS_022411	6	0.5	38	4.1	0.14	30	17.7	26182	145278	15066	4.42	5.16	4.18
July	F5_AS_022411	5.4	1.7	44	3	0.6	33	7.6	105263	241228	43860	5.02	5.38	4.64
	Mean	4.87	0.70	31.00	3.45	0.21	26.83	7.60	101747.34	945462.13	22560.97	4.91	5.74	4.42
	Standard Deviation	0.69	0.51	8.44	0.55	0.19	5.49	7.11	68444.72	852567.64	24939.72	0.34	0.53	0.29
	Median	4.60	0.55	28.50	3.40	0.13	28.50	5.20	101242.69	820018.80	26051.48	5.01	5.76	4.57
	Maximum	6.00	1.70	44.00	4.10	0.60	33.00	17.70	216216.22	2000000.00	46583.85	5.33	6.30	4.67
	Minimum	4.20	0.33	21.00	2.80	0.10	18.00	1.00	26181.62	145278.45	-18518.52	4.42	5.16	4.05
	Spearman's Rank	0.37	0.60	0.14	-0.09	0.71	0.05							
	Pearson	0.60	0.14	0.18	-0.06	0.13	-0.16							
	Poisson	0.78	1.00	0.00	0.94	1.00	0.00							
	Correlation	0.60	0.14	0.18	-0.06	0.13	-0.16							
	95 % CI	0.55	0.40	6.75	0.44	0.16	4.39							
	Variance	25.22	36.07	204.67	27.81	37.88	137.57							
	ttest	0.39	0.06	0.00	0.21	0.05	0.00							

Mid Depth

Date	Location	Total Copper	Total Lead	Total Zinc	Dissolved Copper µg/L	Dissolved Lead µg/L	Dissolved Zinc µg/L	SSC Total µg/L	Kp copper mg/L	Kp lead mg/L	Kp zinc mg/L	log Kp copper	log Kp lead	log Kp zinc
February	MdRH-F-4_022411	3.6	0.31	25	2.8	0.098	23	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
March	MdRH-F-4_022411	1.3	0.68	10	0.83	0.092	8.7	2.9	195264	2203898	51526	5.29	6.34	4.71
April	MdRH-F-4_022411	4.1	0.57	28	2.9	0.11	25	2.8	147783	1493506	42857	5.17	6.17	4.63
May	MdRH-F-4_022411	4.2	0.87	20	2.6	0.16	20	23.8	25856	186450	0	4.41	5.27	#NUM!
June	MdRH-F-4_022411	4.8	0.57	32	3.9	0.059	30	21.1	10937	410475	3160	4.04	5.61	3.50
July	MdRH-F-4_022411	4.9	1.3	27	1.9	0.18	16	2.3	686499	2705314	298913	5.84	6.43	5.48
	Mean	3.82	0.72	23.67	2.49	0.12	20.45	8.82	213267.87	1399928.57	79291.14	4.95	5.97	4.58
	Standard Deviation	1.32	0.34	7.76	1.04	0.05	7.44	10.65	275962.31	1096665.98	124915.20	0.72	0.50	0.81
	Median	4.15	0.63	26.00	2.70	0.10	21.50	2.85	147783.25	1493506.49	42857.14	5.17	6.17	4.67
	Maximum	4.90	1.30	32.00	3.90	0.18	30.00	23.80	686498.86	2705314.01	298913.04	5.84	6.43	5.48
	Minimum	1.30	0.31	10.00	0.83	0.06	8.70	0.00	10936.93	186449.58	0.00	4.04	5.27	3.50
	Spearman's Rank	0.14	0.37	-0.09	0.09	-0.20	0.09							
	Pearson	0.37	0.08	0.17	0.50	-0.05	0.40							
	Poisson	0.91	1.00	0.00	0.99	1.00	0.00							
	Correlation	0.37	0.08	0.17	0.50	-0.05	0.40							
	95 % CI	1.06	0.27	6.21	0.83	0.04	5.95							
	Variance	59.14	69.47	139.06	62.94	72.17	113.57							
	ttest	0.30	0.12	0.02	0.21	0.10	0.06							
February	MdRH-F-5_022411	4.2	0.34	29	3.2	0.1	27	1.7	183824	1411765	43573	5.26	6.15	4.64
March	MdRH-F-5_022411	1.1	0.6	8.6	0.77	0.054	7.6	1.8	238095	5617284	73099	5.38	6.75	4.86
April	MdRH-F-5_022411	4.1	0.61	27	2.8	0.12	24	3.2	145089	1276042	39063	5.16	6.11	4.59
May	MdRH-F-5_022411	4.3	0.8	20	2.5	0.16	18	10.9	66055	366972	10194	4.82	5.56	4.01
June	MdRH-F-5_022411	4.2	0.63	29	3.4	0.12	27	21.5	10944	197674	3445	4.04	5.30	3.54
July	MdRH-F-5_022411	4.9	0.8	33	2.9	0.16	24	1.5	459770	2500000	250000	5.66	6.40	5.40
	Mean	3.80	0.62	24.43	2.60	0.12	21.27	6.77	183962.85	1894956.20	69895.65	5.05	6.04	4.51
	Standard Deviation	1.35	0.16	8.85	0.95	0.04	7.46	8.06	157701.58	2002689.73	91729.36	0.57	0.53	0.65
	Median	4.20	0.62	28.00	2.85	0.12	24.00	2.50	164456.41	1343903.19	41317.74	5.21	6.13	4.62
	Maximum	4.90	0.80	33.00	3.40	0.16	27.00	21.50	459770.11	5617283.95	250000.00	5.66	6.75	5.40
	Minimum	1.10	0.34	8.60	0.77	0.05	7.60	1.50	10943.91	197674.42	3445.31	4.04	5.30	3.54
	Spearman's Rank	-0.17	0.31	-0.33	0.09	0.13	0.03							
	Pearson	0.23	0.26	0.14	0.40	0.24	0.28							
	Poisson	0.91	1.00	0.00	0.98	1.00	0.00							
	Correlation	0.23	0.26	0.14	0.40	0.24	0.28							
	95 % CI	1.08	0.13	7.09	0.76	0.03	5.97							
	Variance	32.77	39.85	150.30	34.70	41.59	112.17							
	ttest	0.41	0.12	0.00	0.26	0.10	0.01							

Appendix E: Translator Results

Appendix E

A translator is defined as the ratio of dissolved metal measurement to the total recoverable measurements. It is calculated by the following equation:

$$\text{Translator} = \frac{10^6}{(K_p \times SSC + 10^6)}$$

SSC = suspended sediment concentration (kg/L)

This equation defines a curve that goes to one (1) at zero SSC. In other words, 100% of the total metal concentration is dissolved because there are no particles. The curve asymptotically approaches zero as SSC increases. As SSC approaches infinity, all of the total metal concentration is accounted for by the particulate concentrations.

As presented in Appendices A and D, there are instances in the data where this is observed – either the total metal concentration is equal to the dissolved concentration, or the SSC concentration is equal to zero. Therefore, the copper translators were calculated from the analytical results for dissolved and total copper for stormwater and harbor water quality data. The stormwater translators versus SSC are presented in Figure E.1. The K_p is determined using a best fit calculation, as shown in the curves.

The harbor water quality translators versus SSC are presented in Figures E.2 – E.X. The K_p is determined using a best fit calculation, as shown in the curves. The translators for the three depths are presented in Figures E.X – E.X, including the best fit K_p. The translators for the individual sampling locations in the harbor are presented in Figures E.X – E.X, including the best fit K_p.

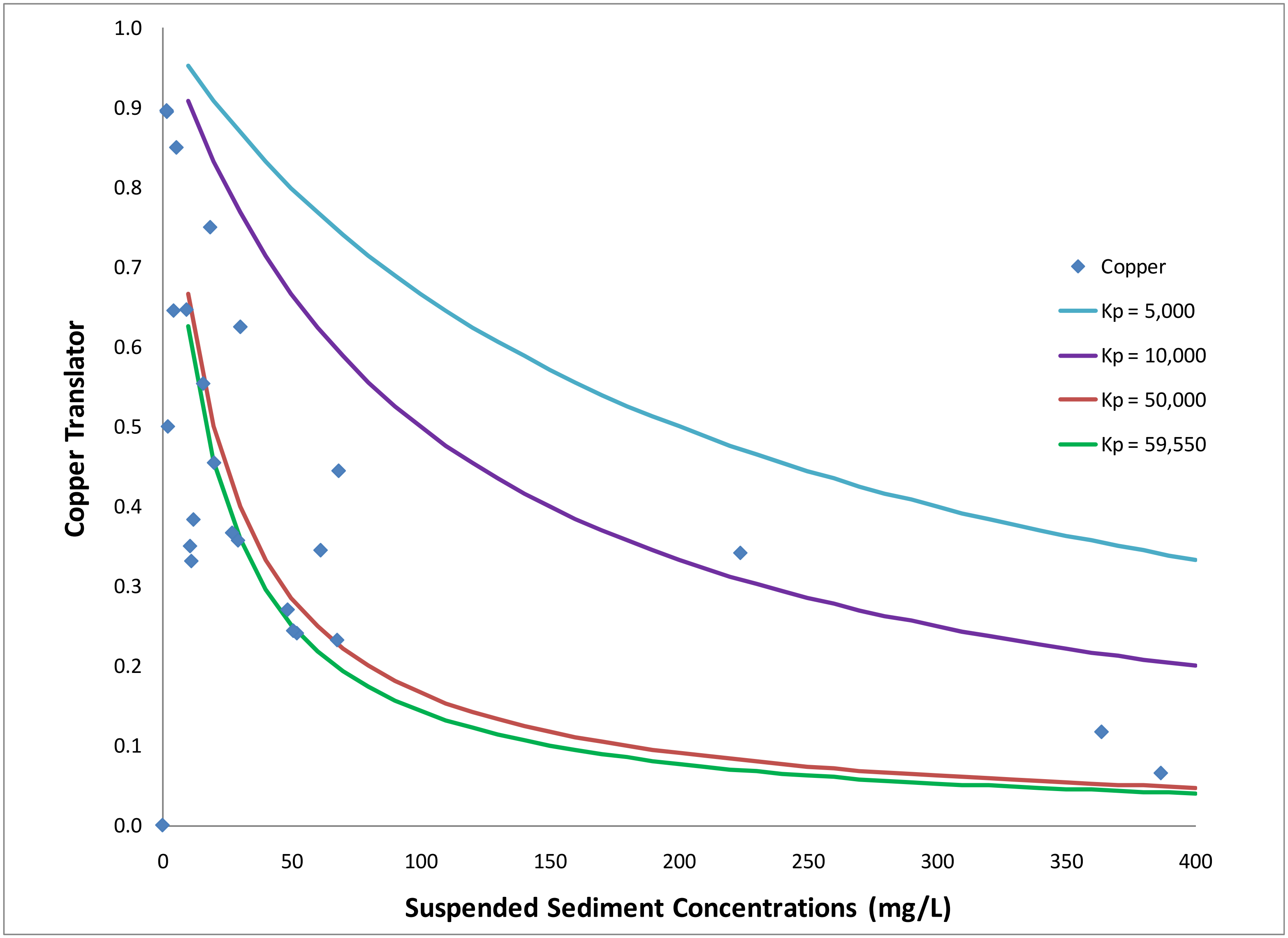


Figure E.1. Copper Translators versus SSC for Stormwater with Various Partitioning Coefficients. K_p represented by the green line is the best fit.

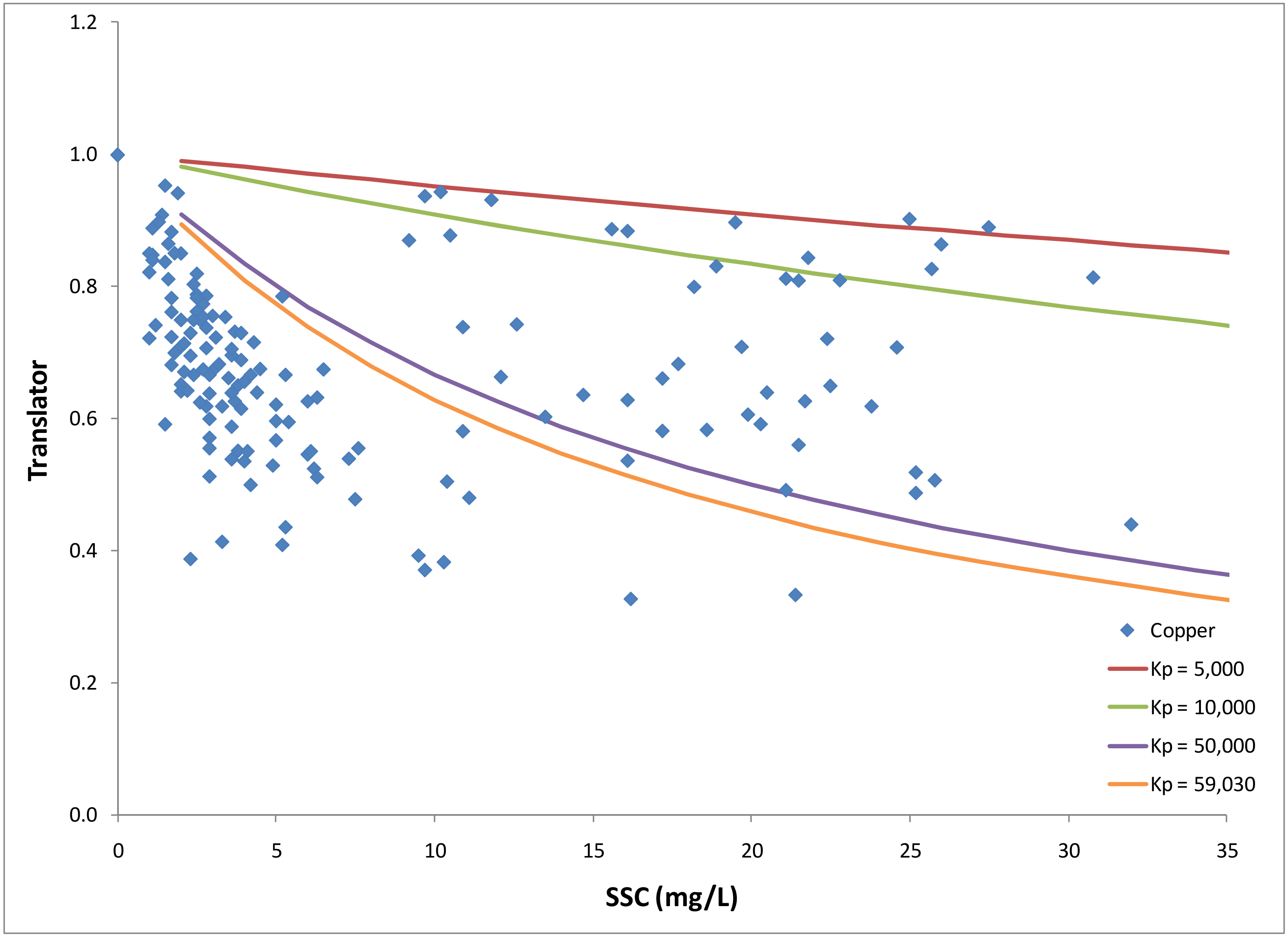


Figure E.2. Copper Translators versus SSC for Harbor Water Quality with Various Partitioning Coefficients. K_p represented by the orange line is the best fit.

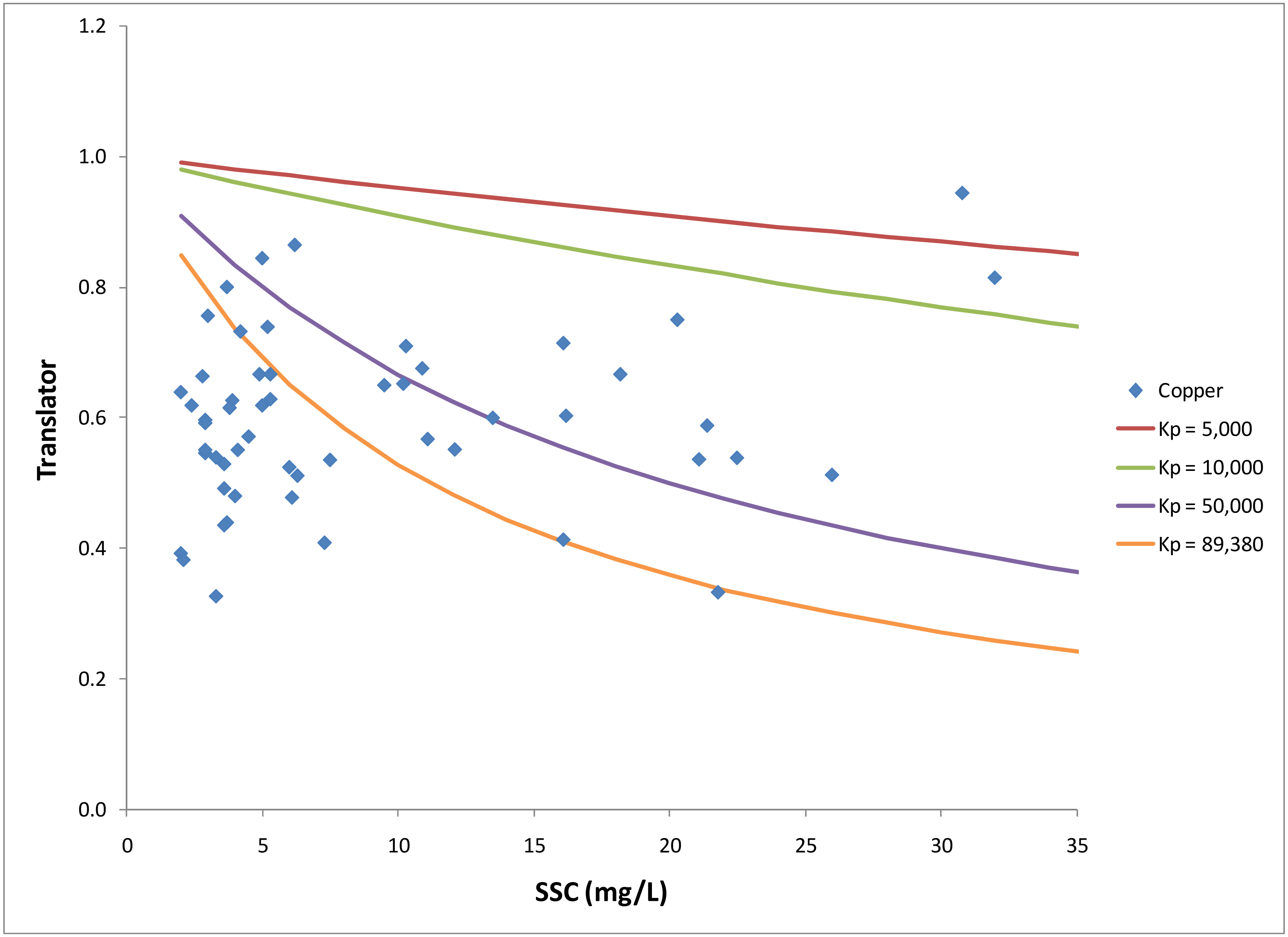


Figure E.3. Copper Translators versus SSC for Harbor Water Quality At Depth Samples with Various Partitioning Coefficients. K_p represented by the orange line is the best fit.

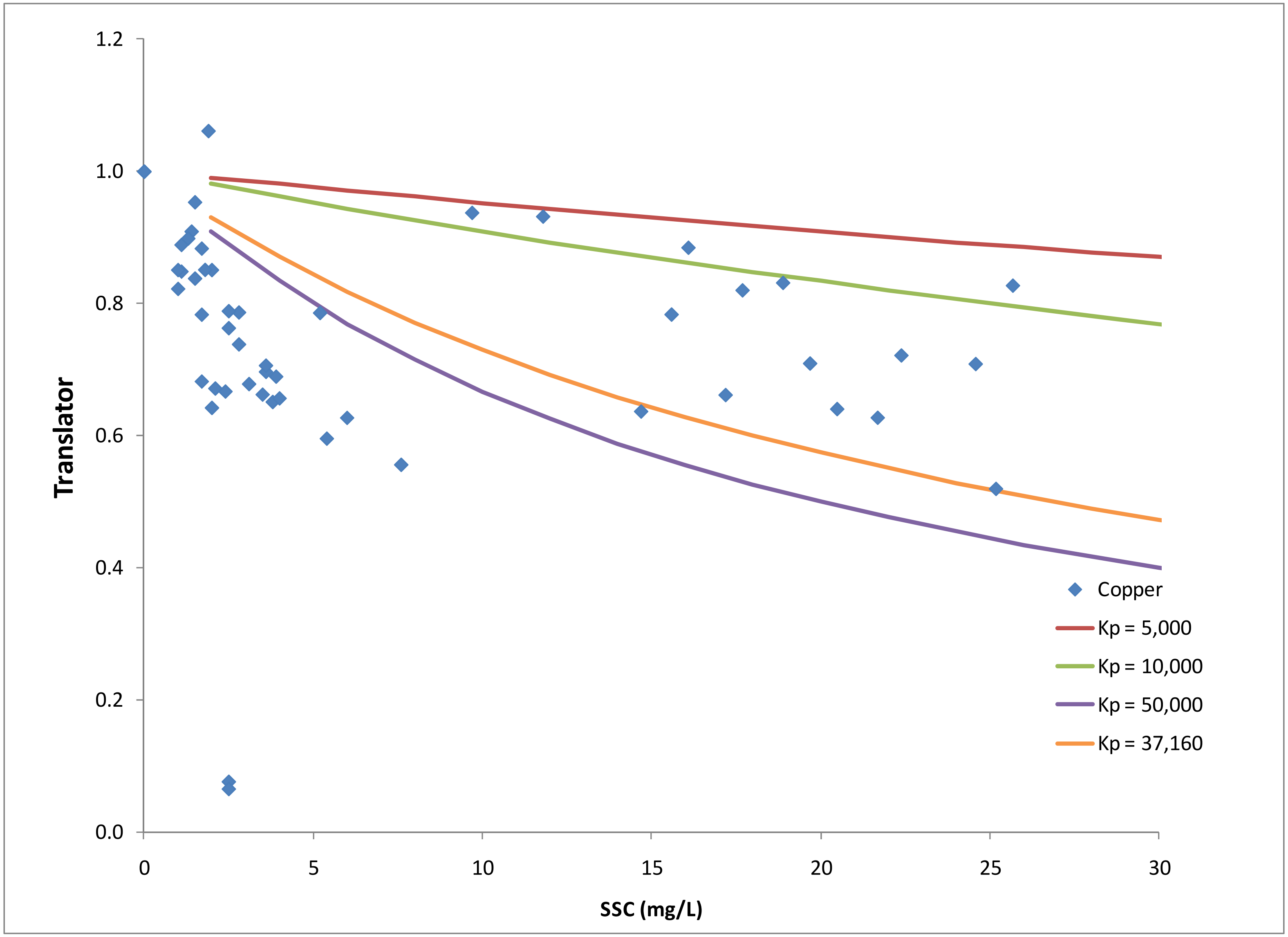


Figure E.4. Copper Translators versus SSC for Harbor Water Quality At Surface Samples with Various Partitioning Coefficients. K_p represented by the orange line is the best fit.

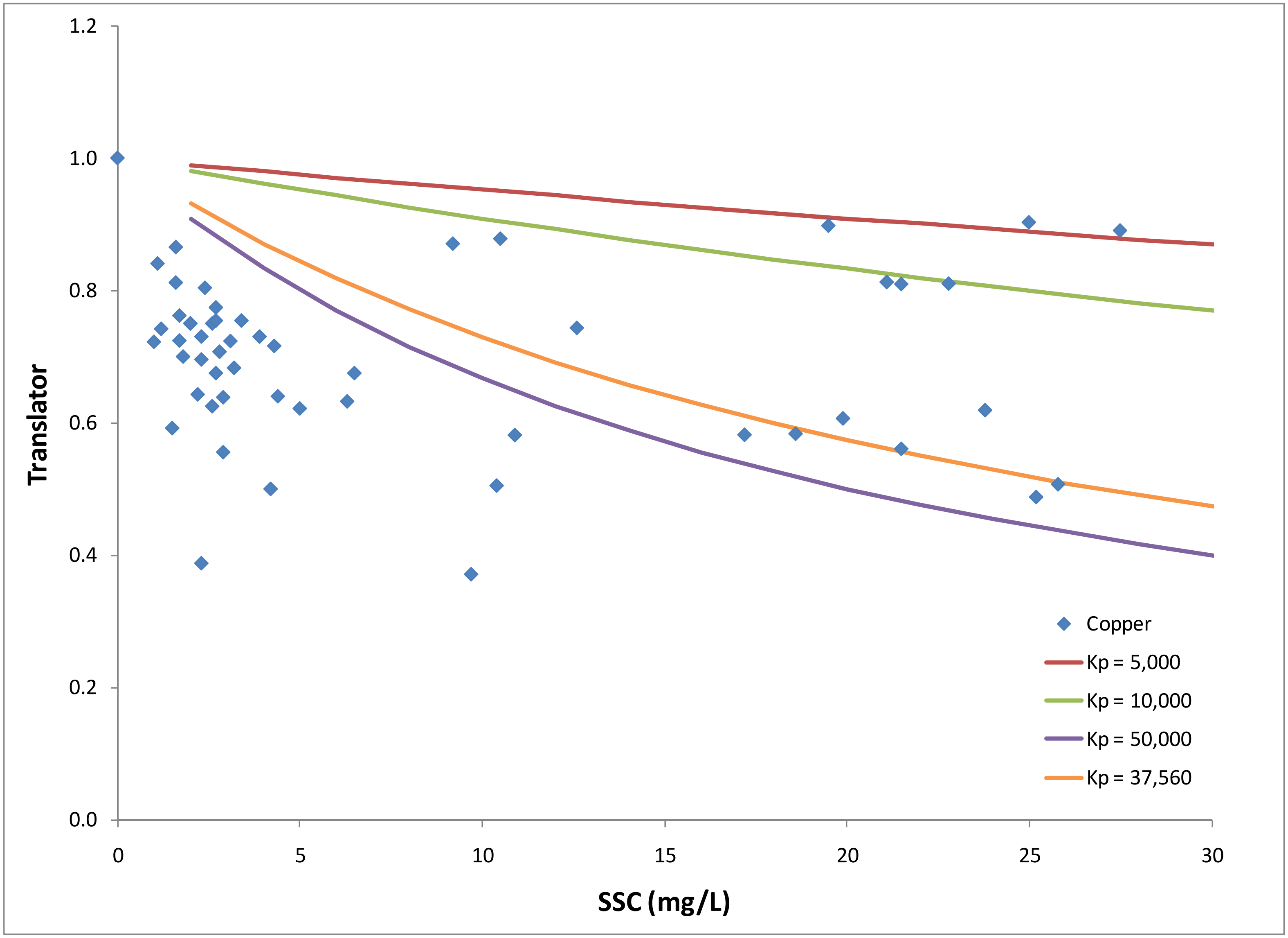


Figure E.5. Copper Translators versus SSC for Harbor Water Quality Mid Depth Samples with Various Partitioning Coefficients. K_p represented by the orange line is the best fit.

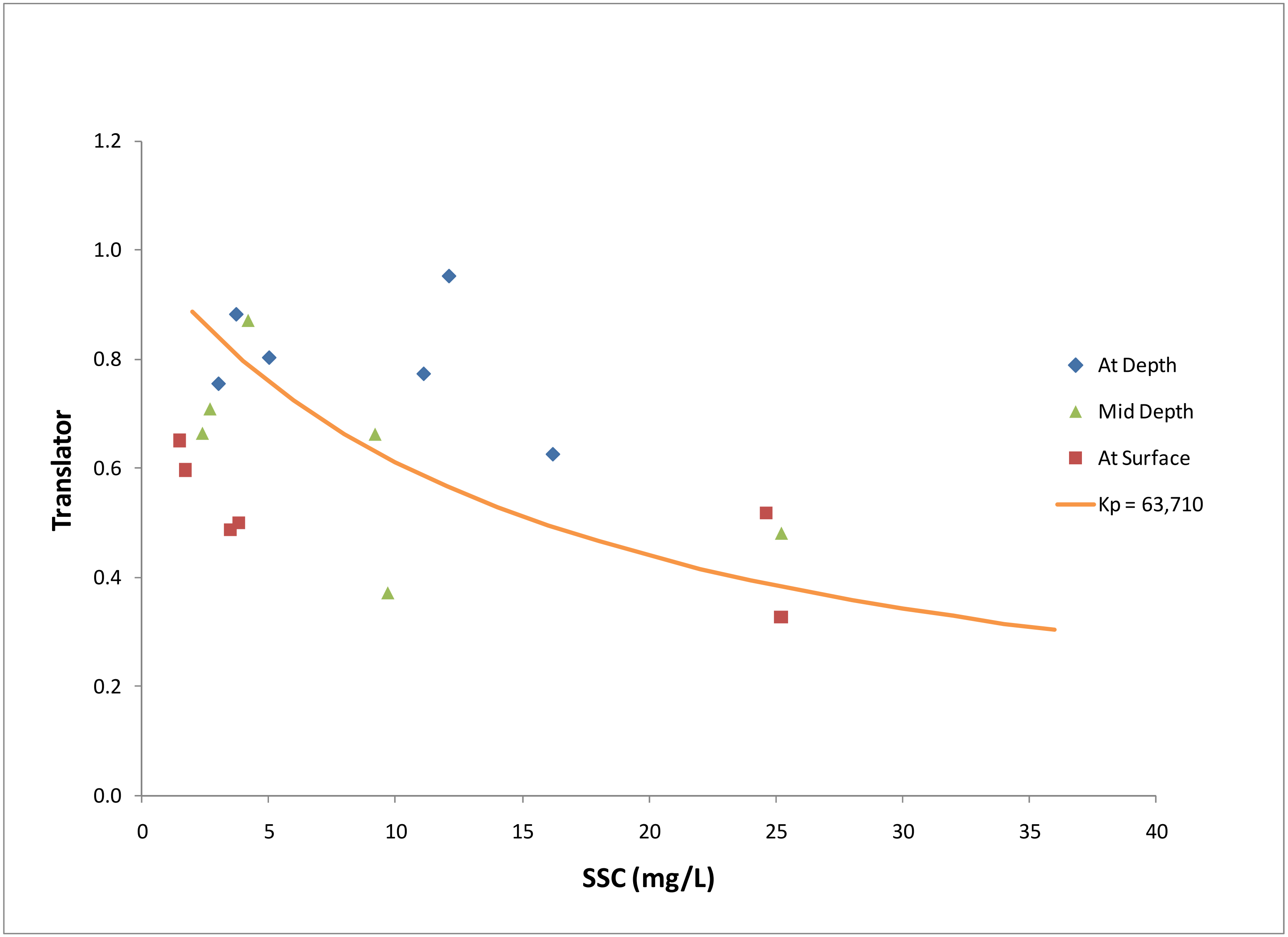


Figure E.6. Copper Translators versus SSC for MdRH-B1 Samples with Various Partitioning Coefficients.

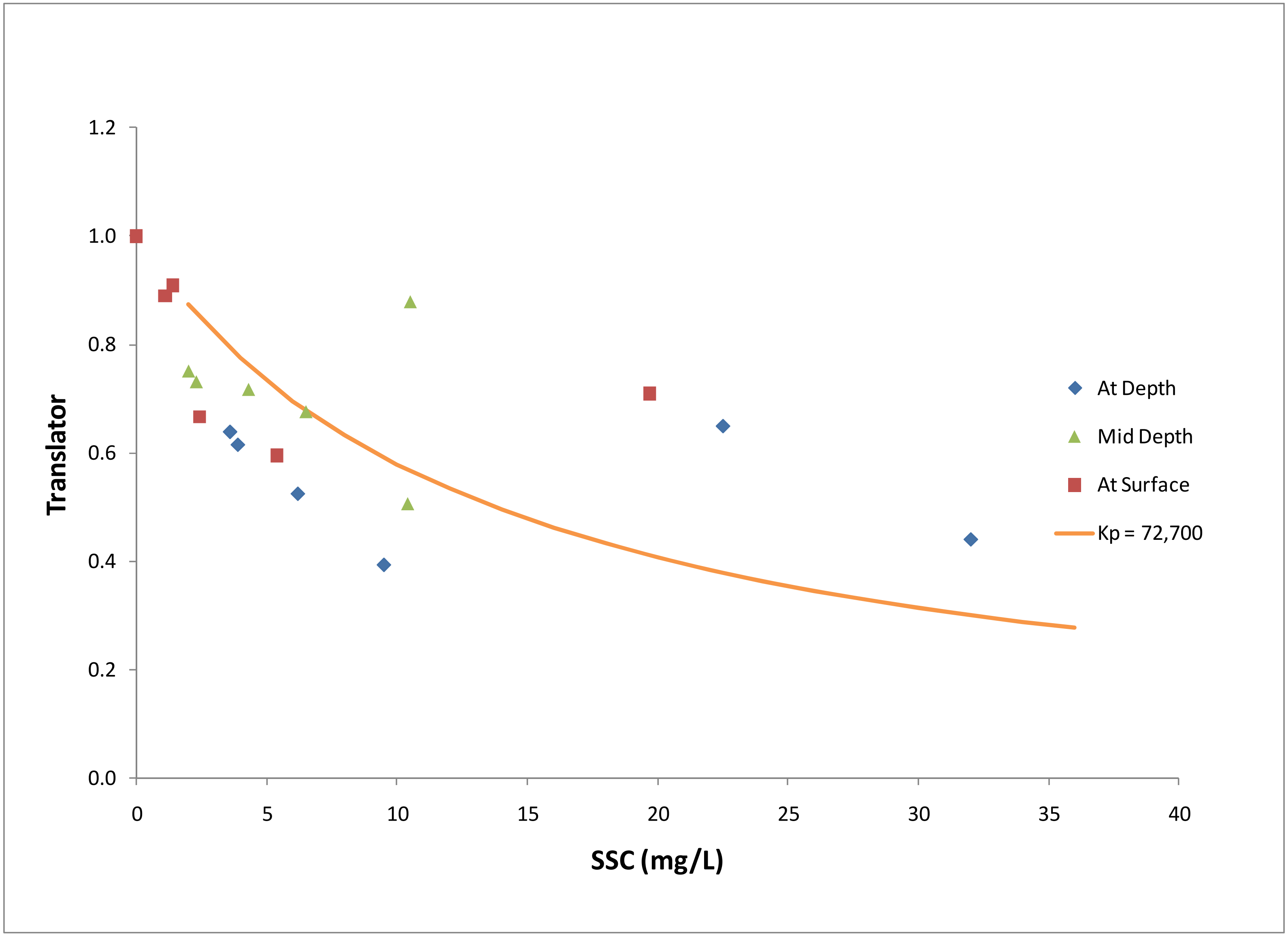


Figure E.7. Copper Translators versus SSC for MdRH-B2 Samples with Various Partitioning Coefficients.

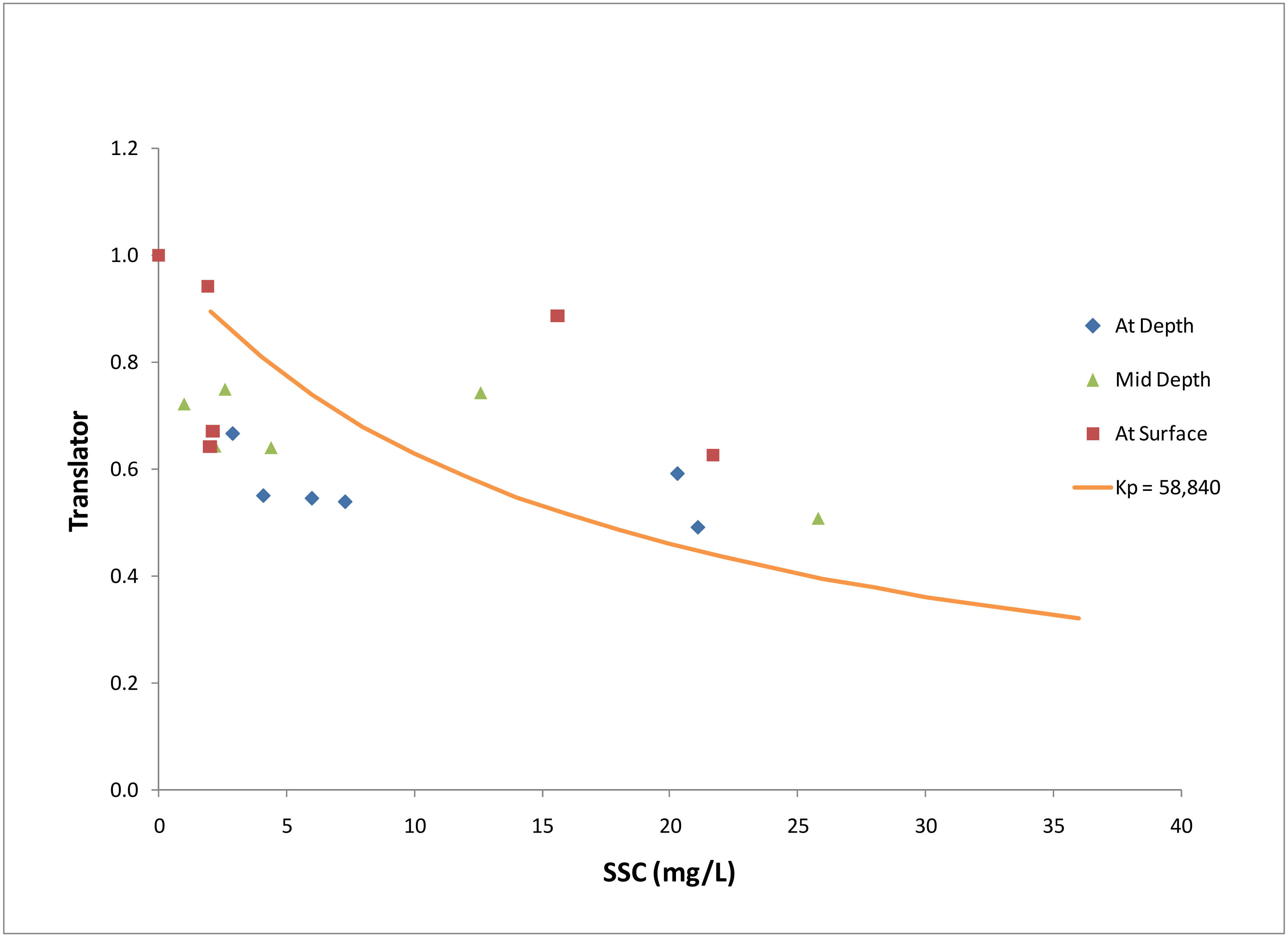


Figure E.8. Copper Translators versus SSC for MdRH-B3 Samples with Various Partitioning Coefficients.

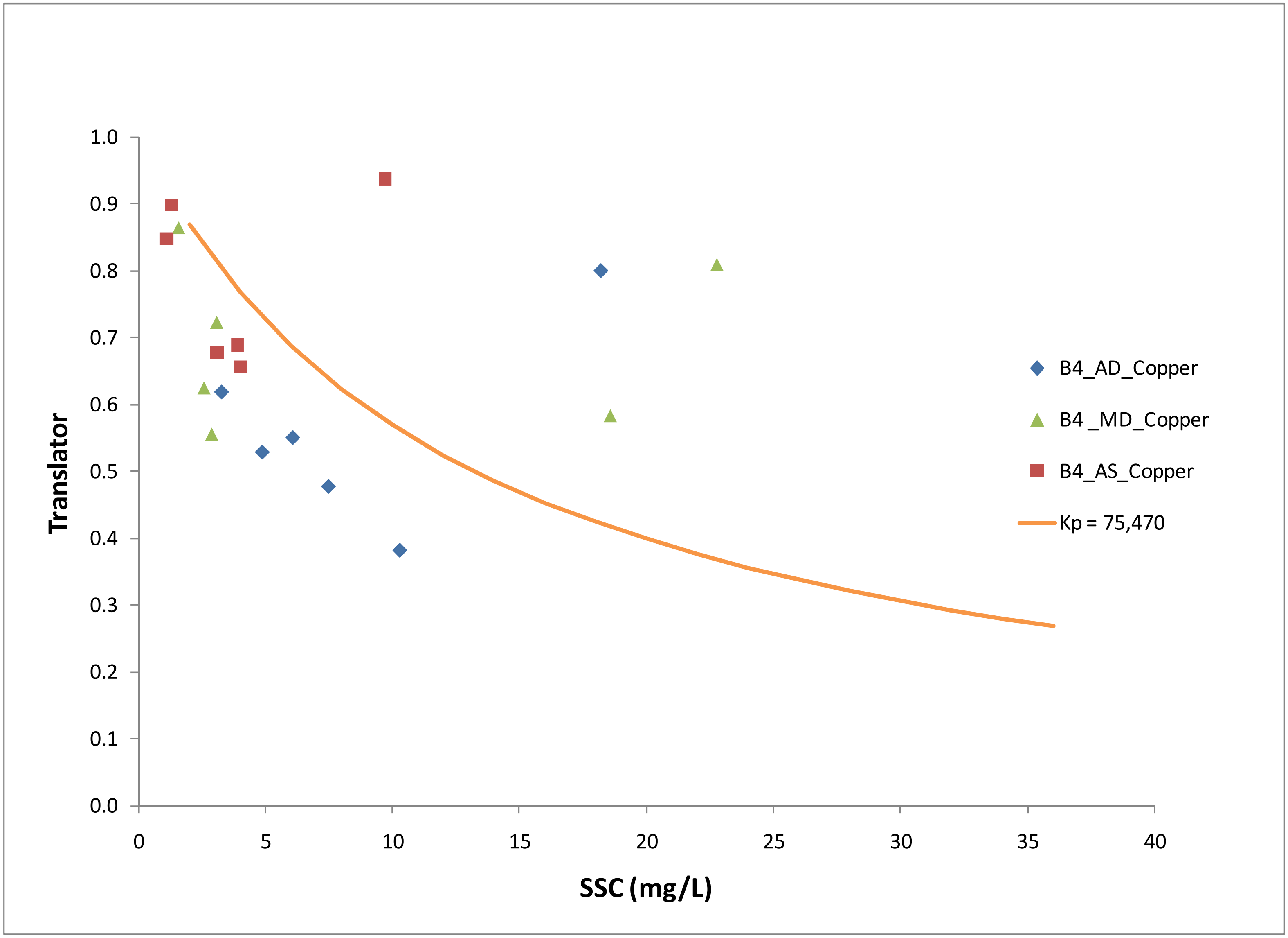


Figure E.9. Copper Translators versus SSC for MdRH-B4 Samples with Various Partitioning Coefficients.

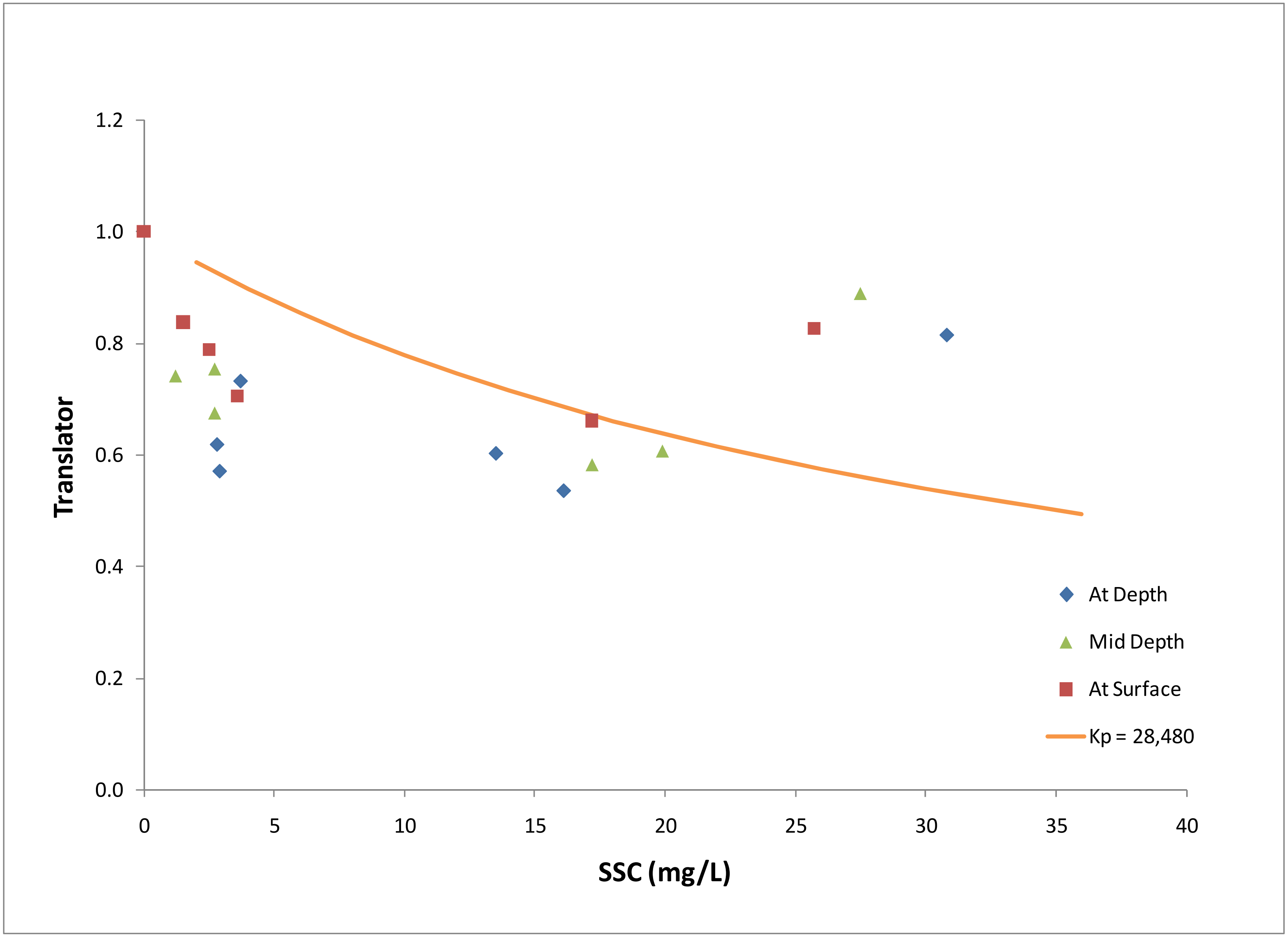


Figure E.10. Copper Translators versus SSC for MdRH-F1 Samples with Various Partitioning Coefficients.

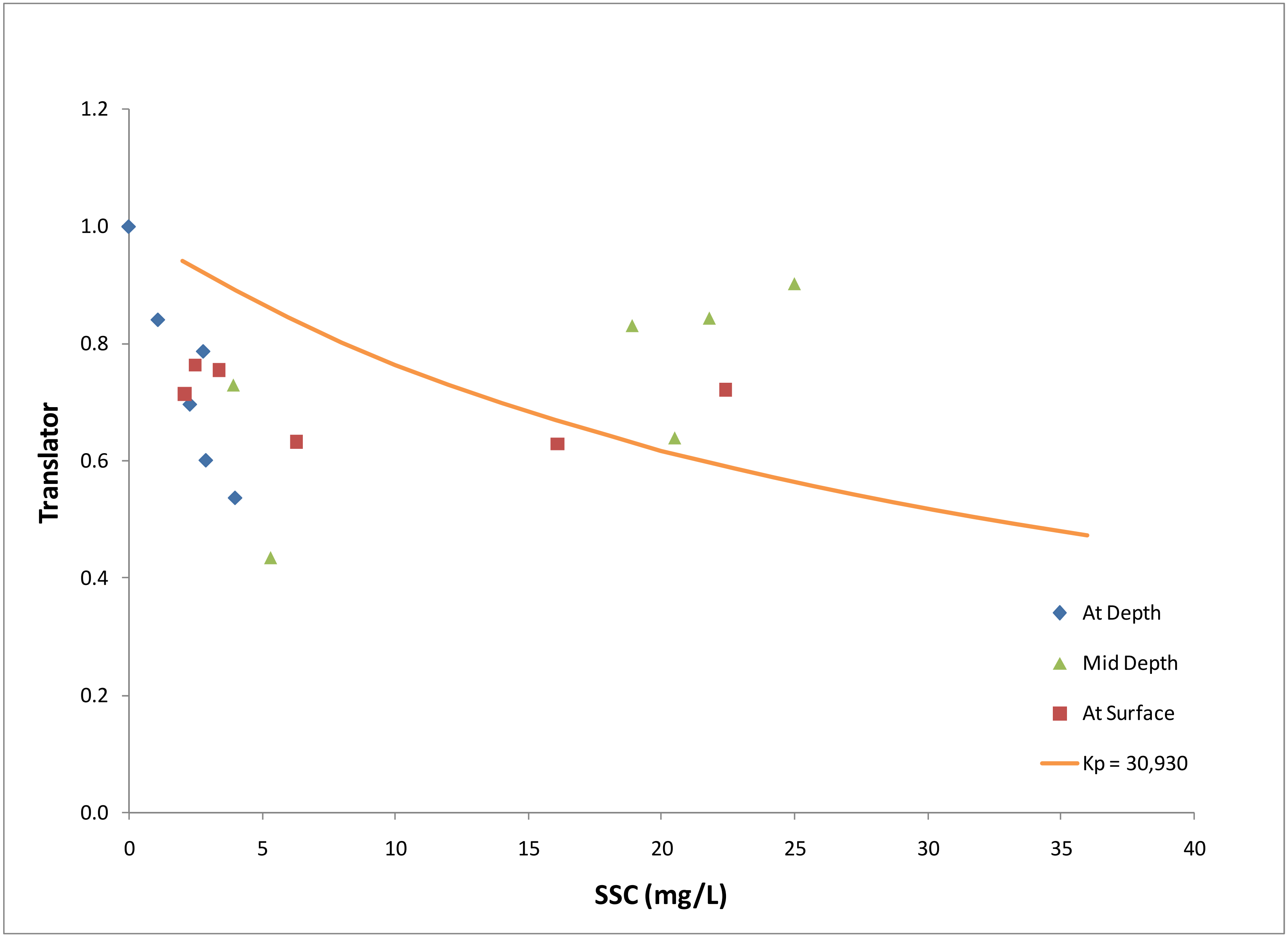


Figure E.11. Copper Translators versus SSC for MdRH-F2 Samples with Various Partitioning Coefficients.

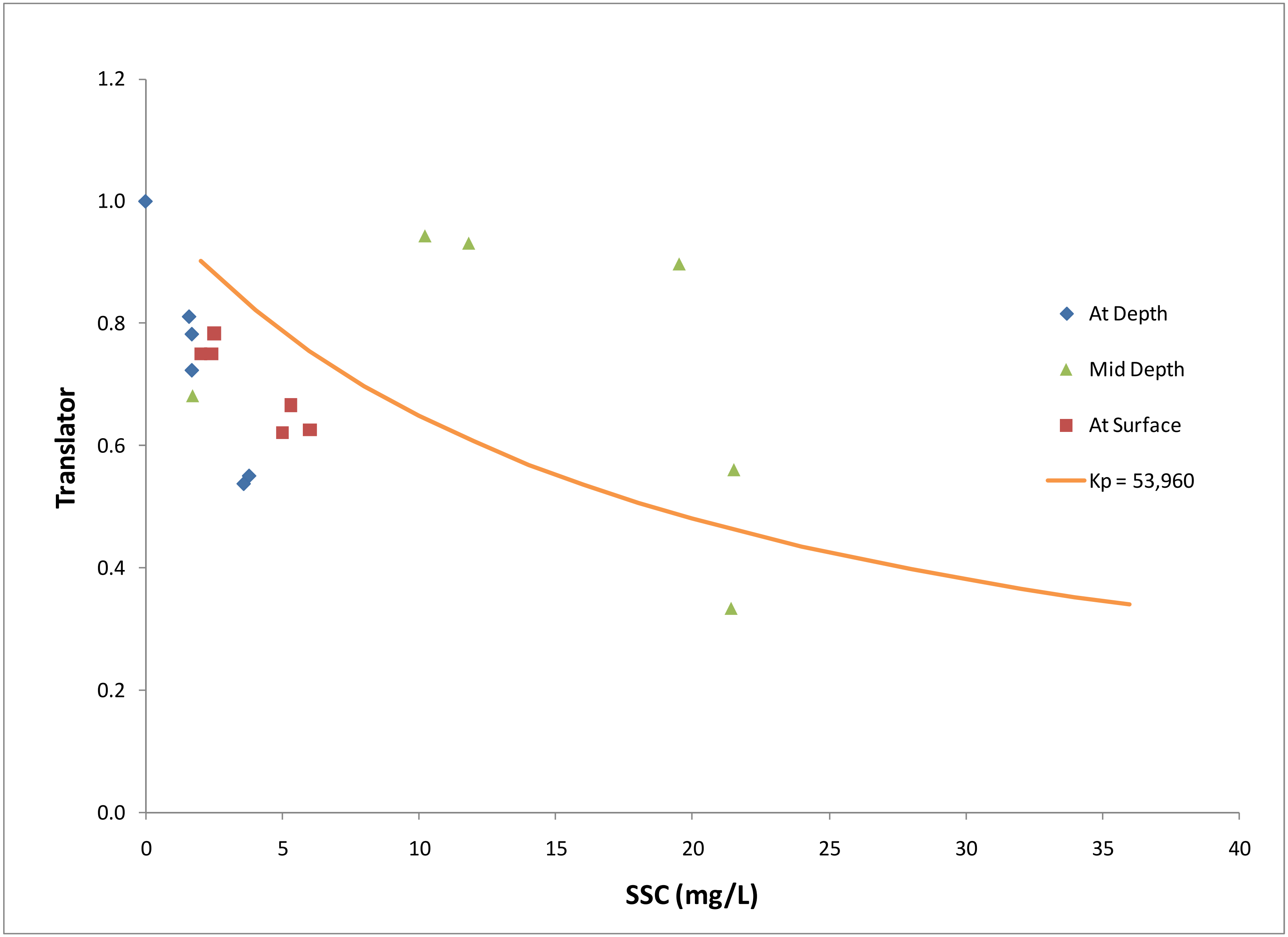


Figure E.12. Copper Translators versus SSC for MdRH-F3 Samples with Various Partitioning Coefficients.

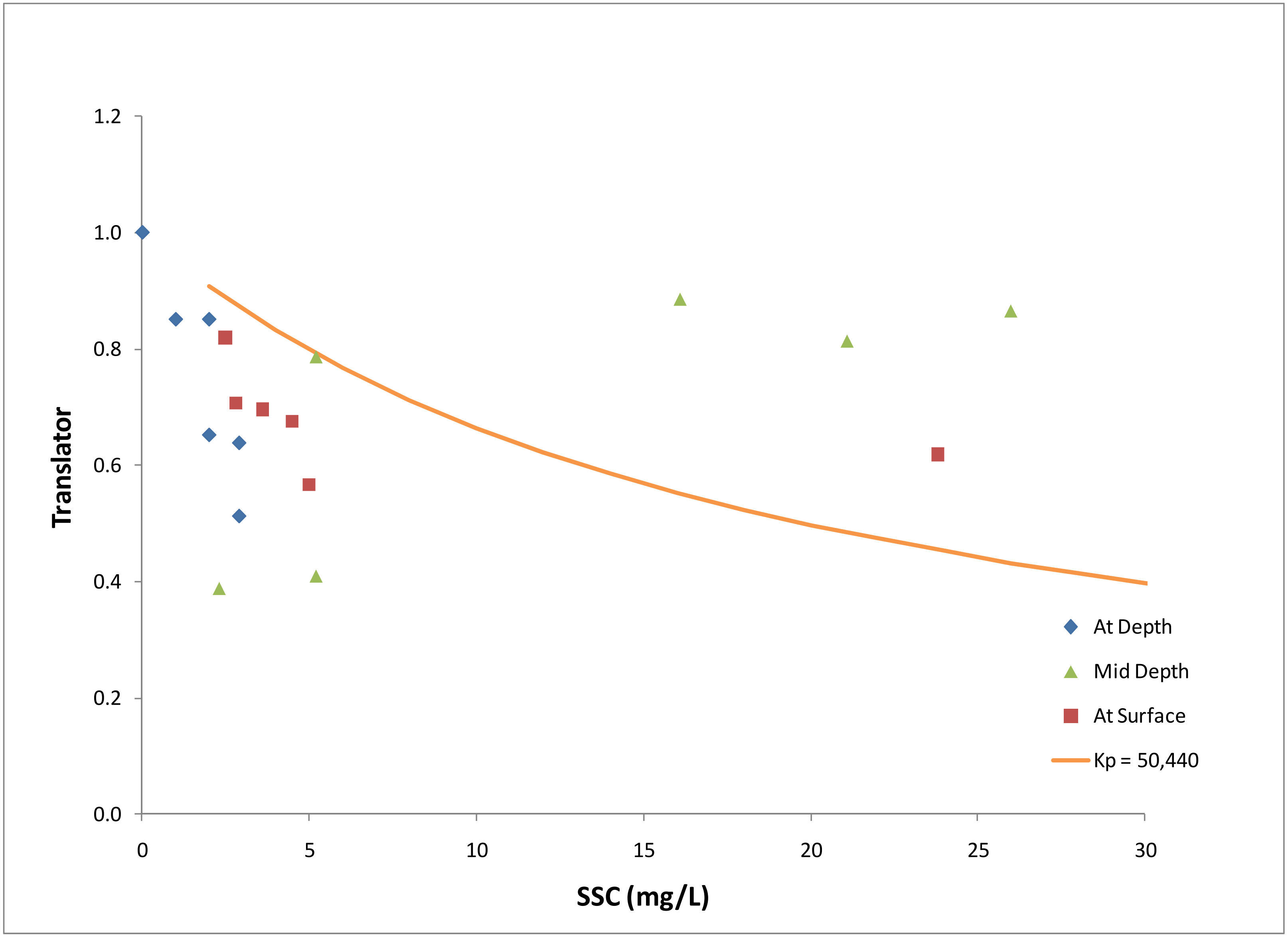


Figure E.13. Copper Translators versus SSC for MdRH-F4 Samples with Various Partitioning Coefficients.

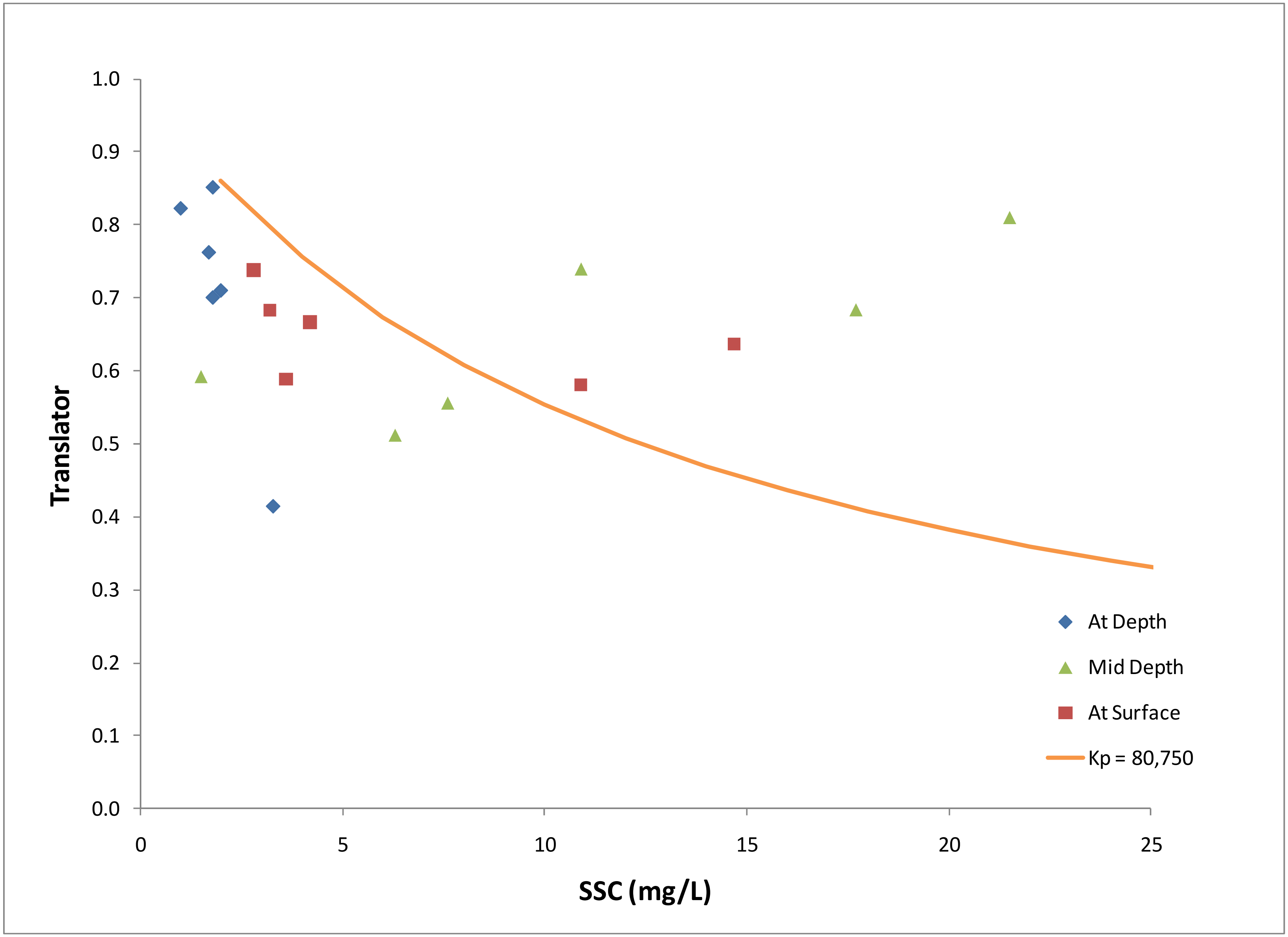


Figure E.14. Copper Translators versus SSC for MdRH-F5 Samples with Various Partitioning Coefficients.

Appendix F: Spatial and Temporal Maps

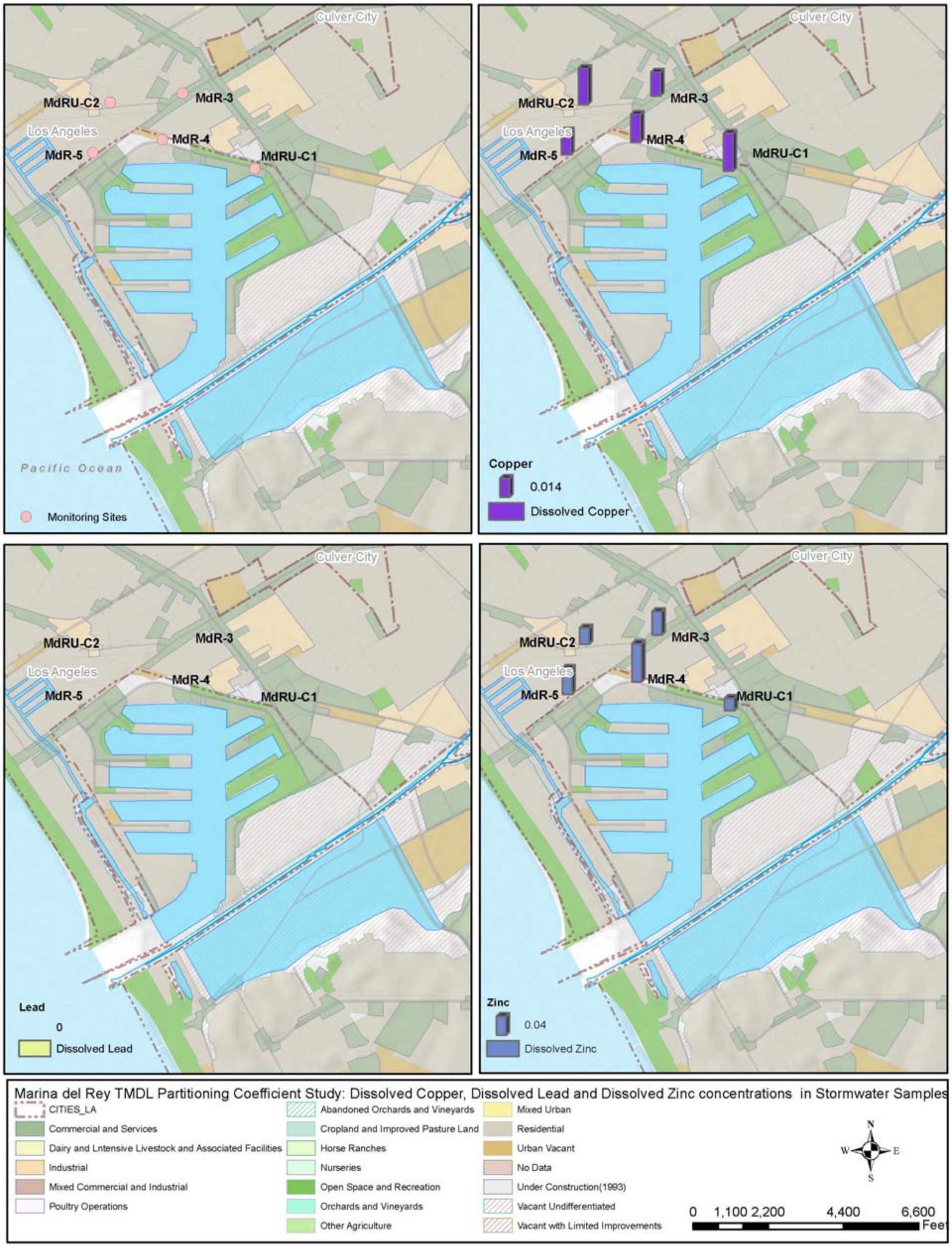


Figure 1. Dissolved Copper, Dissolved Lead and Dissolved Zinc Concentrations in Stormwater Samples, 2/15/2011.

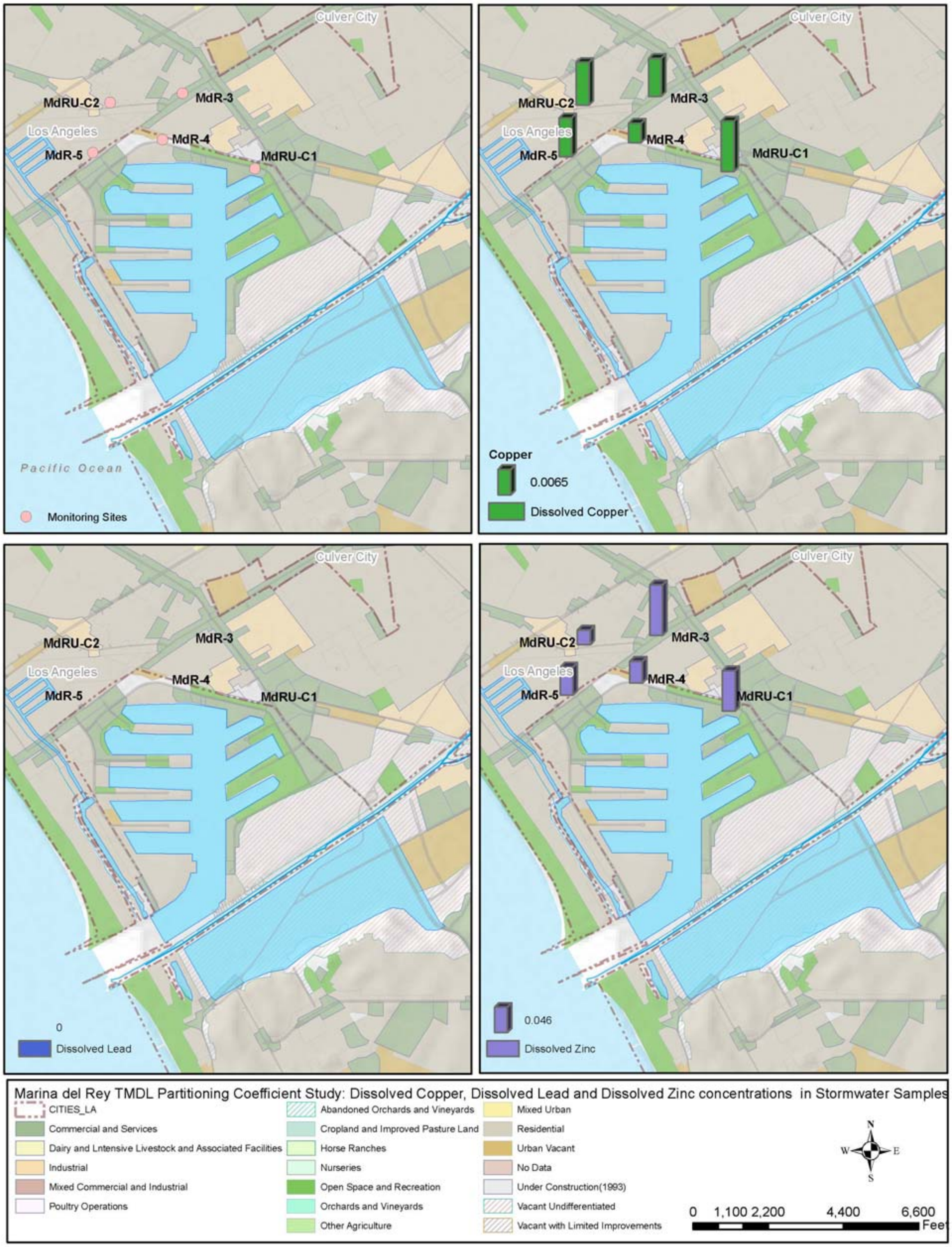


Figure 2. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in Stormwater Samples, 2/17/2011.

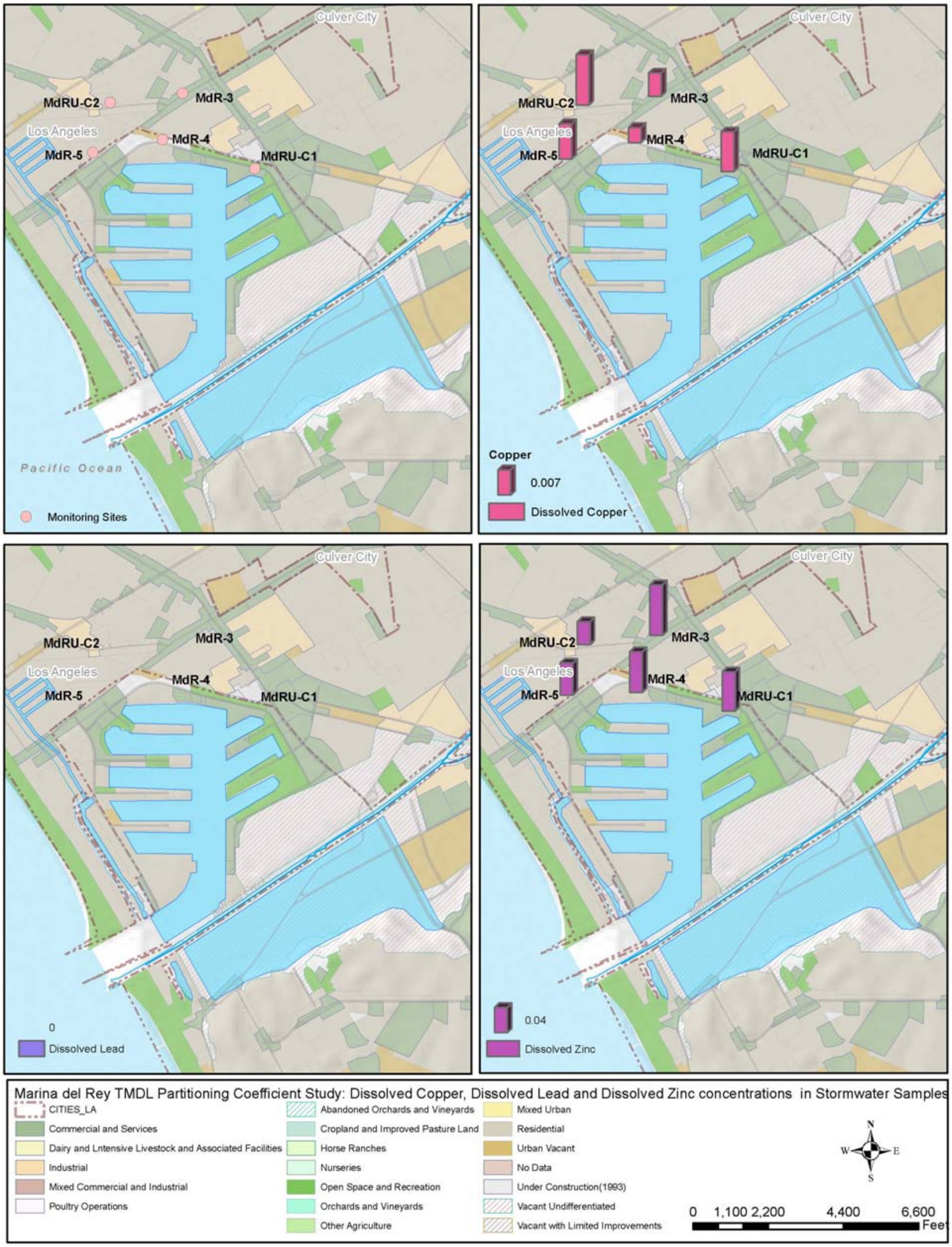


Figure 3. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in Stormwater Samples, 2/25/2011.

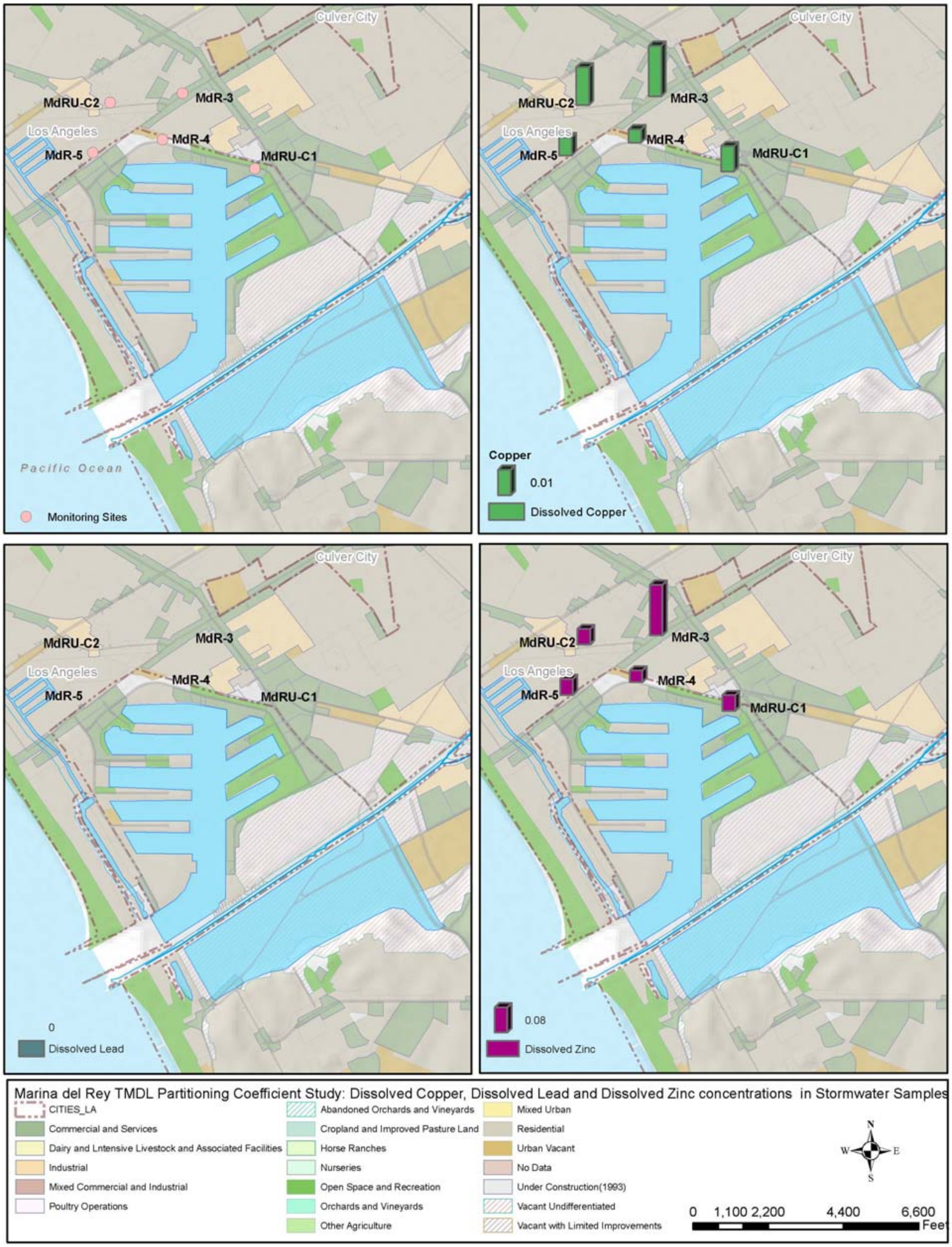


Figure 4. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in Stormwater Samples, 3/20/2011.

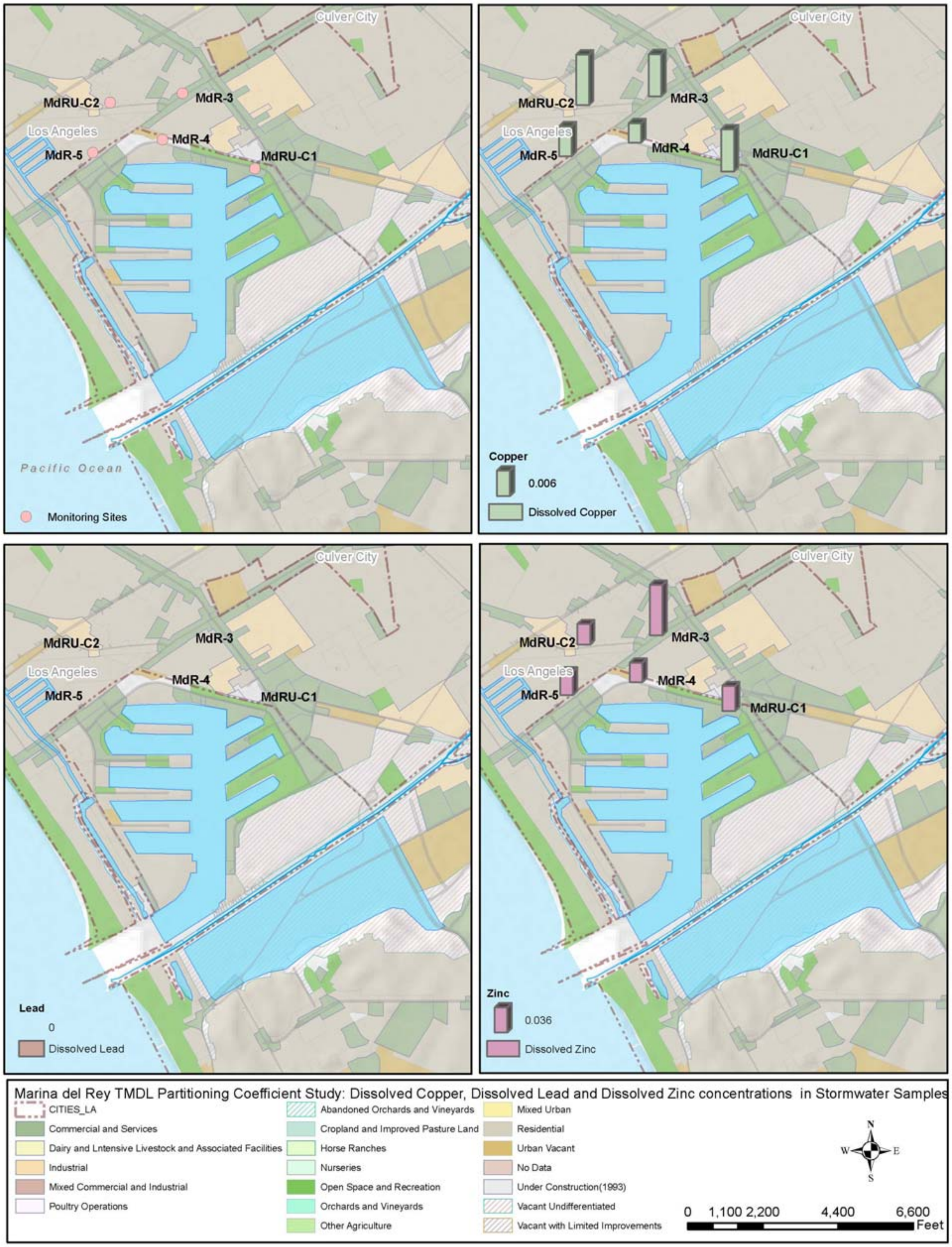


Figure 5. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in Stormwater Samples, 3/25/2011.

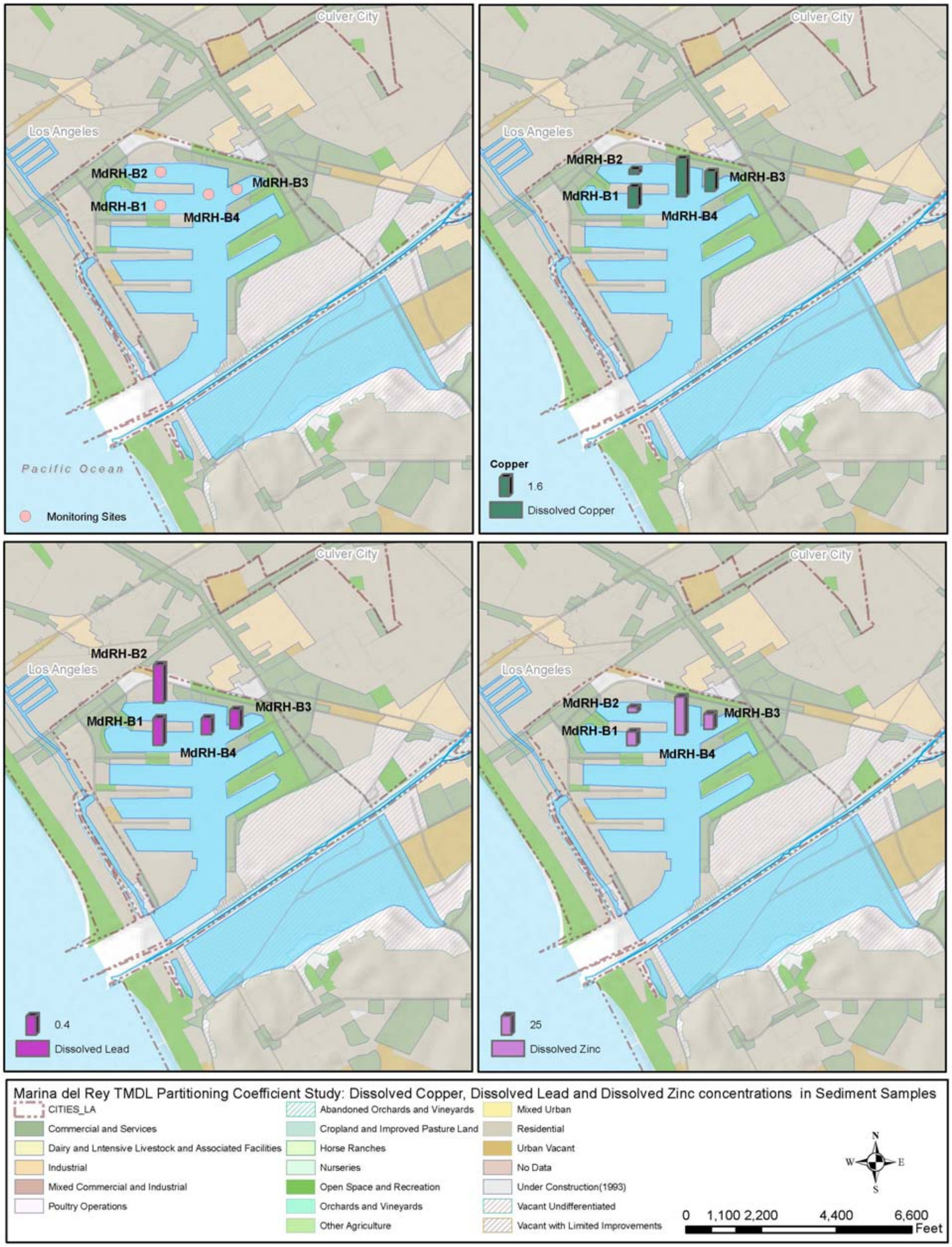


Figure 6. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in Sediment Samples, March 2011.

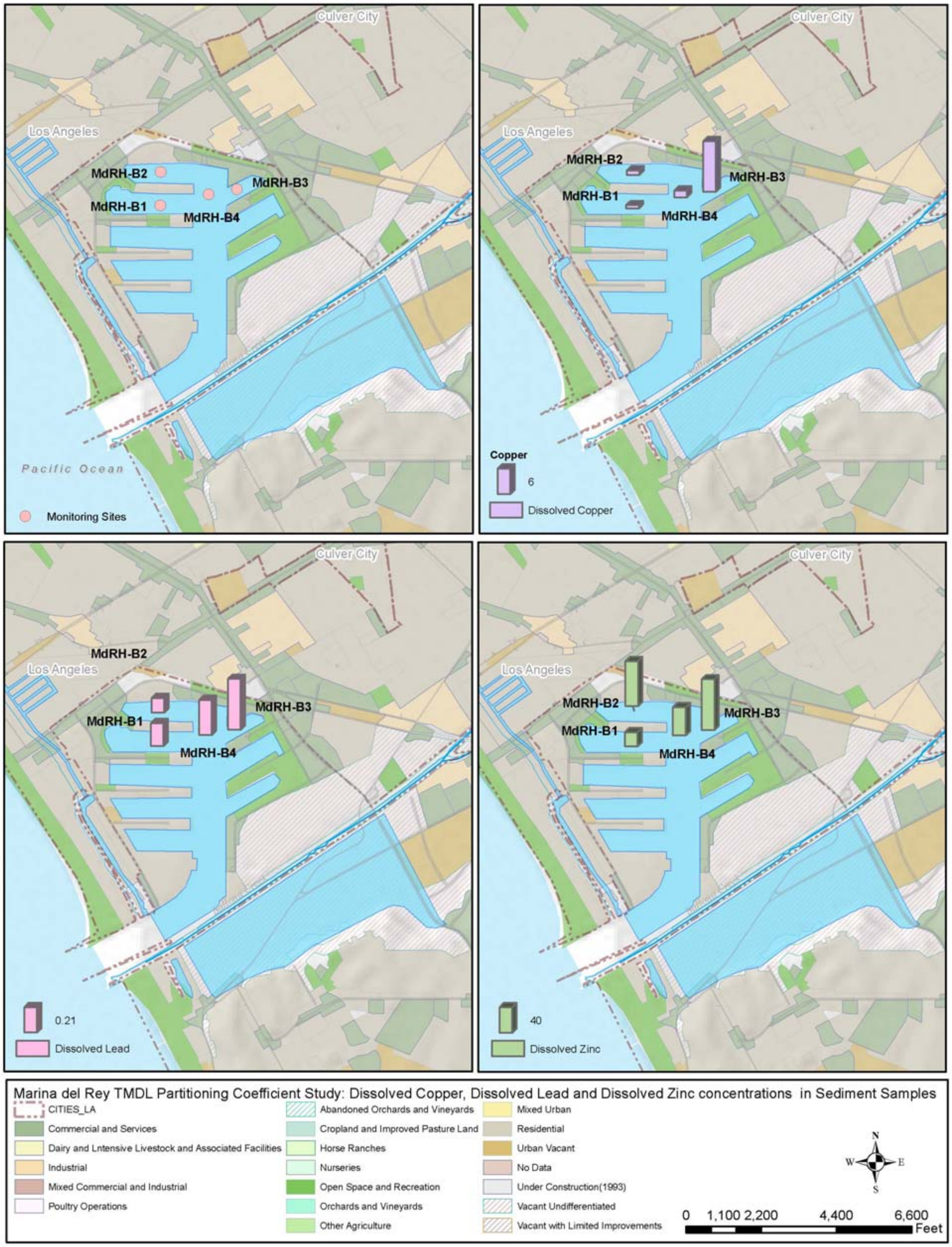


Figure 7. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in Sediment Samples, June 2011.

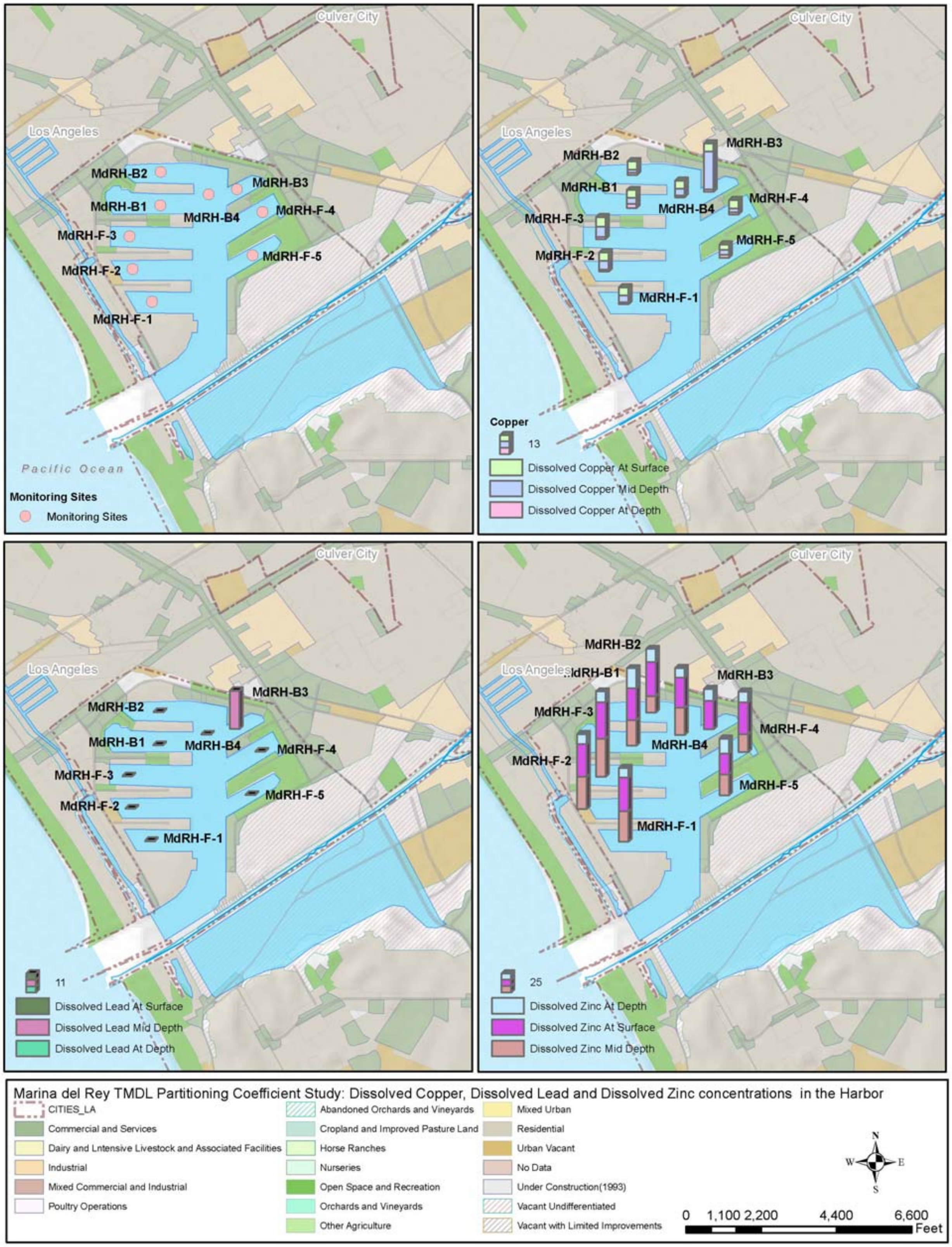


Figure 8. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in the Harbor, February 2011.

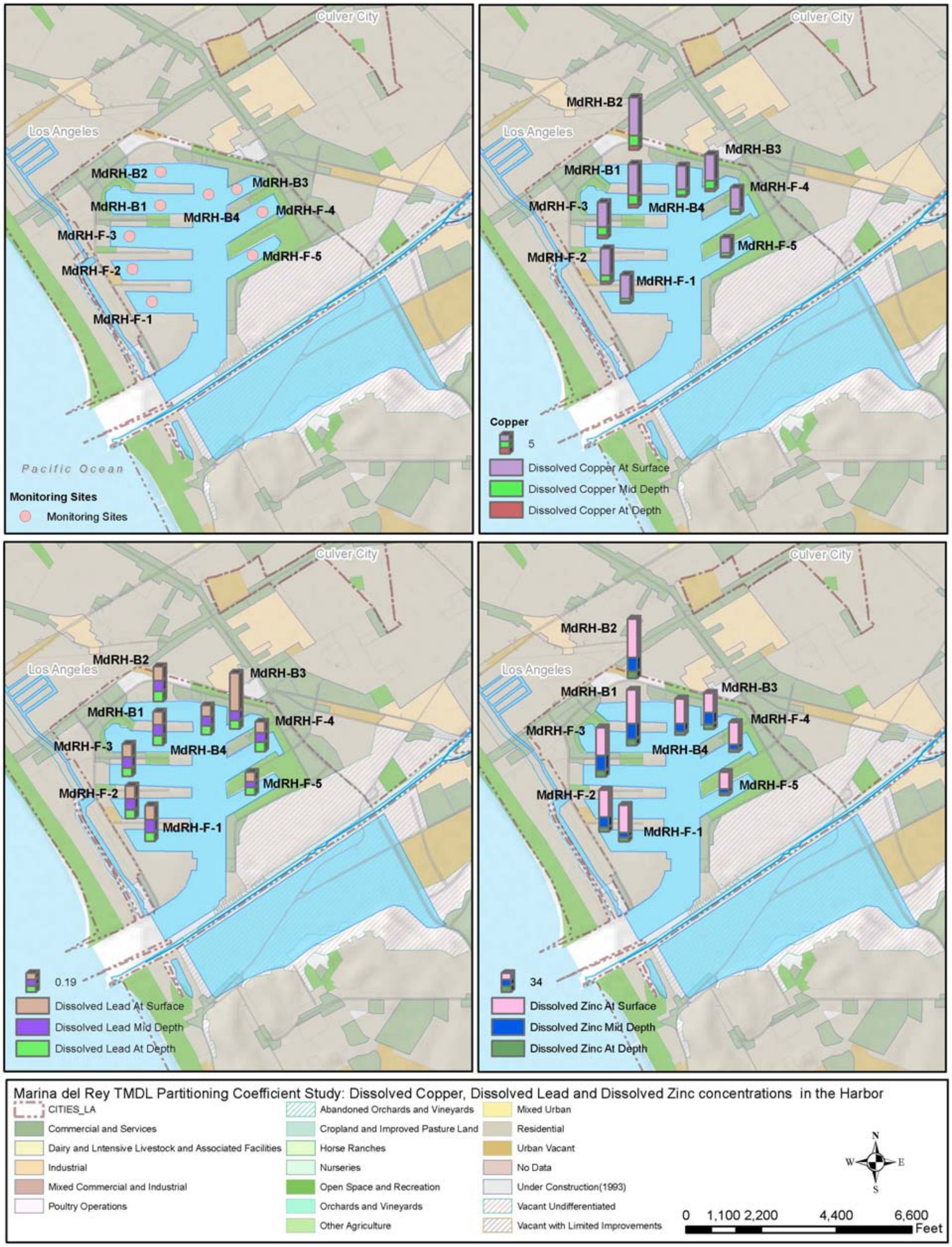


Figure 9. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in the Harbor, March 2011.

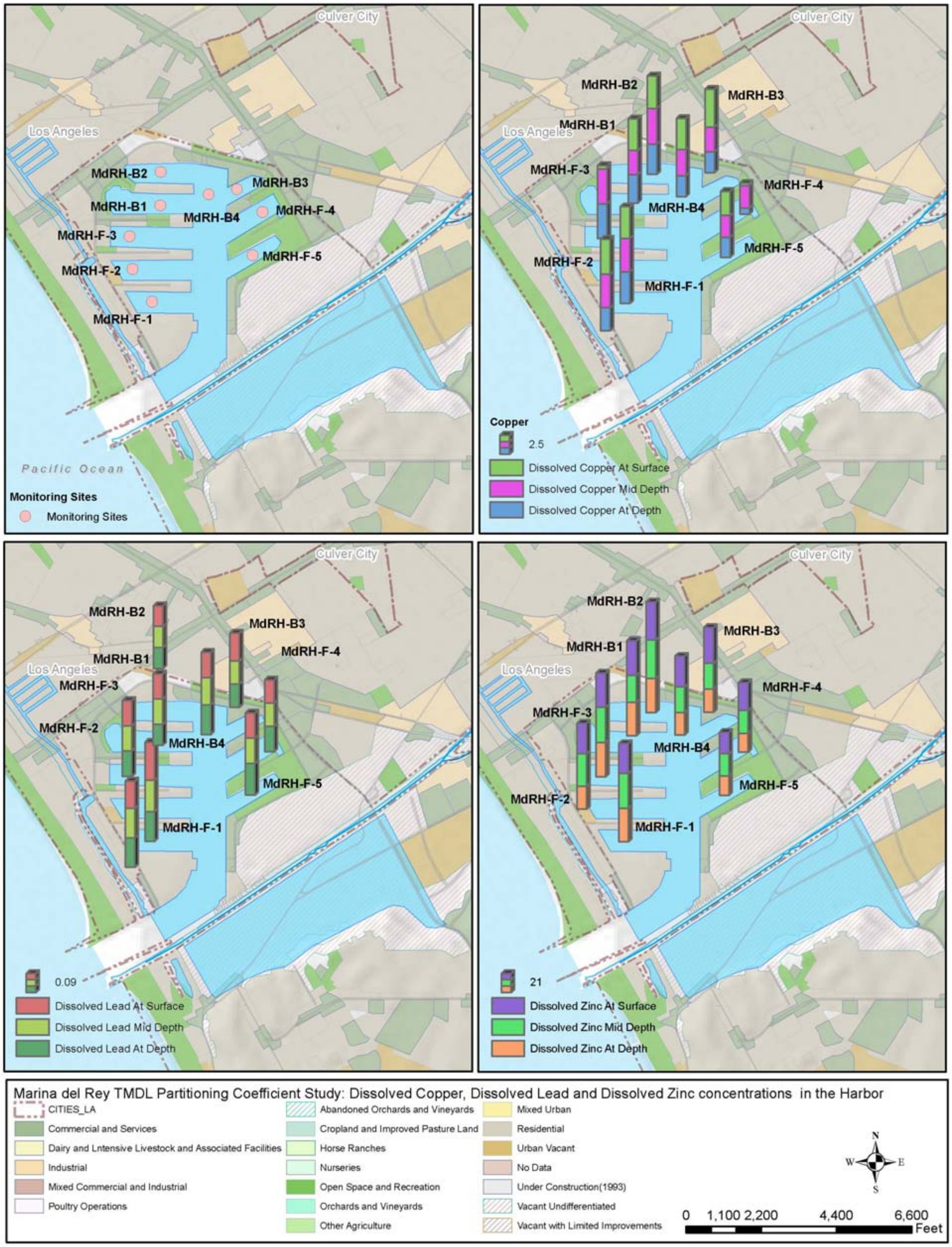


Figure 10. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in the Harbor, April 2011.

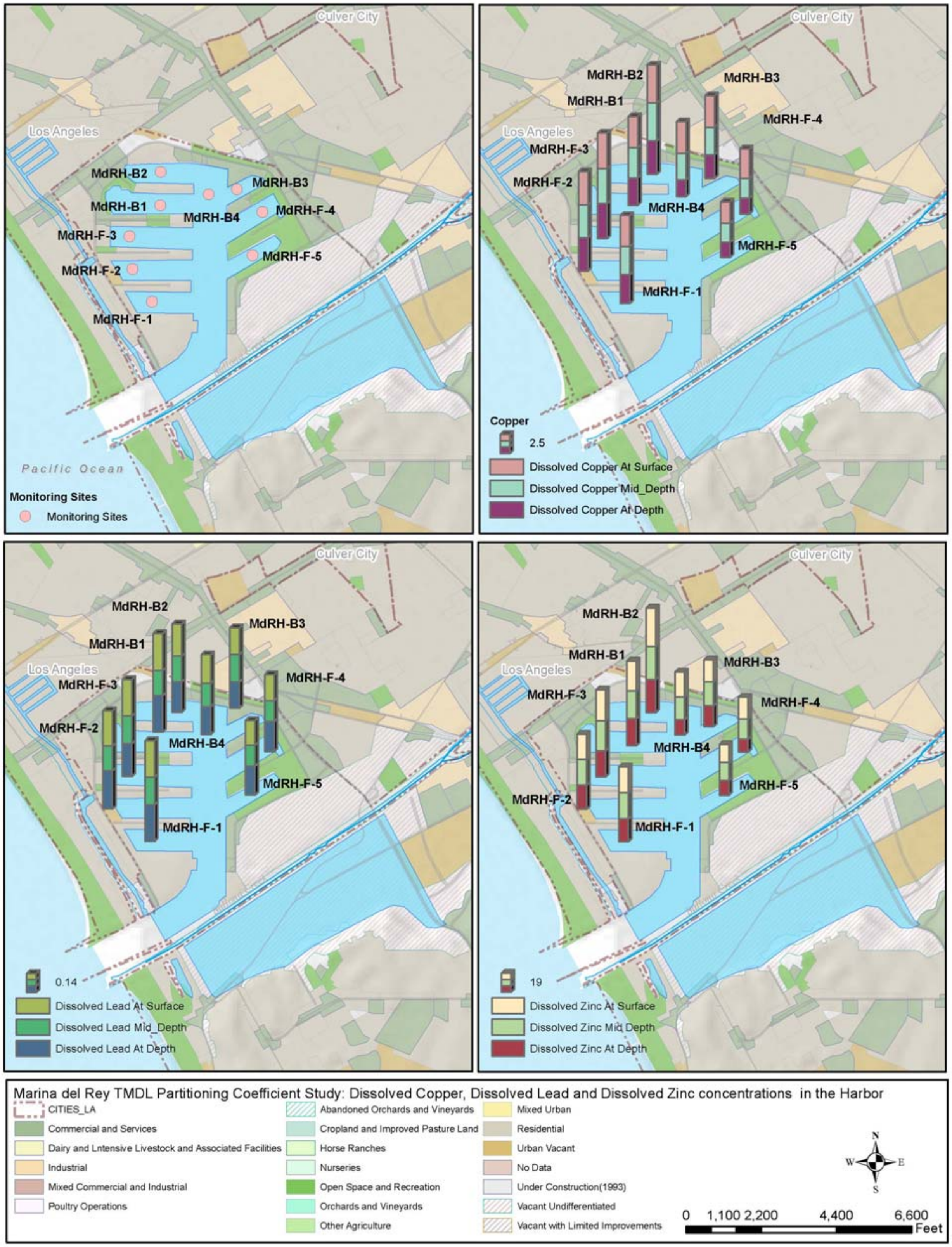


Figure 11. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in the Harbor, May 2011.

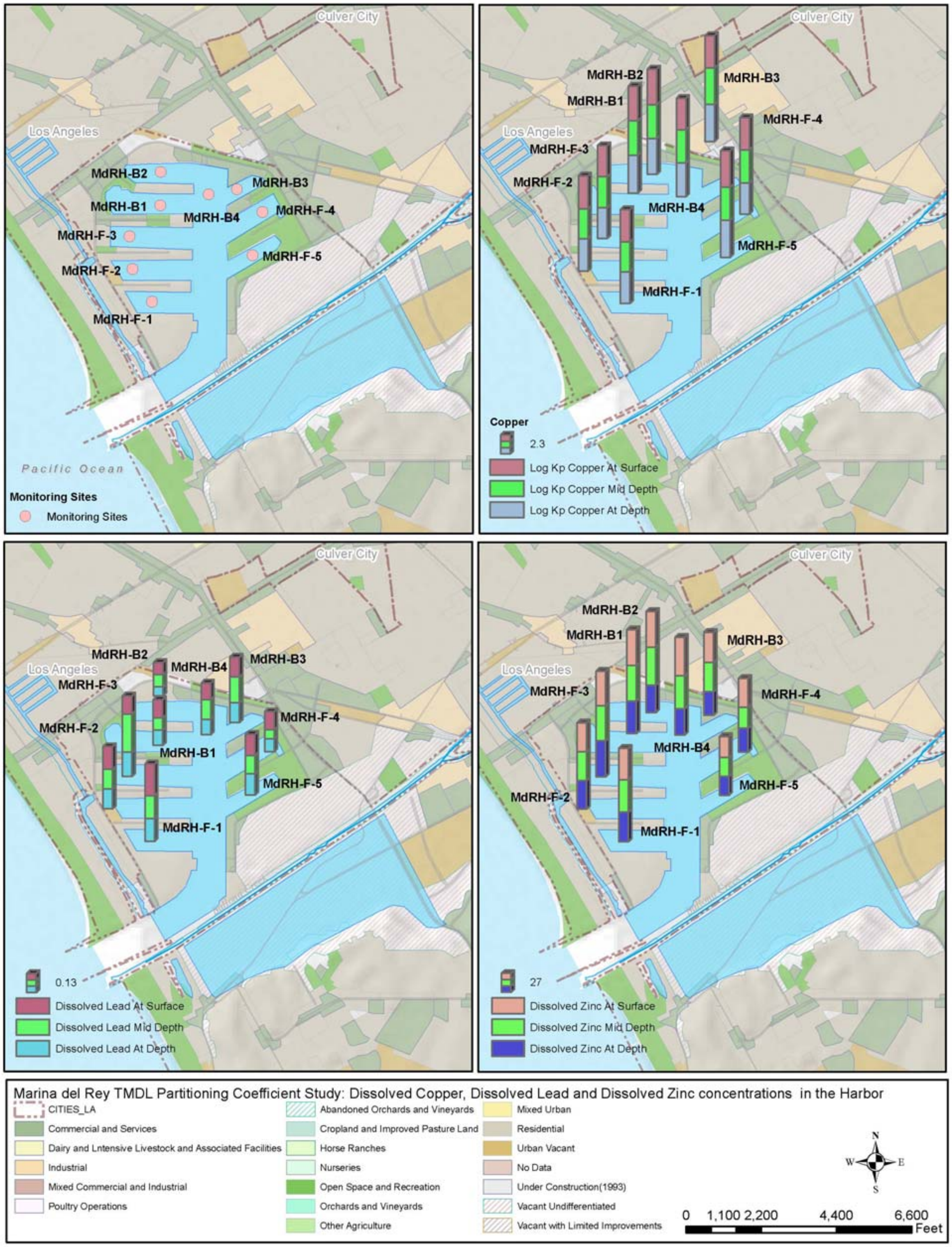


Figure 12. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in the Harbor, June 2011.

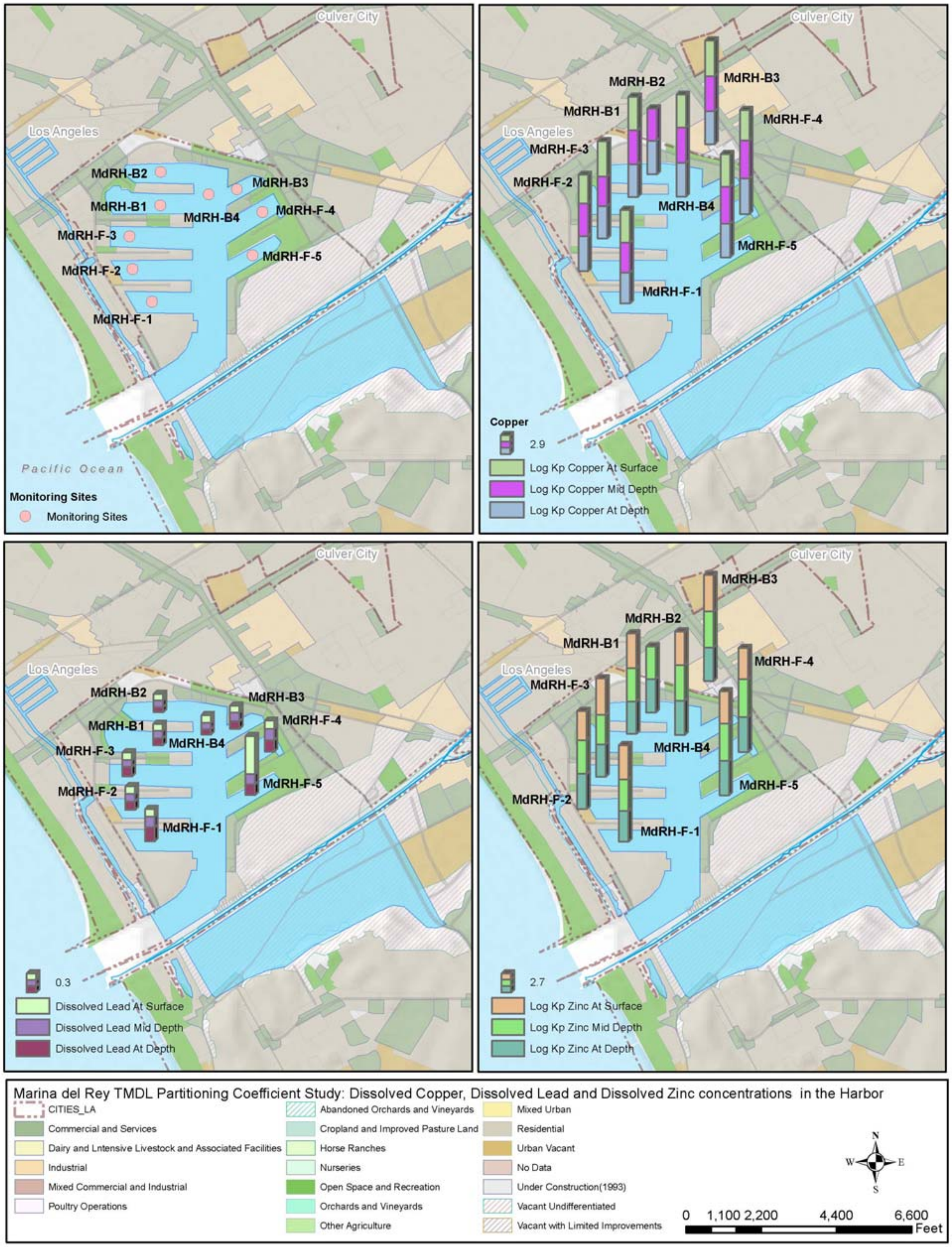


Figure 13. Dissolved Copper, Dissolved Lead and Dissolved Zinc concentrations in the Harbor, July 2011.

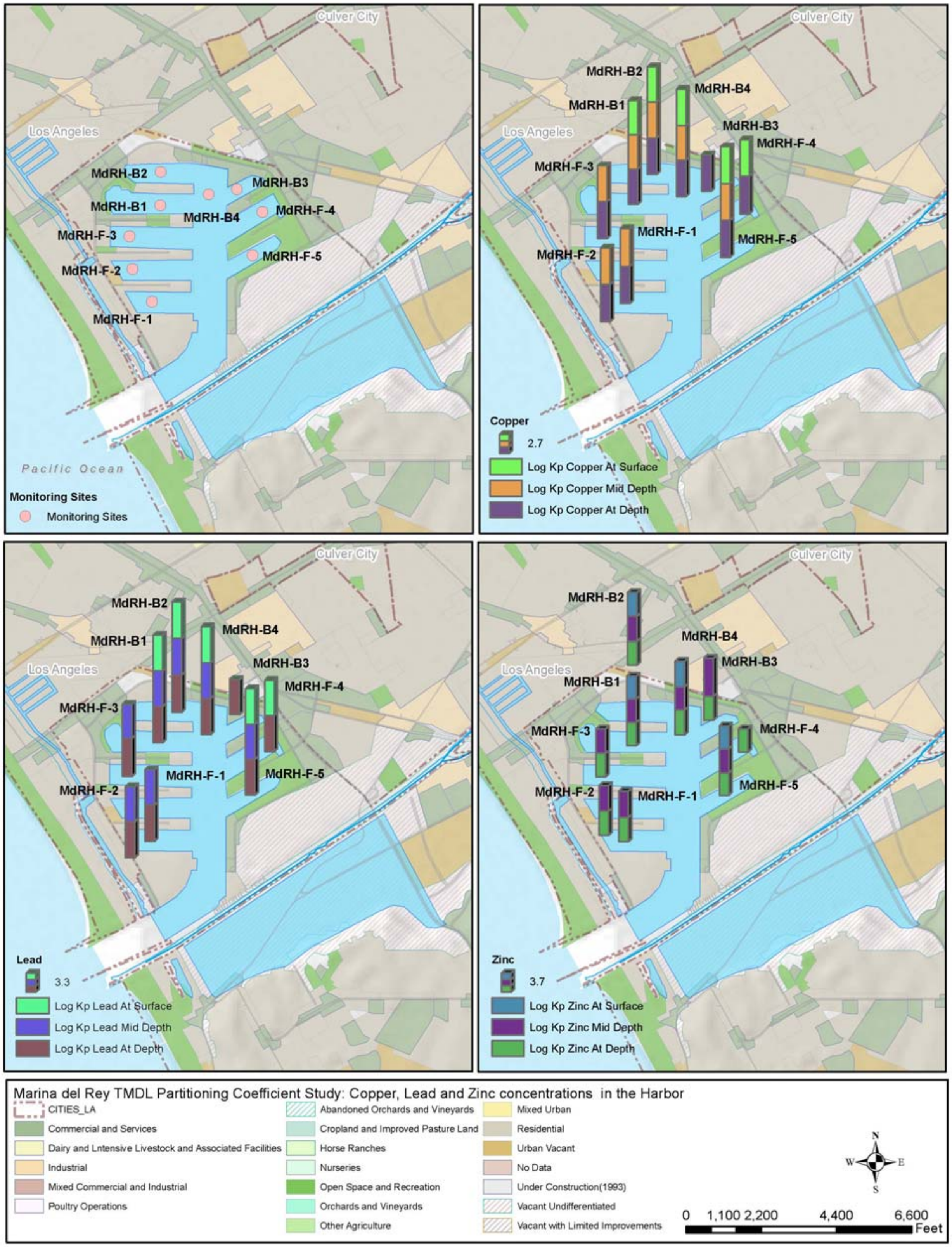


Figure 14. Copper, Lead and Zinc concentrations in the Harbor, February 2011.

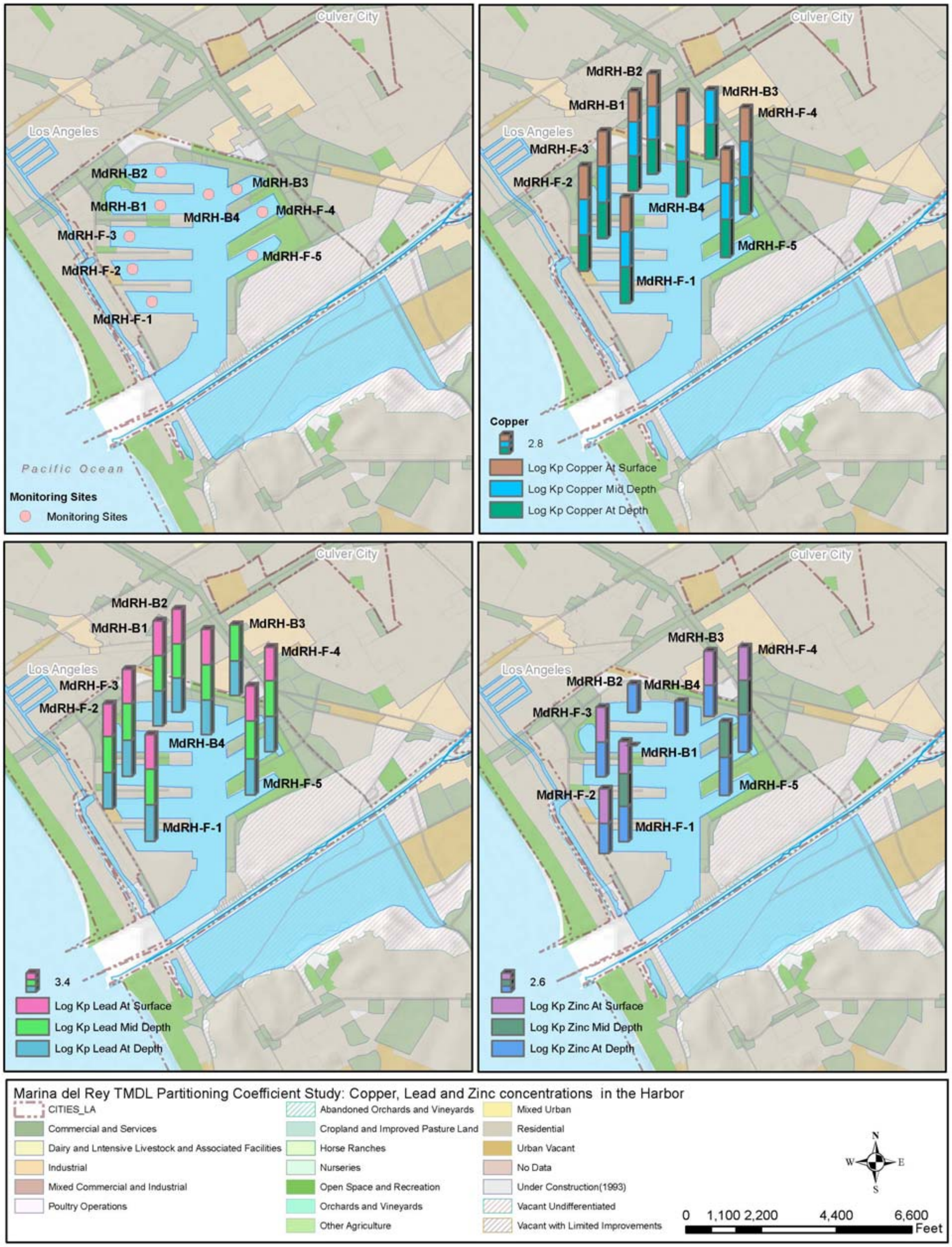


Figure 15. Copper, Lead and Zinc concentrations in the Harbor, March 2011.

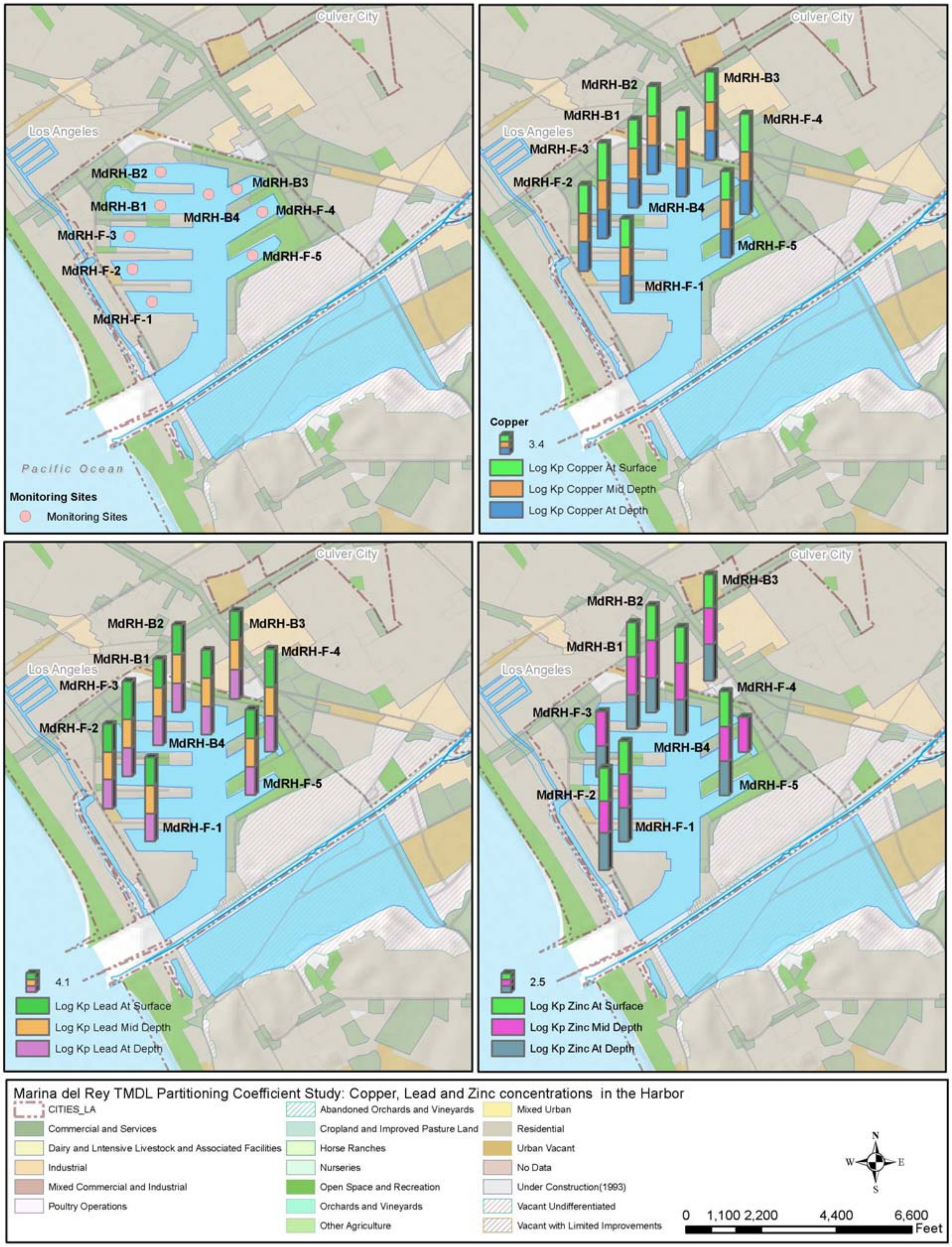


Figure 16. Copper, Lead and Zinc concentrations in the Harbor, April 2011.

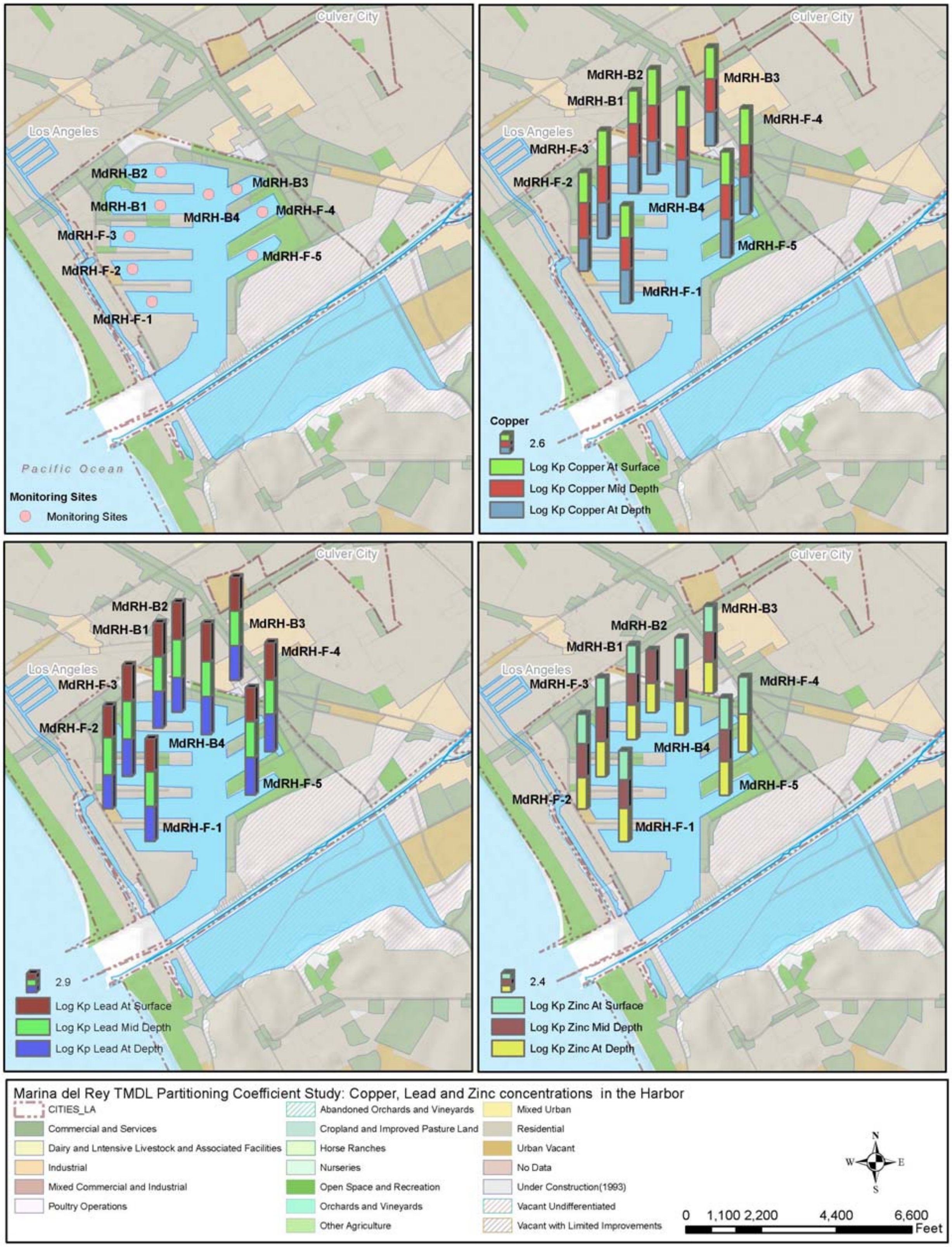


Figure 17. Copper, Lead and Zinc concentrations in the Harbor, May 2011.

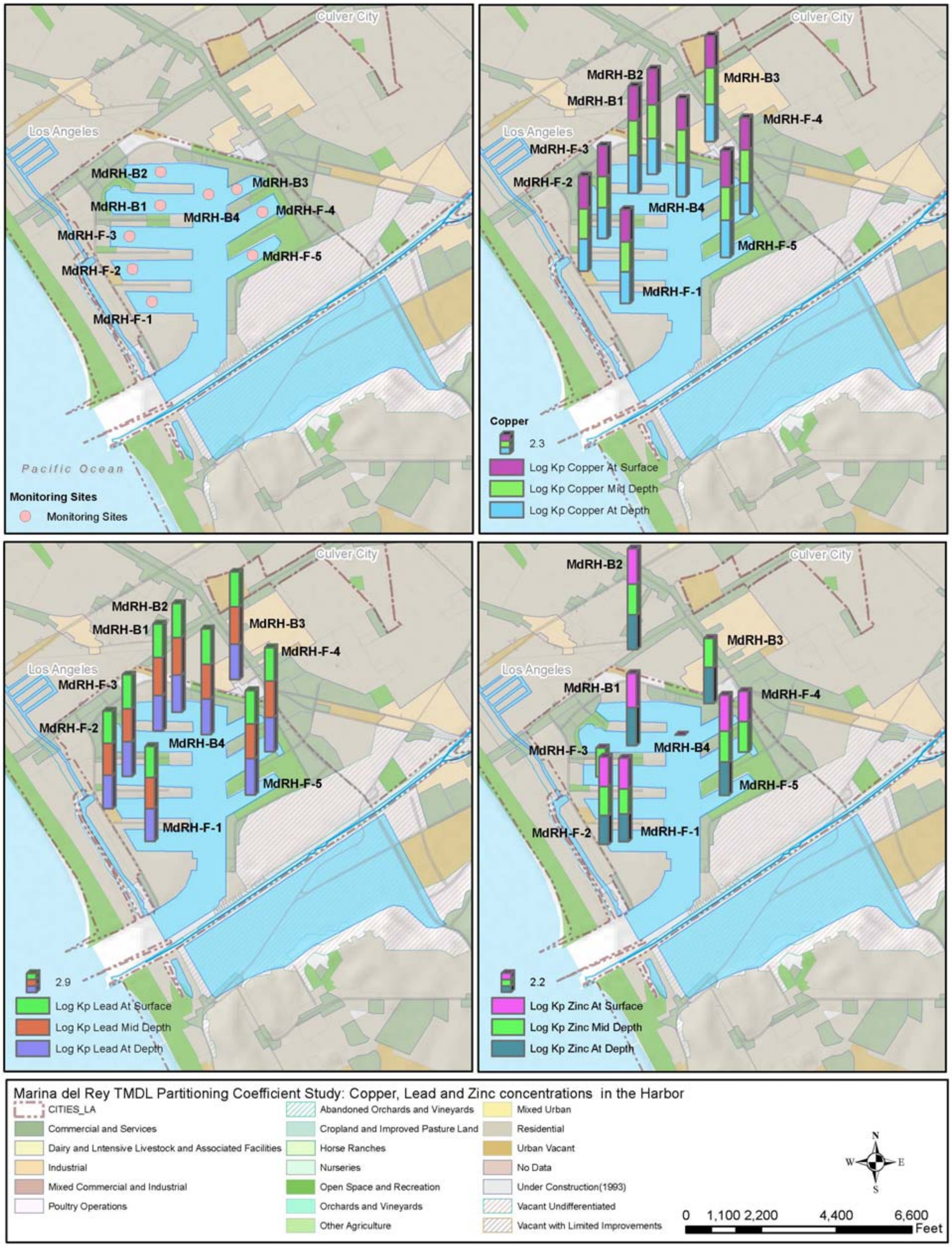


Figure 18. Copper, Lead and Zinc concentrations in the Harbor, June 2011.

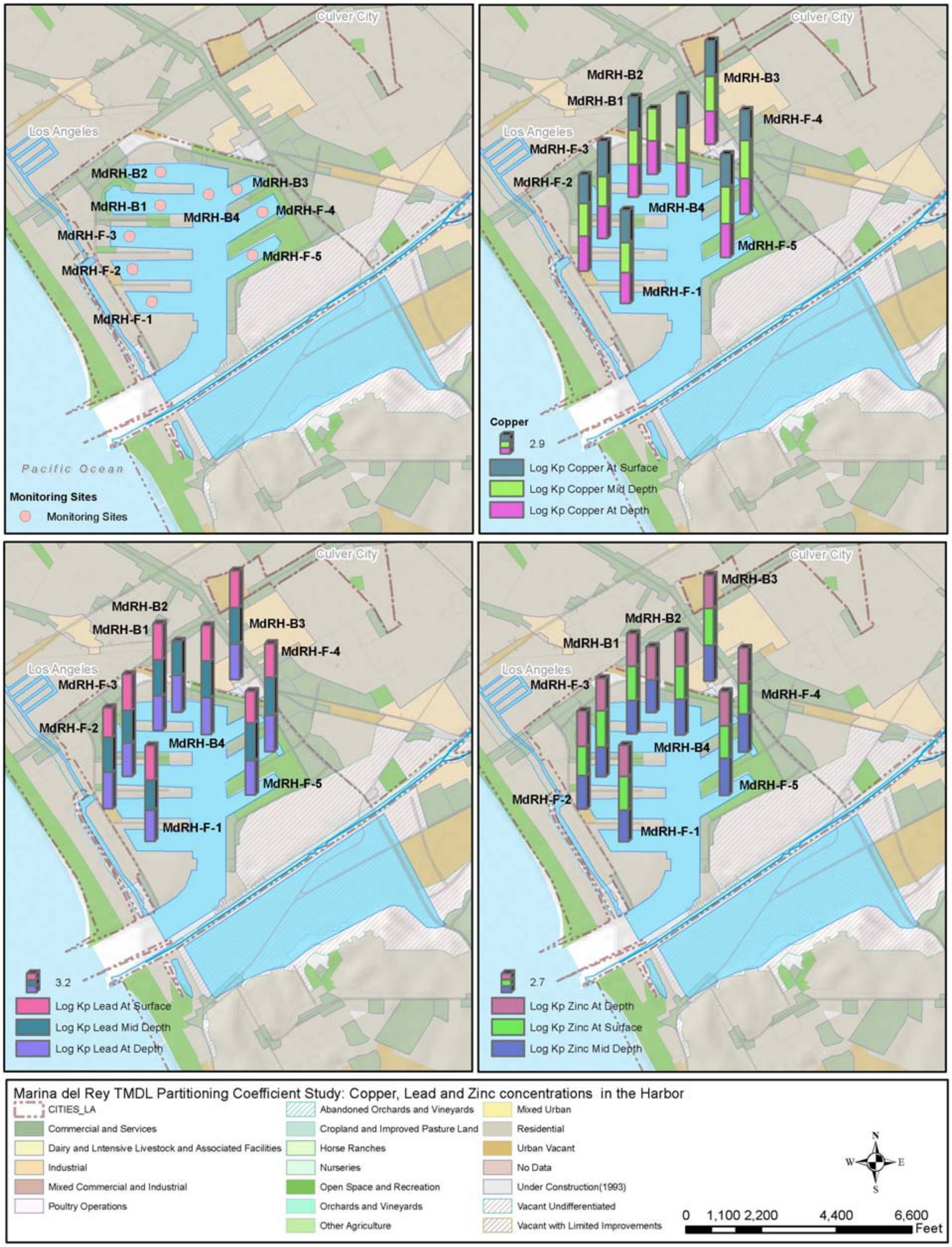


Figure 19. Copper, Lead and Zinc concentrations in the Harbor, July 2011.

Appendix G: Lead and Zinc Results

Lead and Zinc Results for the Sediment Analyses:

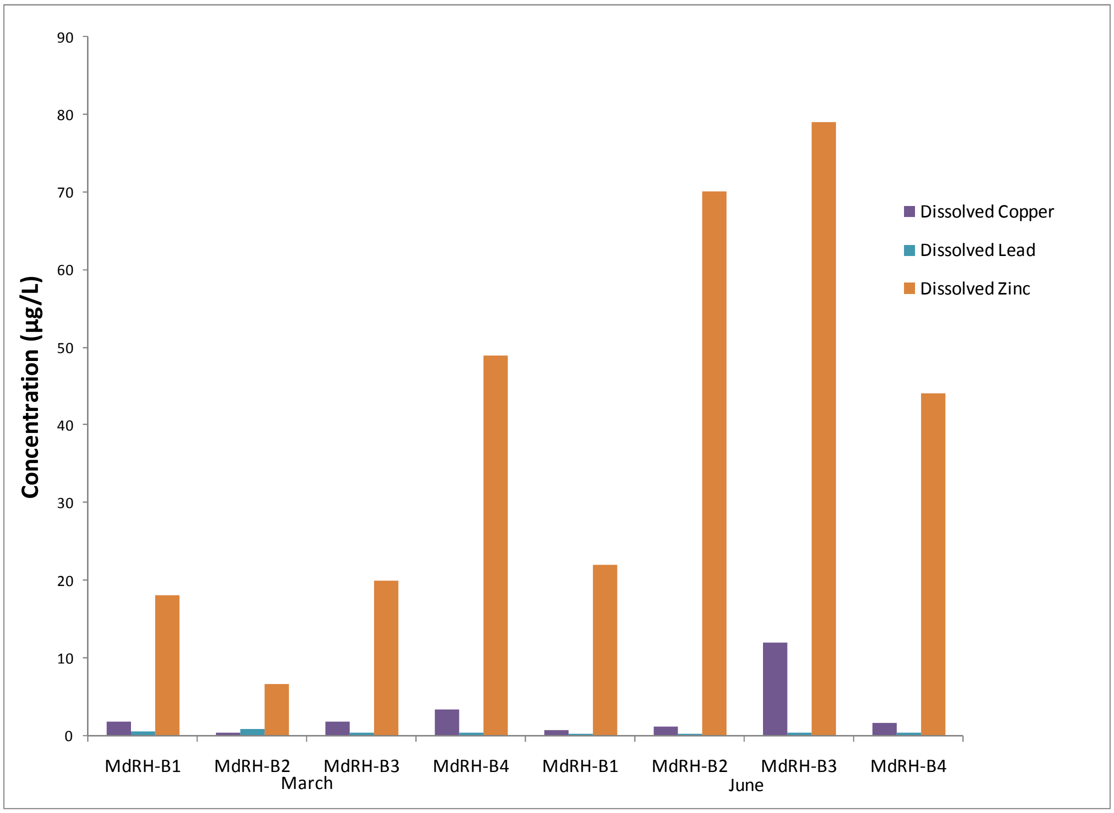


Figure G.1. Dissolved Metals for Sediment Samples

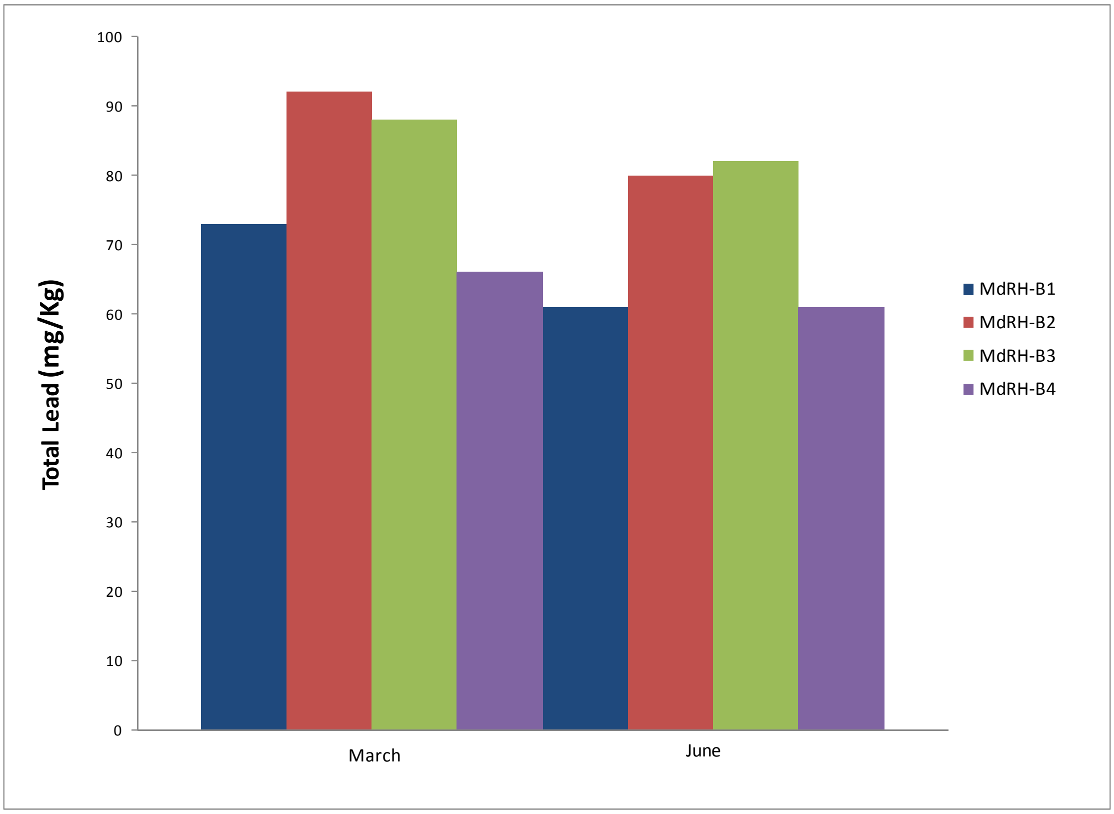


Figure G.2. Total Lead Concentrations in the Sediment

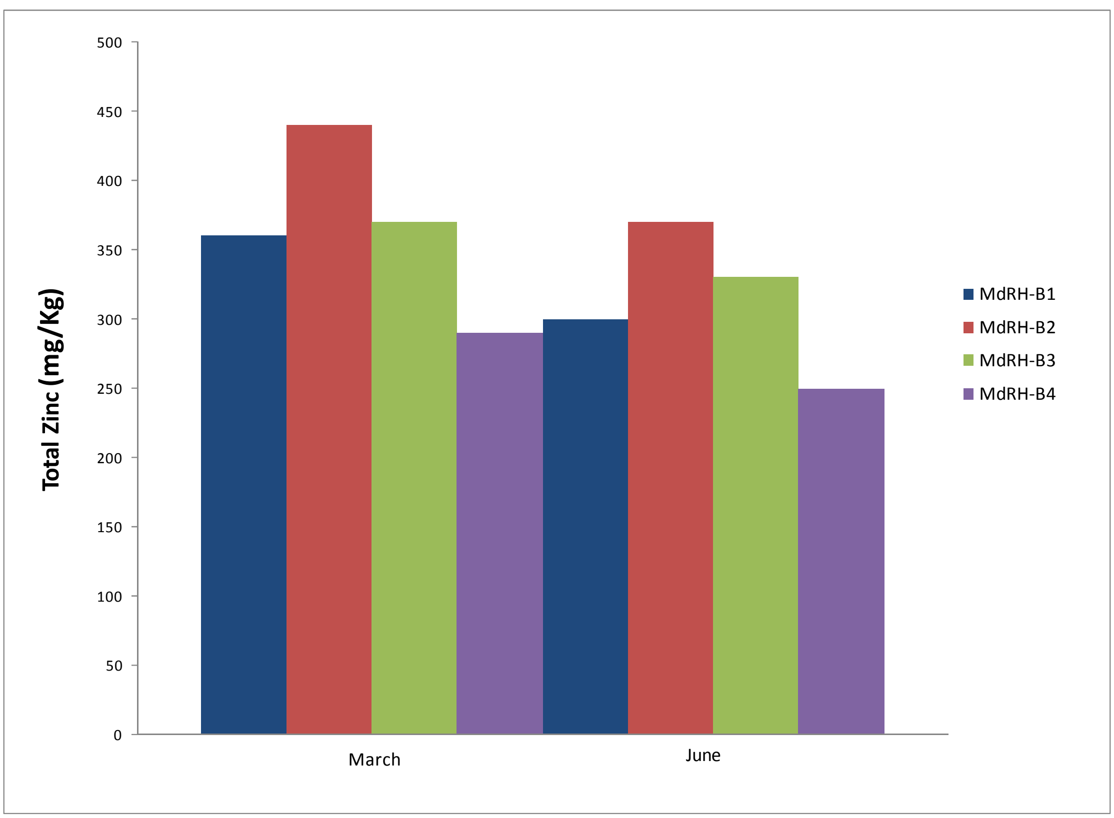


Figure G.3. Total Zinc Concentrations in the Sediment

Lead and Zinc Results for the Stormwater Analyses

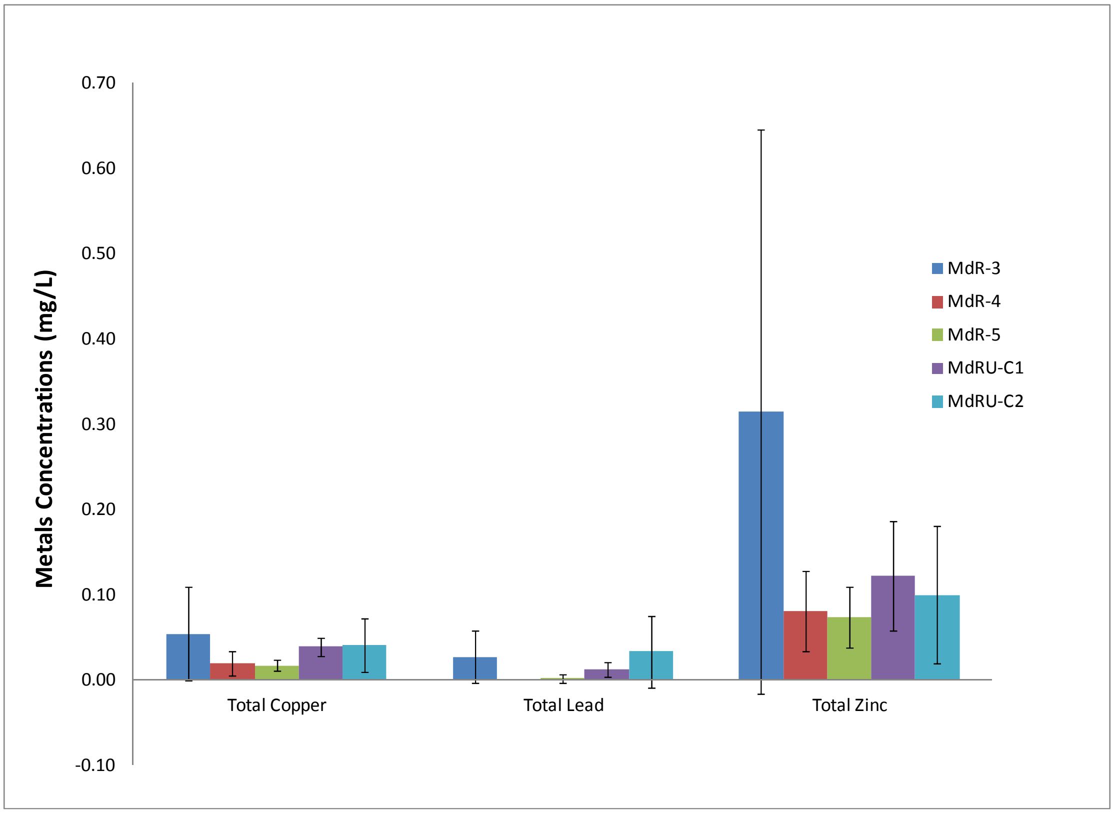


Figure G.4. Total Metal Concentrations for the Stormwater Samples

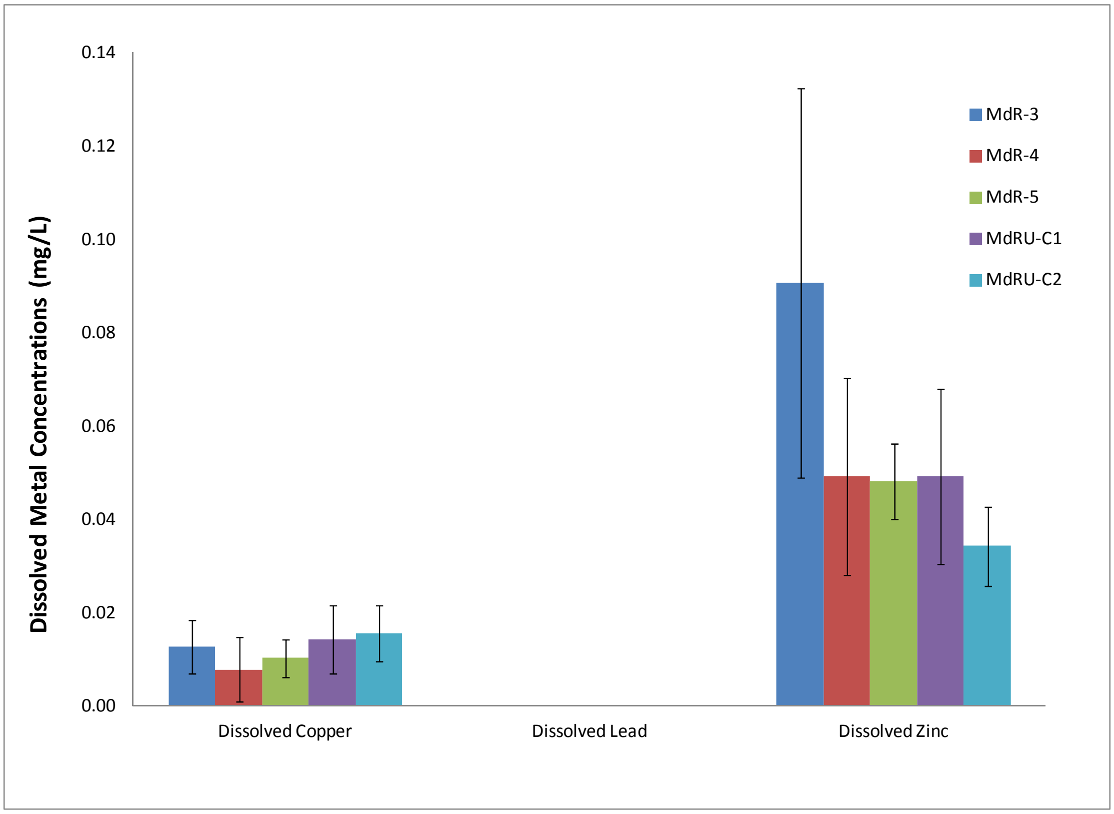


Figure G.5. Dissolved Metal Concentrations for the Stormwater Samples.
Note that Dissolved Lead is Zero (0).

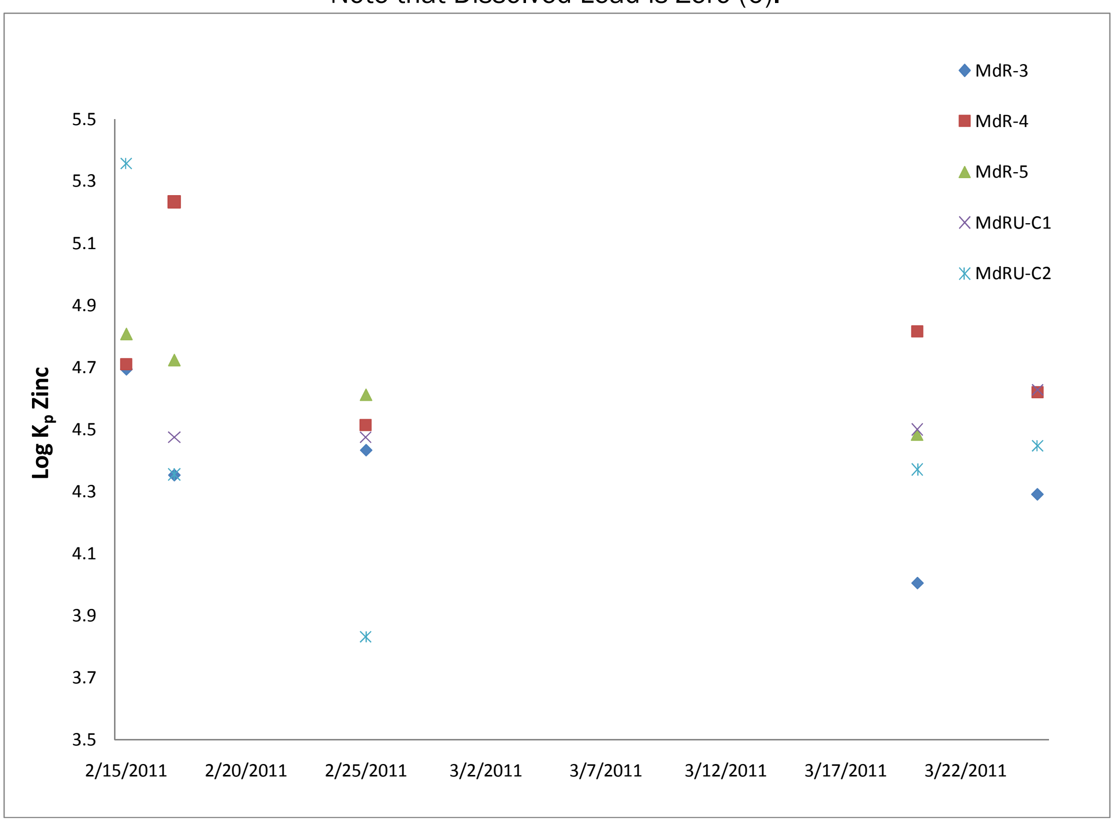


Figure G.6. Log K_p for Zinc in Stormwater

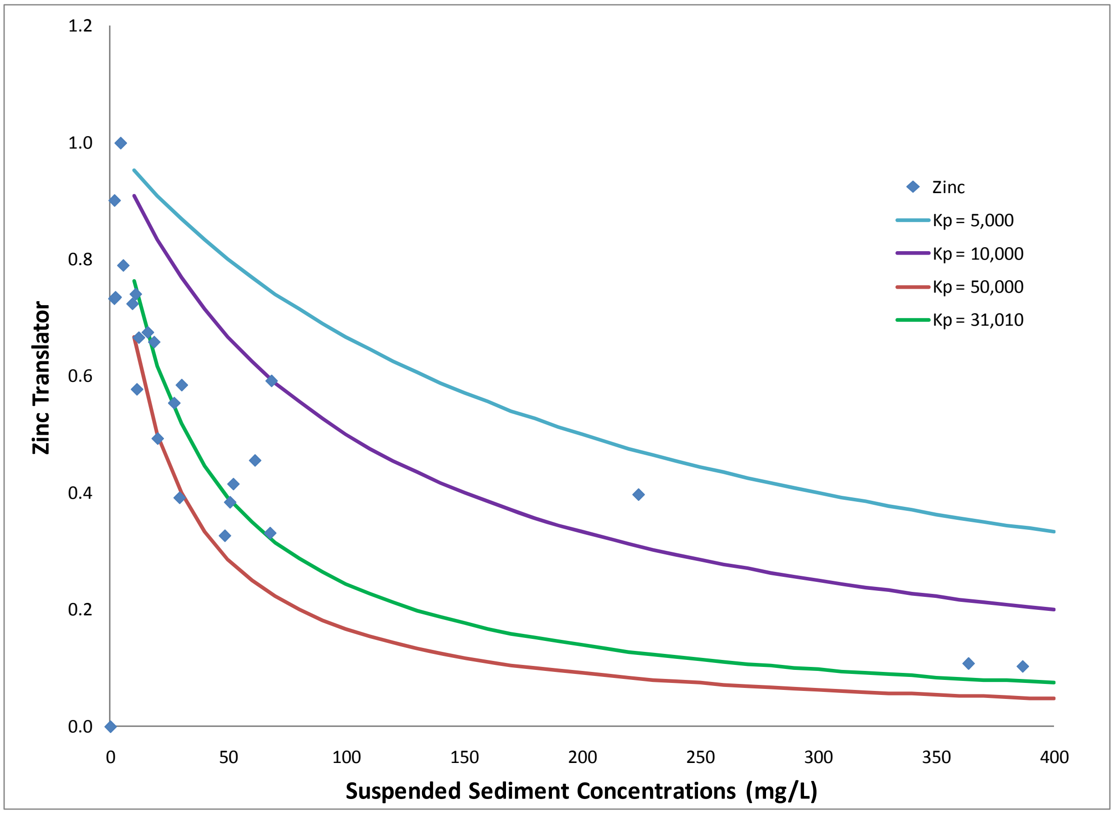


Figure G.7. Translator for Zinc in Stormwater

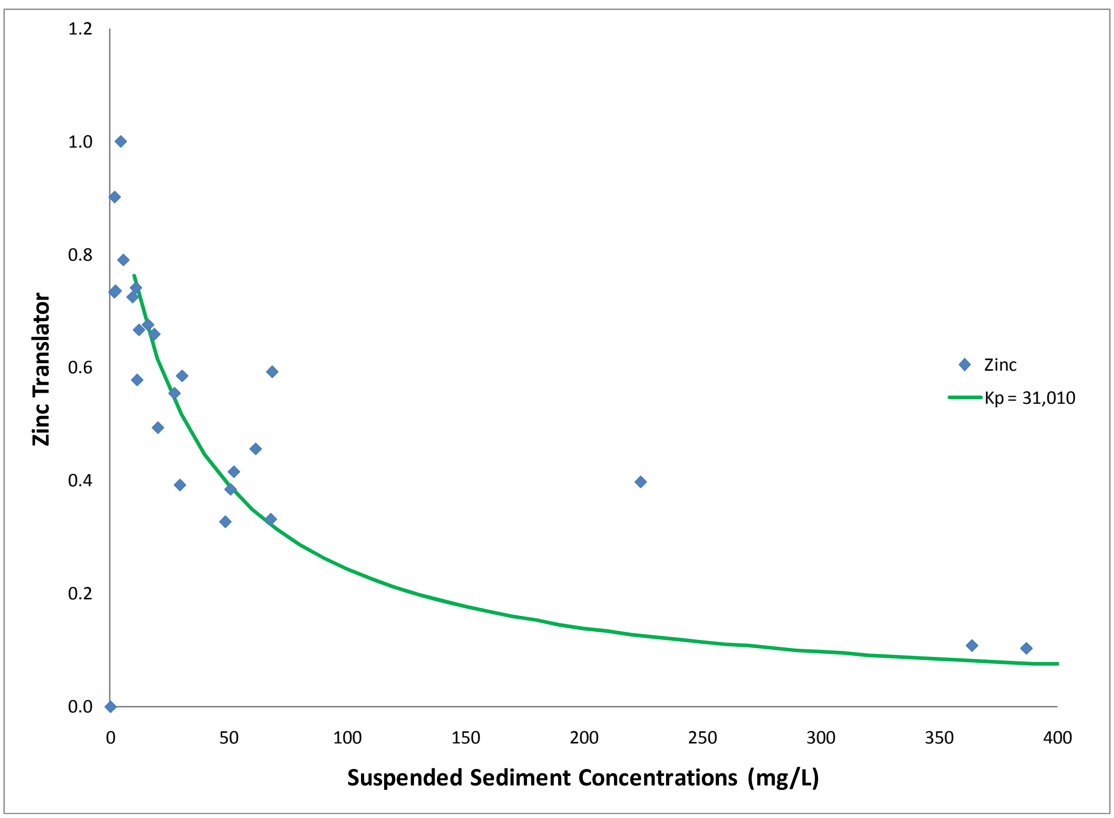


Figure G.8. Translator Best Fit for Zinc in Stormwater

Lead and Zinc Results for the Harbor Water Quality Analyses

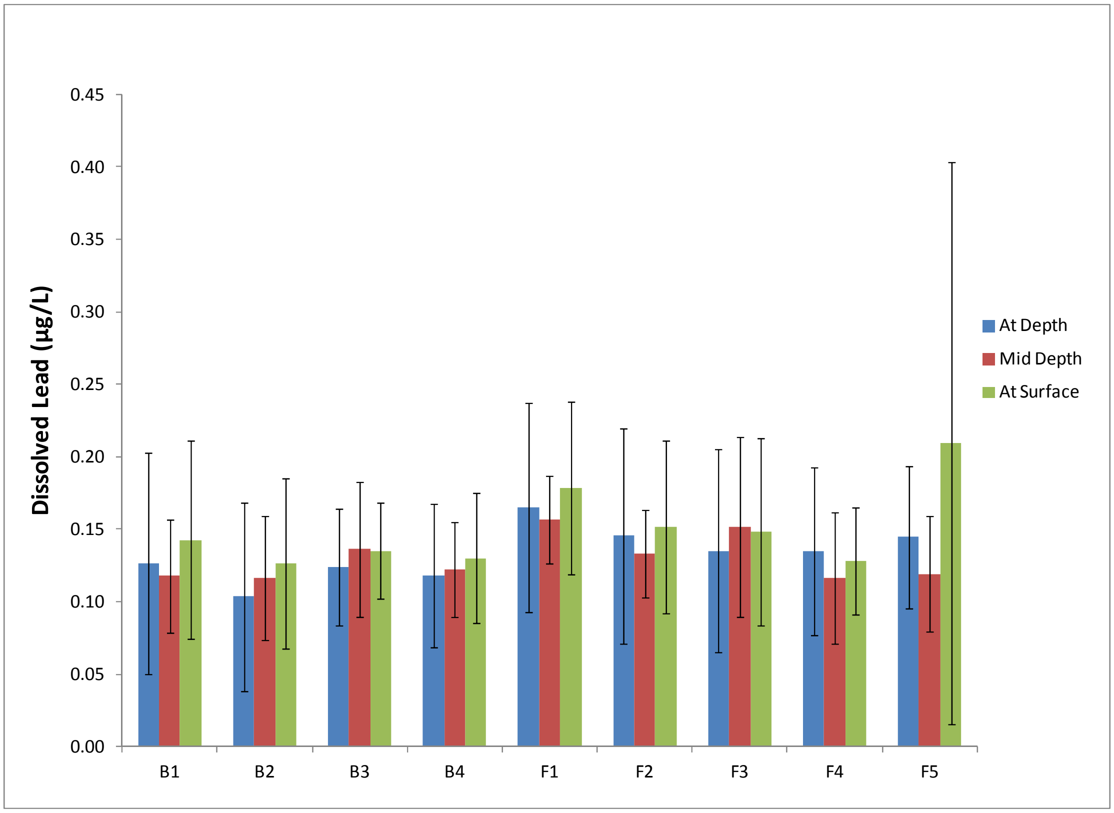


Figure G.9. Dissolved Lead Concentrations for the Harbor Water Quality Samples.

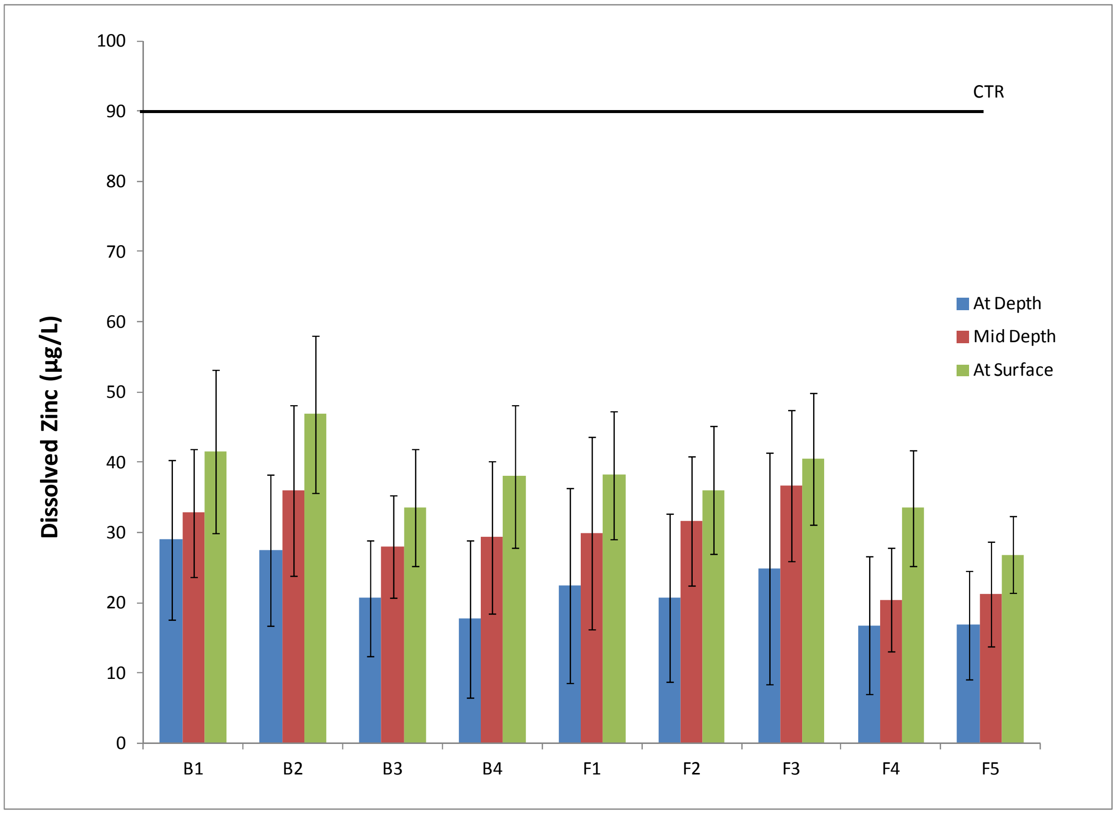


Figure G.10. Dissolved Zinc Concentrations for the Harbor Water Quality Samples.

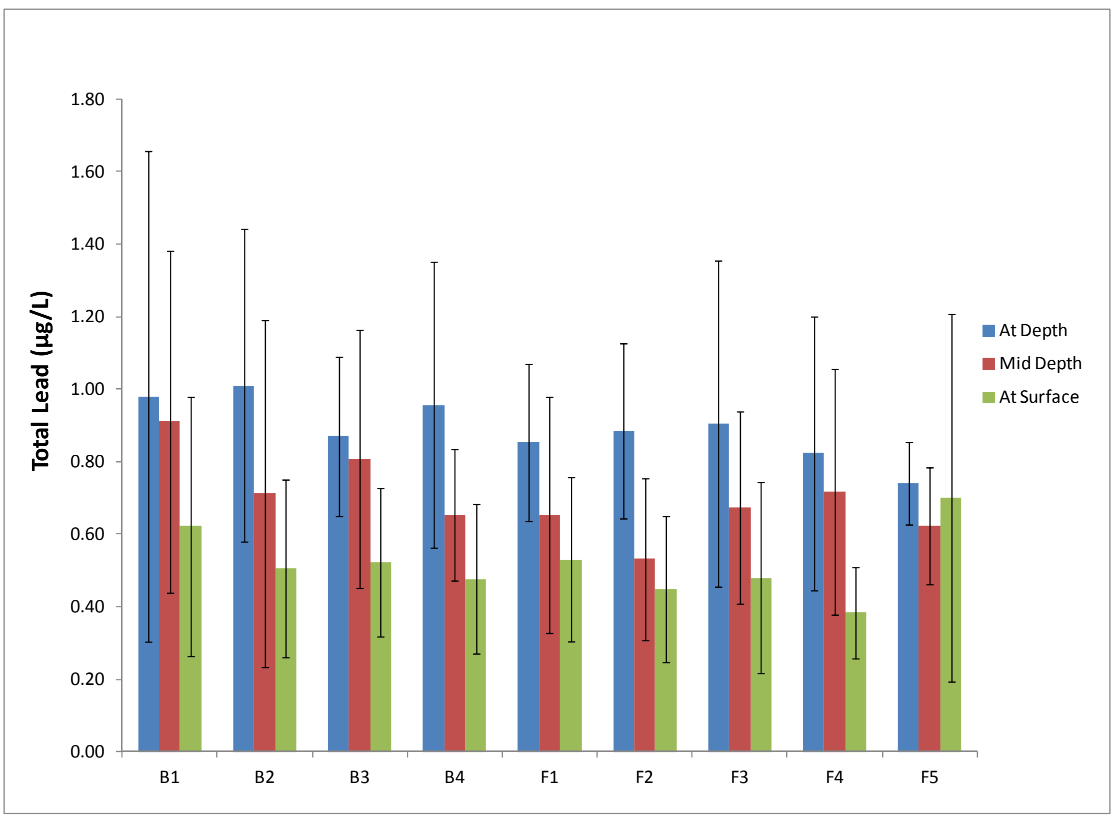


Figure G.11. Total Lead Concentrations for the Harbor Water Quality Samples.

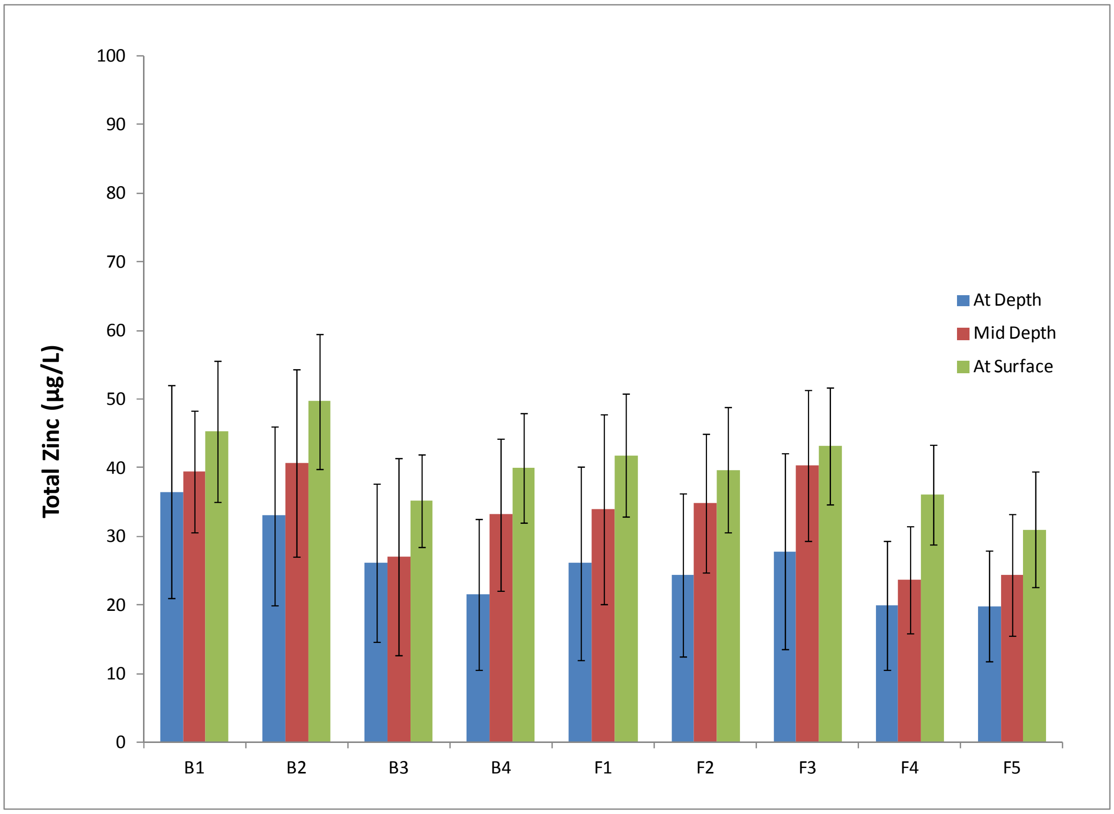


Figure G.12. Total Zinc Concentrations for the Harbor Water Quality Samples.

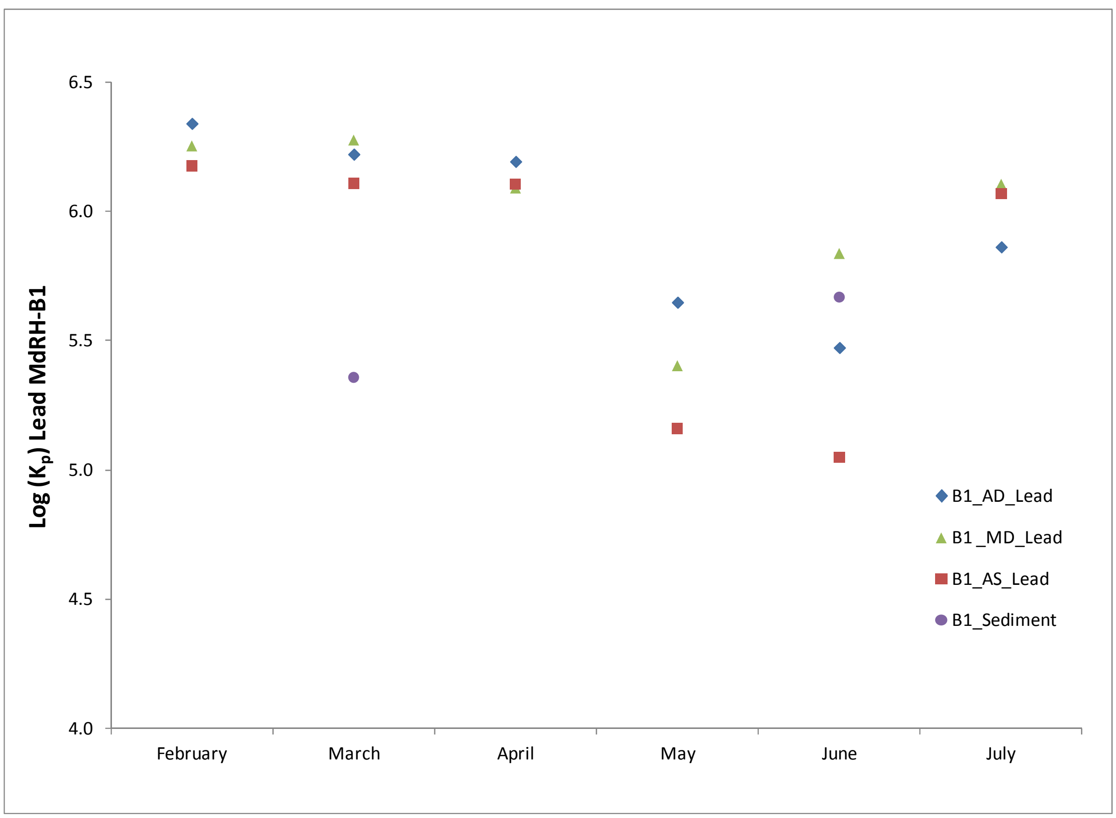


Figure G.13. Log K_p for Lead for MdRH-B1.

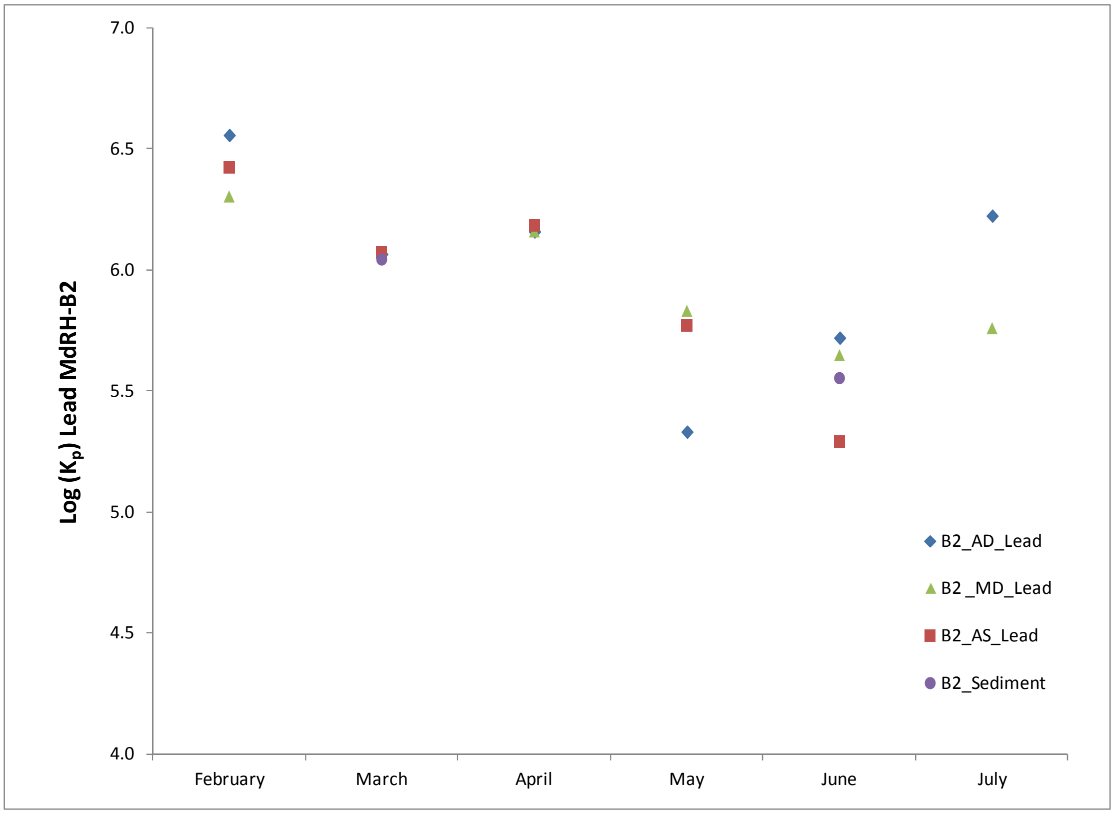


Figure G.14. Log K_p for Lead for MdRH-B2.

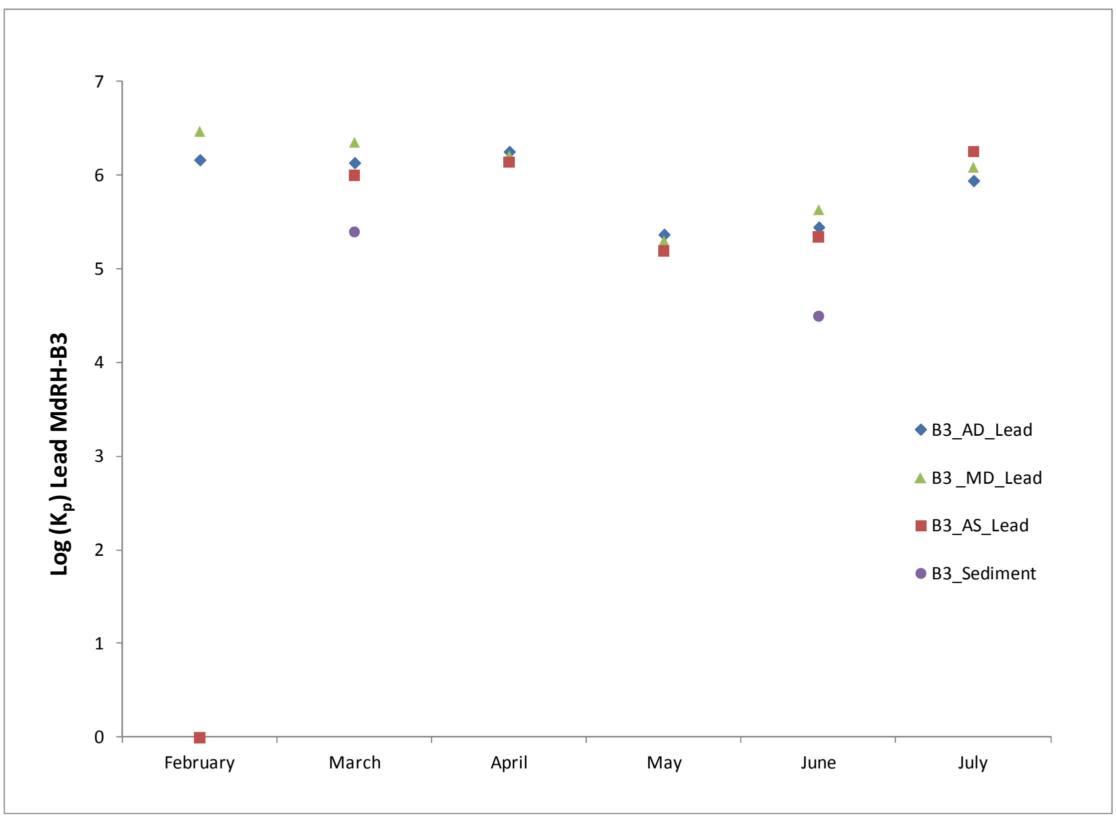


Figure G.15. Log K_p for Lead for MdRH-B3.

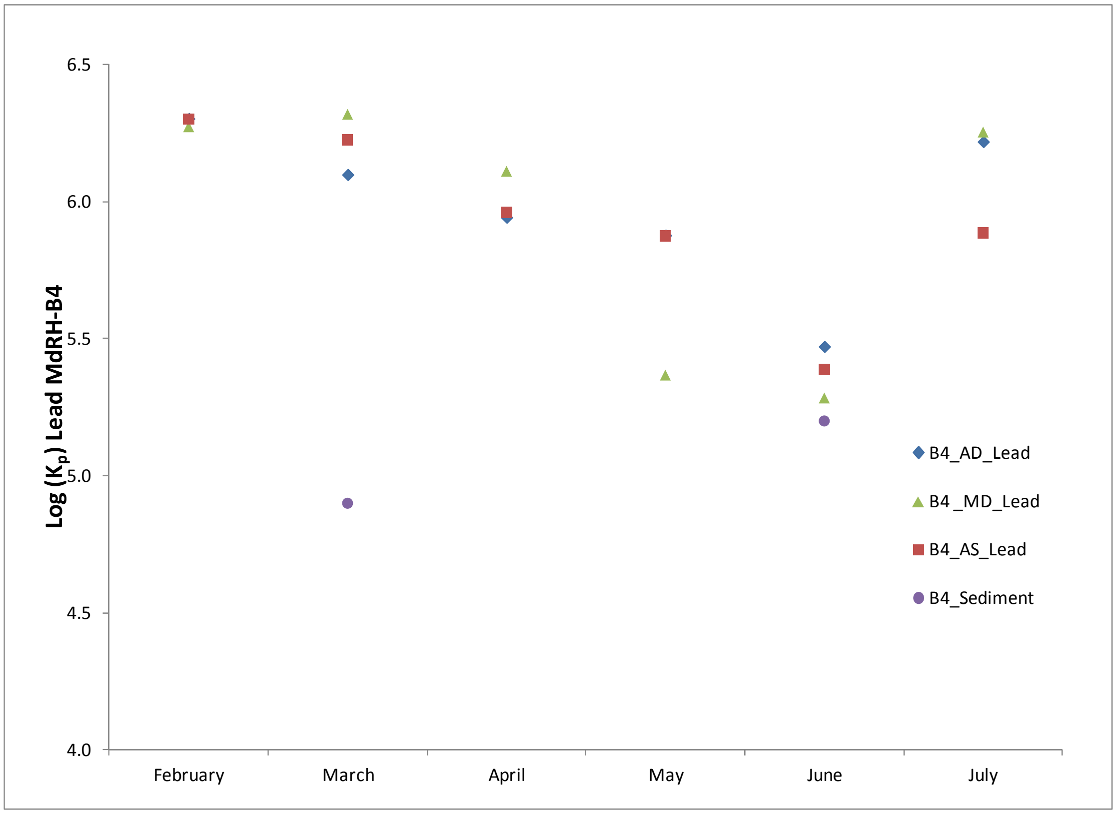


Figure G.16. Log K_p for Lead for MdRH-B4.

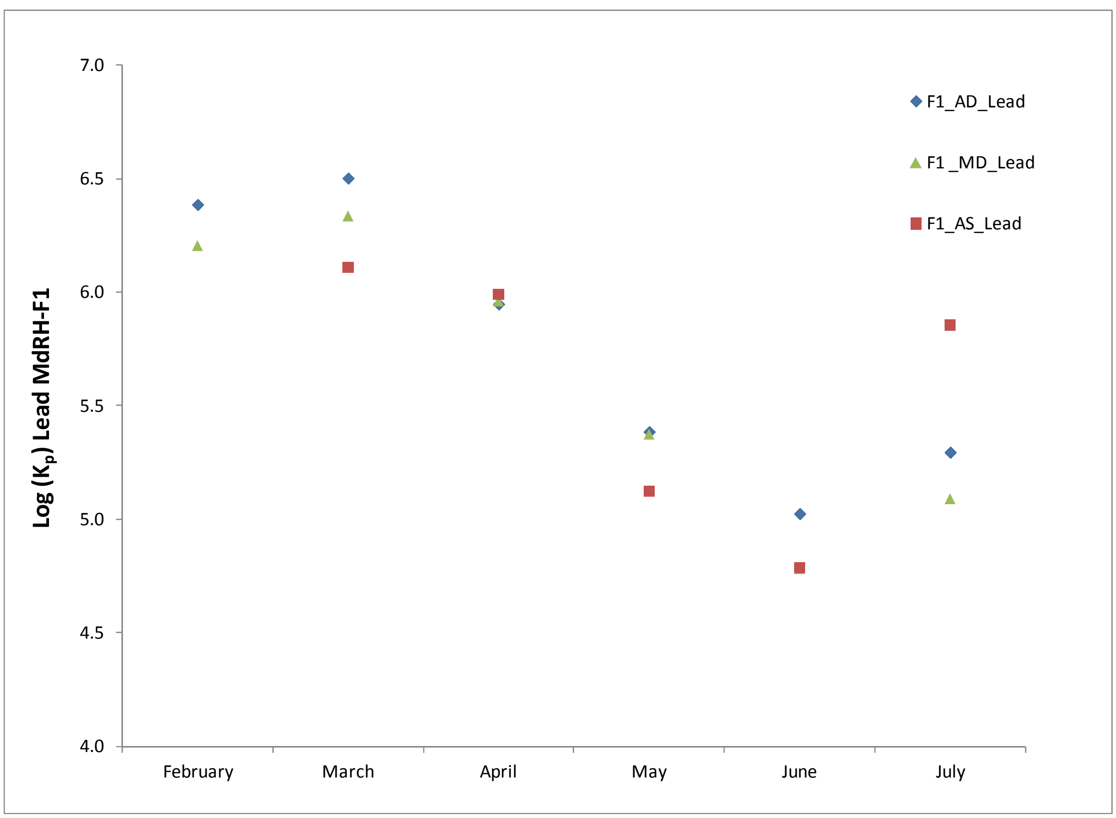


Figure G.17. Log K_p for Lead for MdRH-F1.

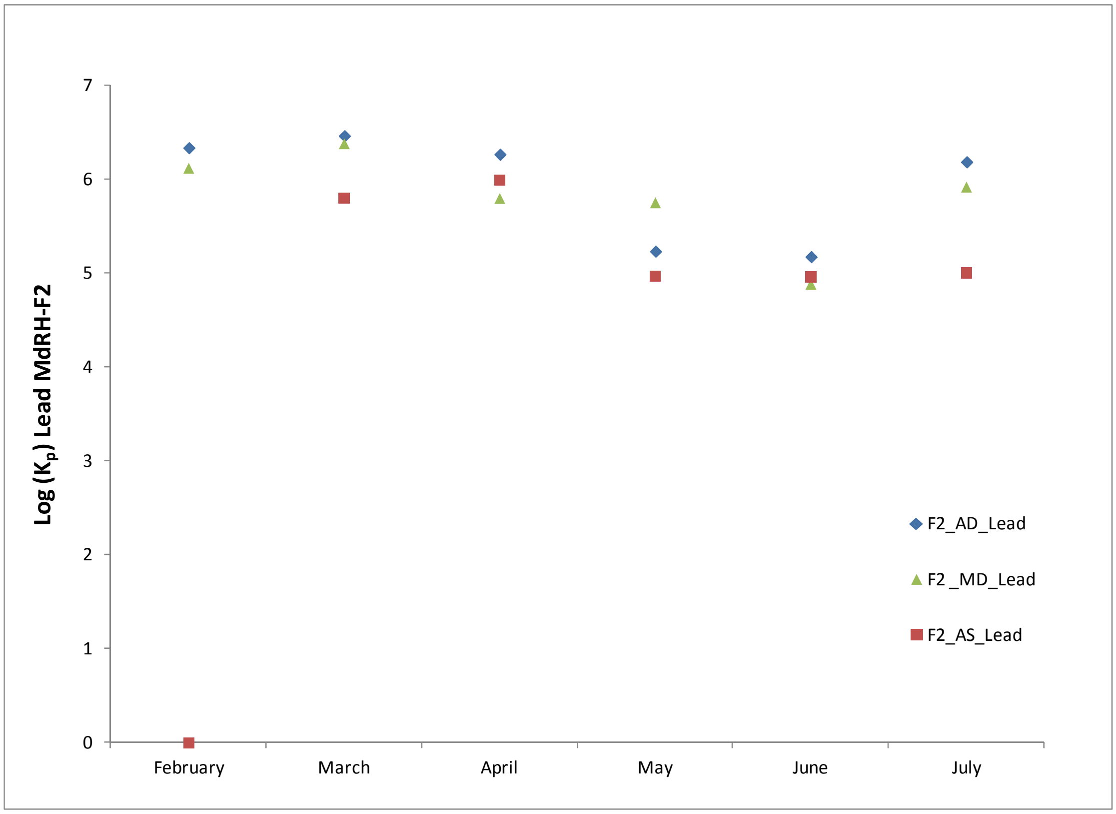


Figure G.18. Log K_p for Lead for MdRH-F2.

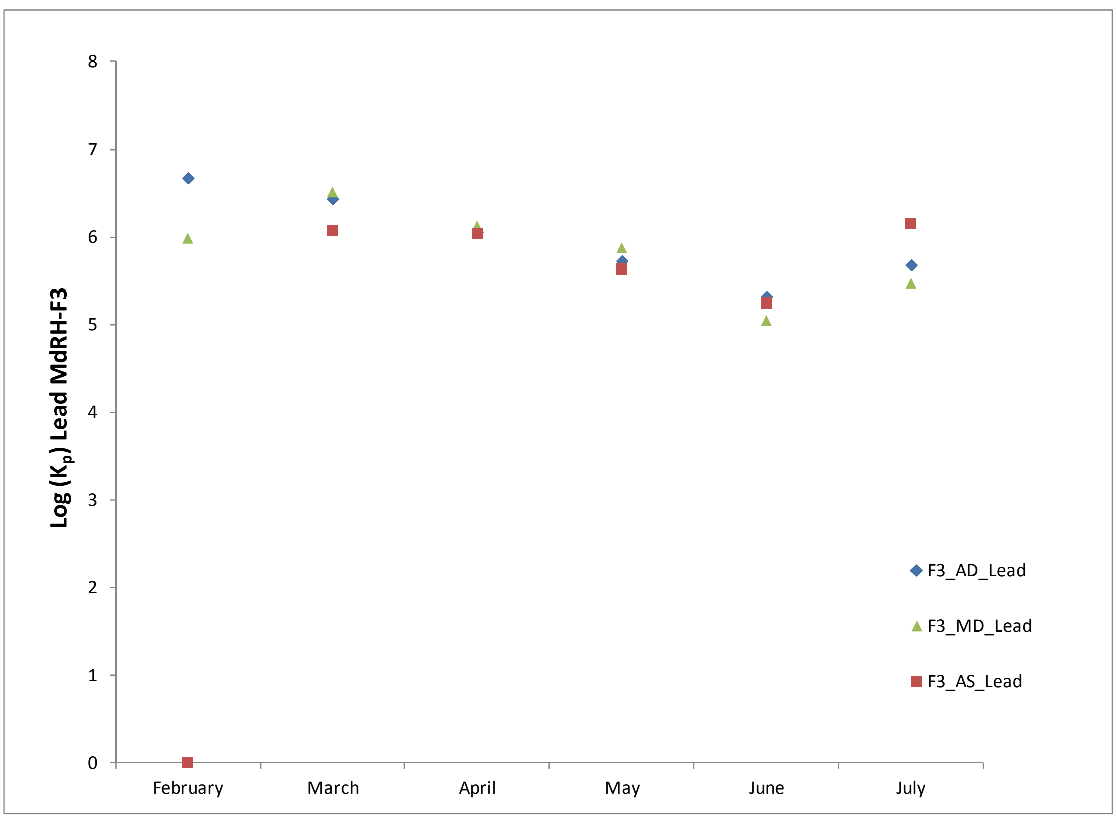


Figure G.19. Log K_p for Lead for MdRH-F3.

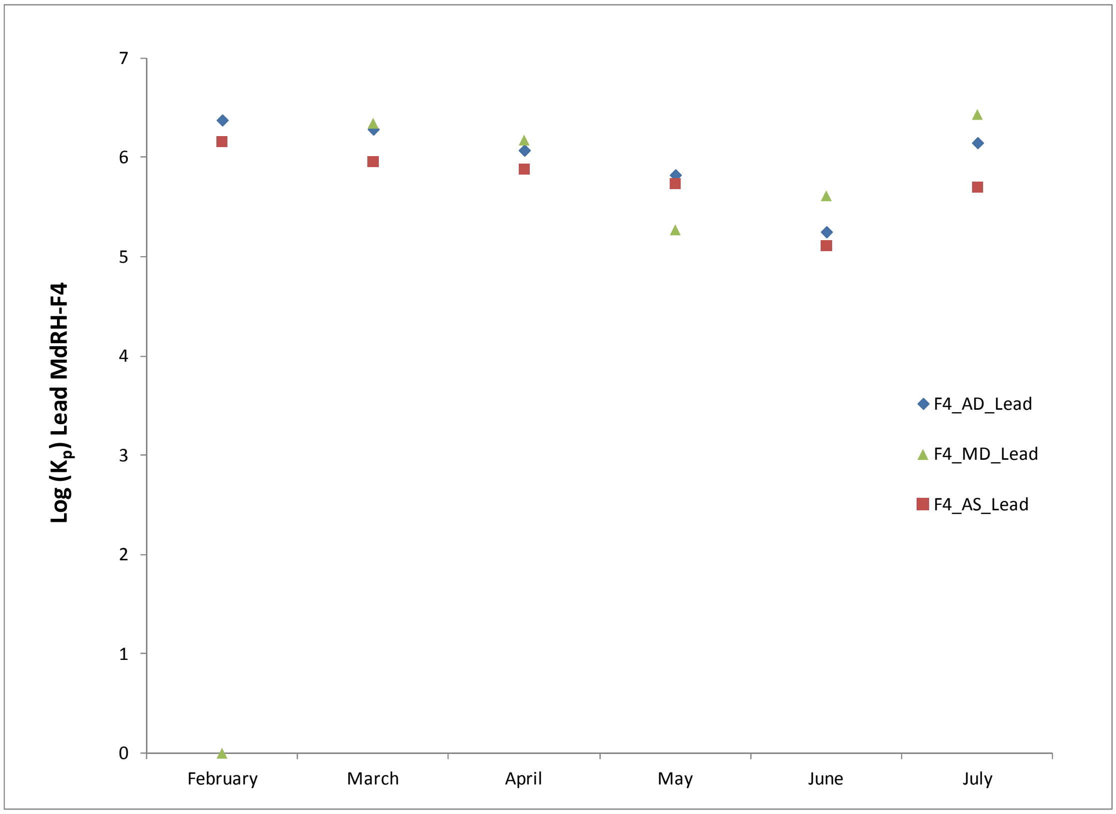


Figure G.20. Log K_p for Lead for MdRH-F4.

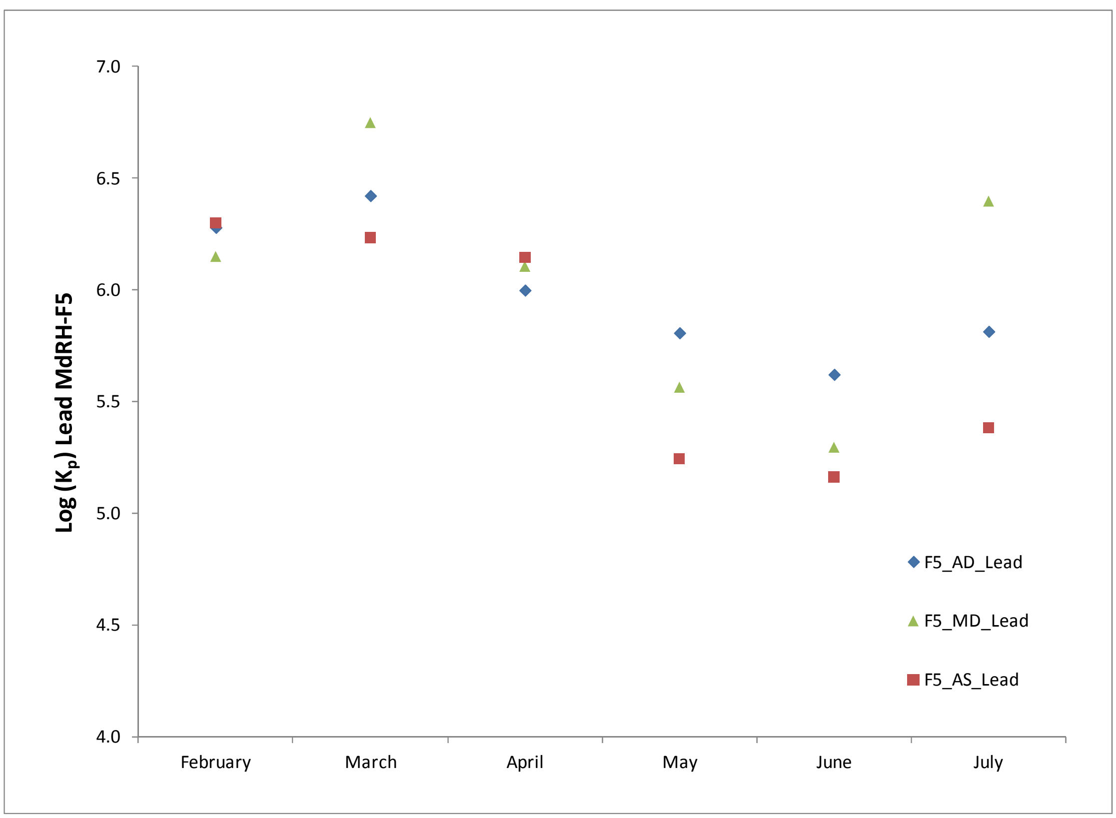


Figure G.21. Log K_p for Lead for MdRH-F5.

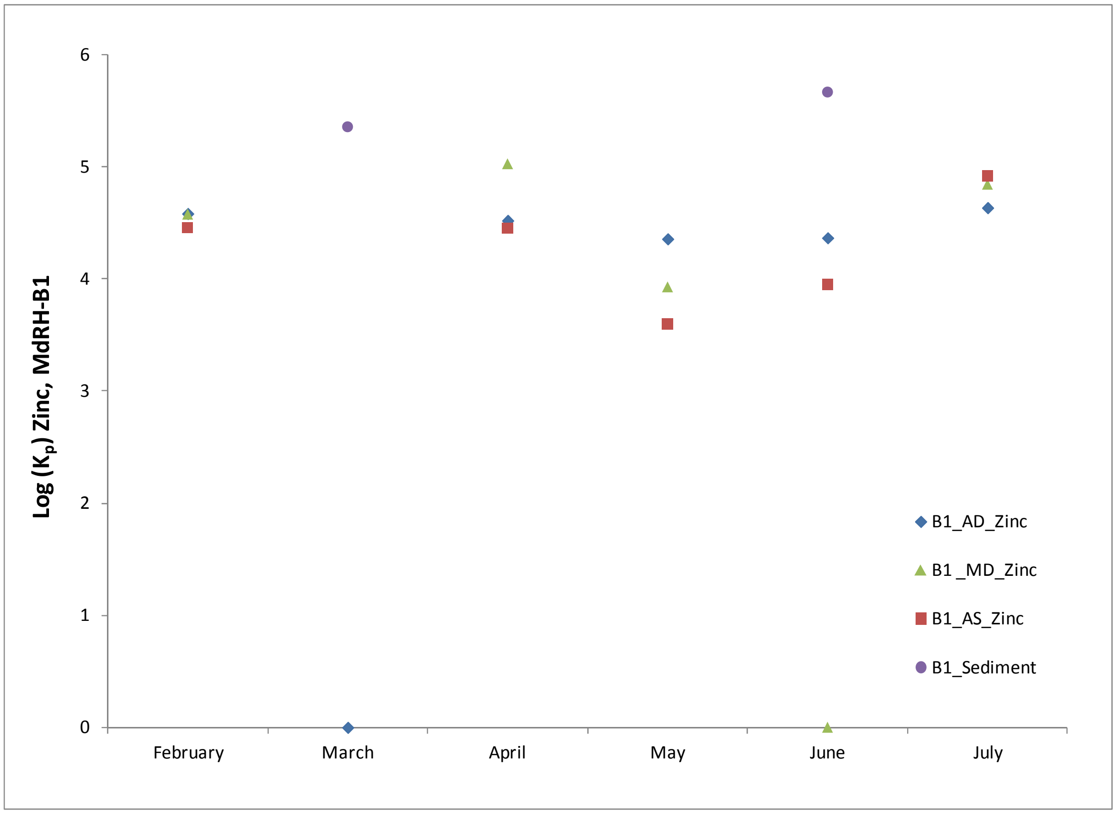


Figure G.22. Log K_p for Zinc for MdRH-B1.

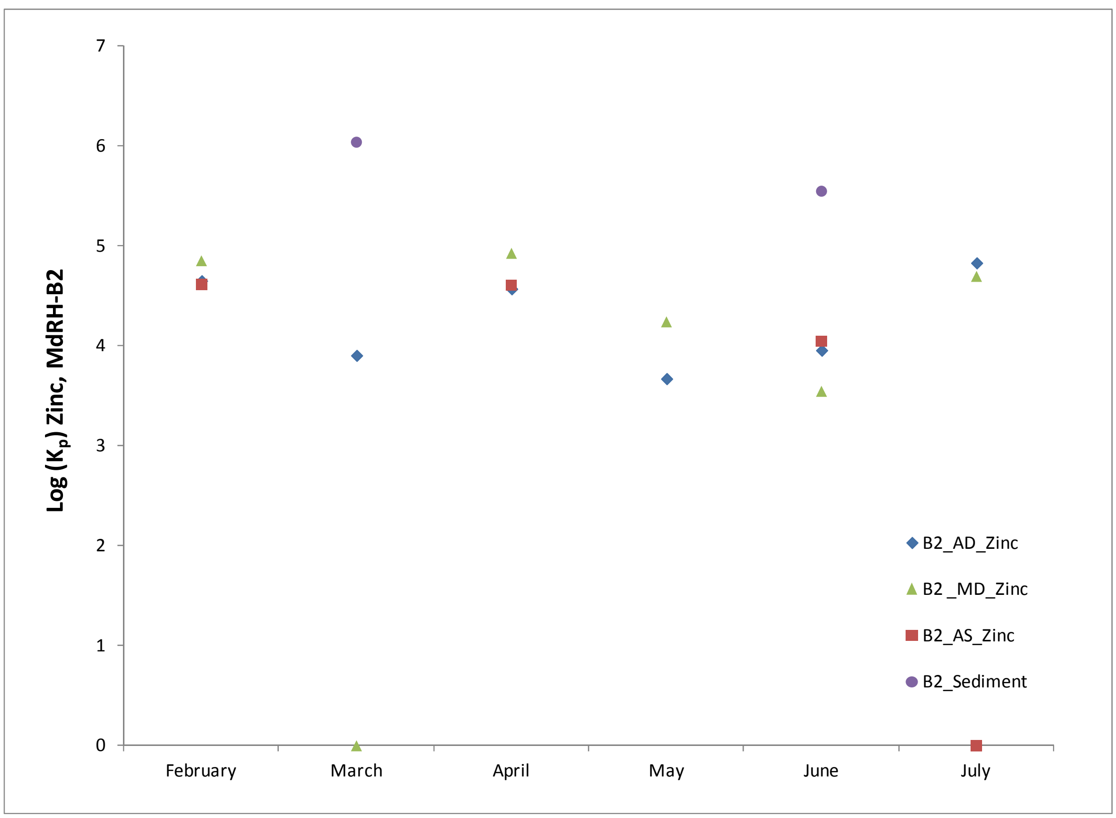


Figure G.23. Log K_p for Zinc for MdRH-B2.

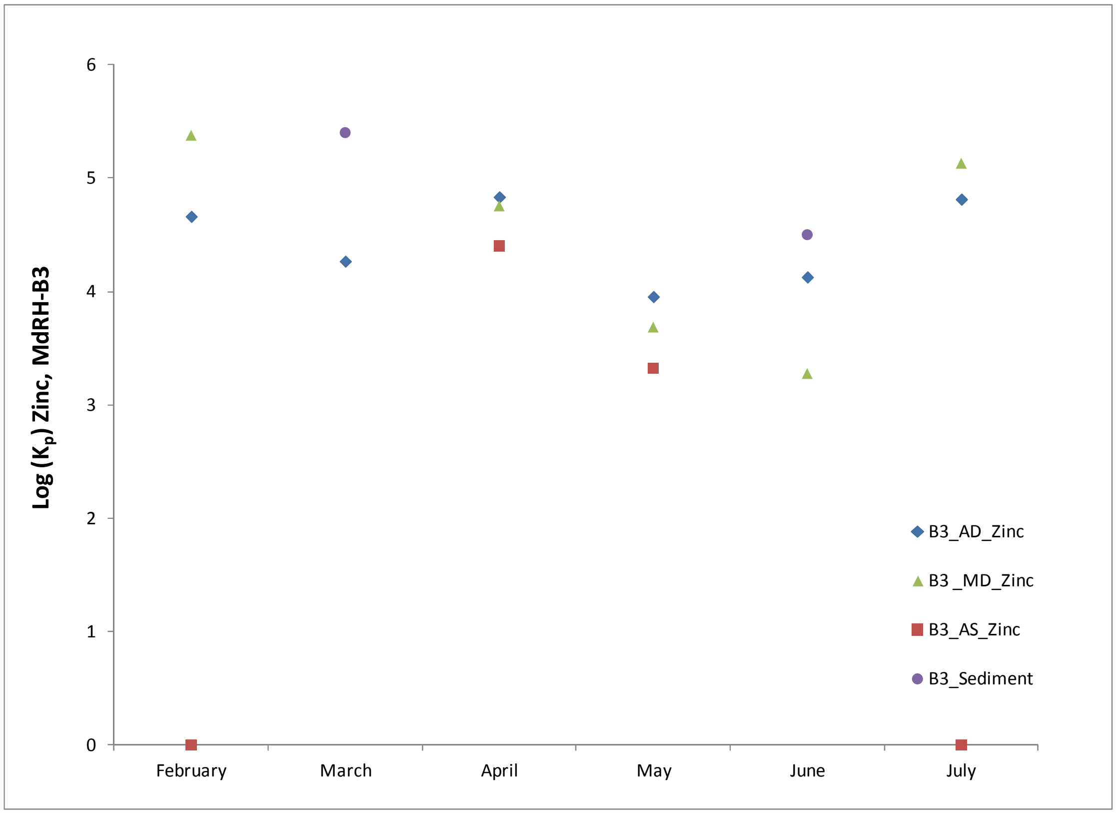


Figure G.24. Log K_p for Zinc for MdRH-B3.

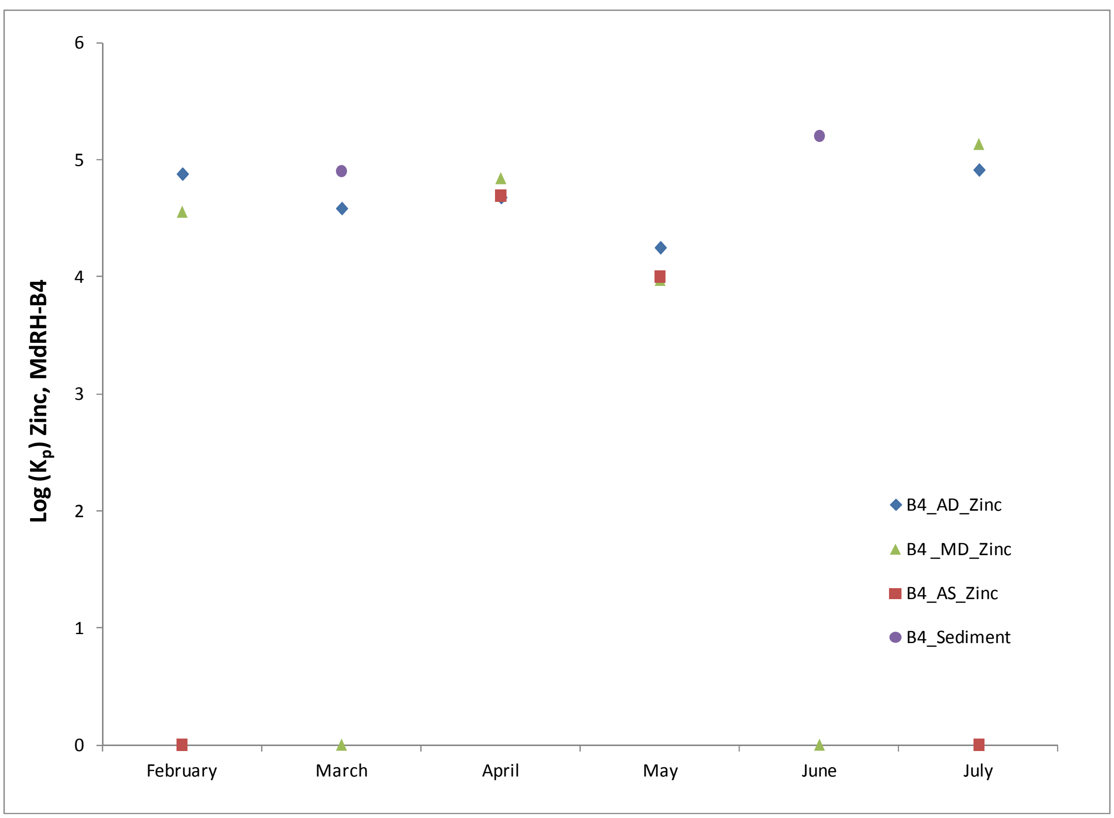


Figure G.25. Log K_p for Zinc for MdRH-B4.

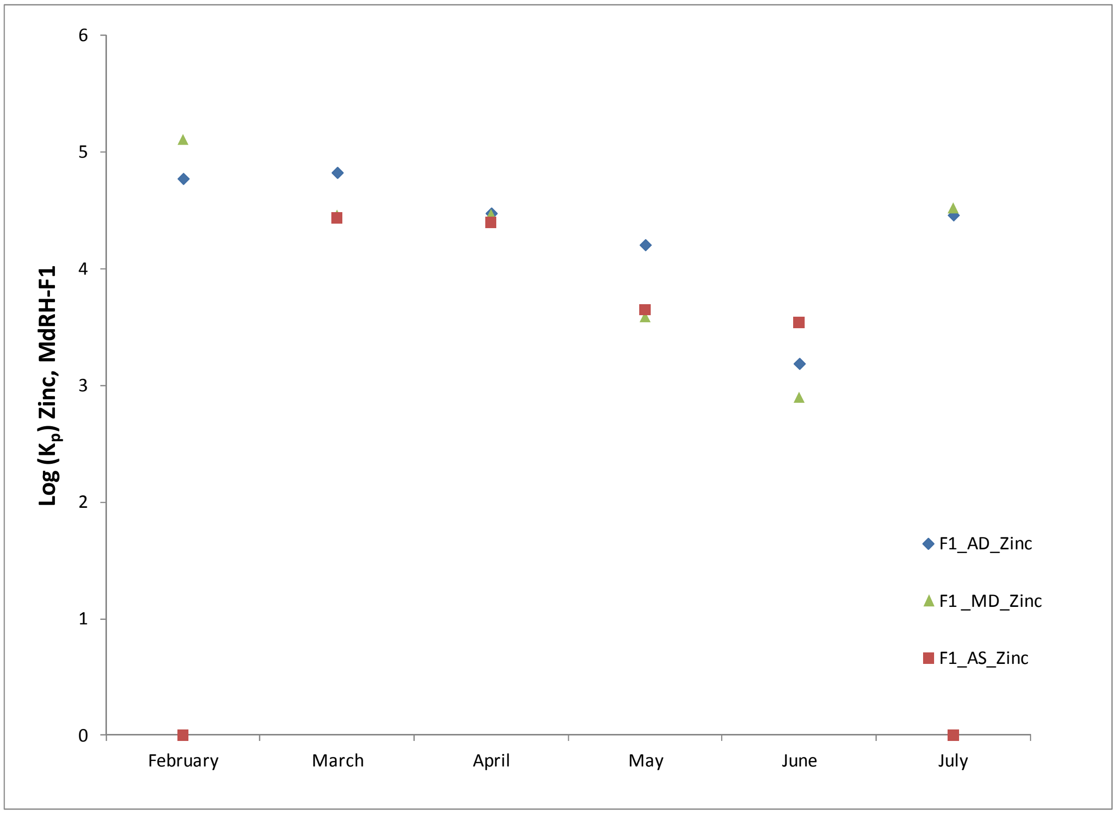


Figure G.26. Log K_p for Zinc for MdRH-F1.

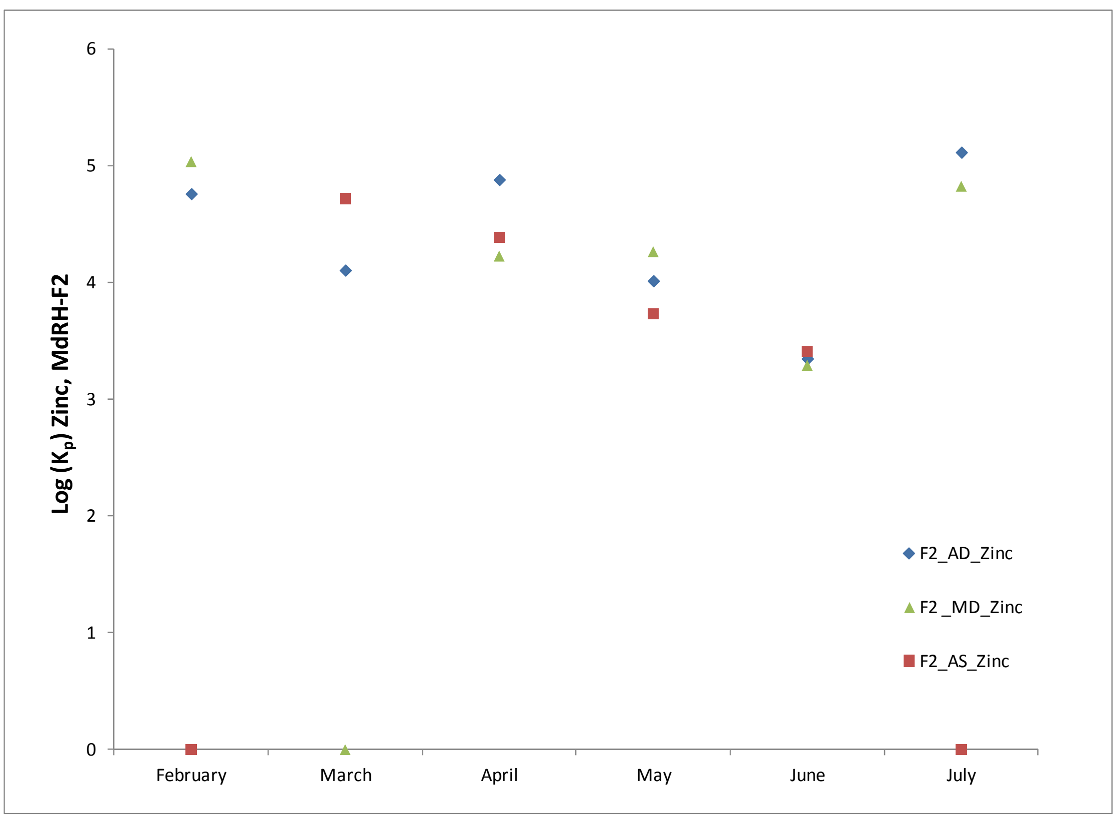


Figure G.27. Log K_p for Zinc for MdRH-F2.

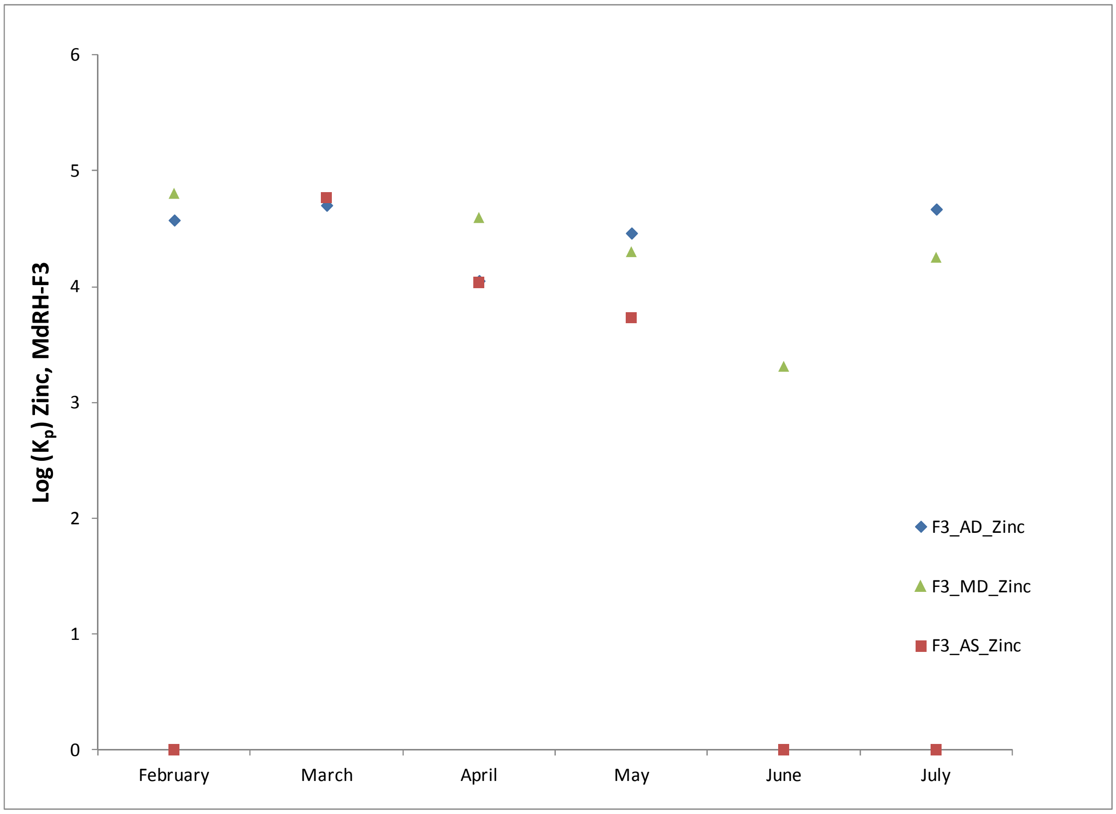


Figure G.28. Log K_p for Zinc for MdRH-F3.

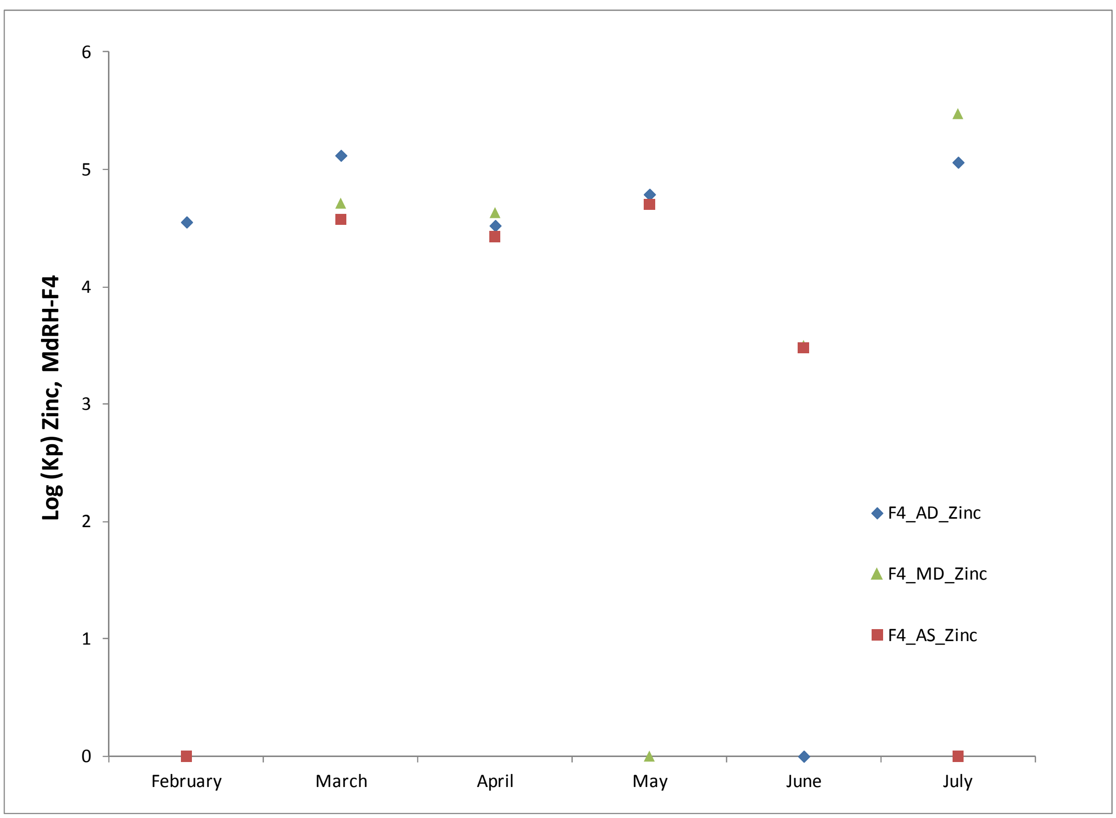


Figure G.29. Log K_p for Zinc for MdRH-F4.

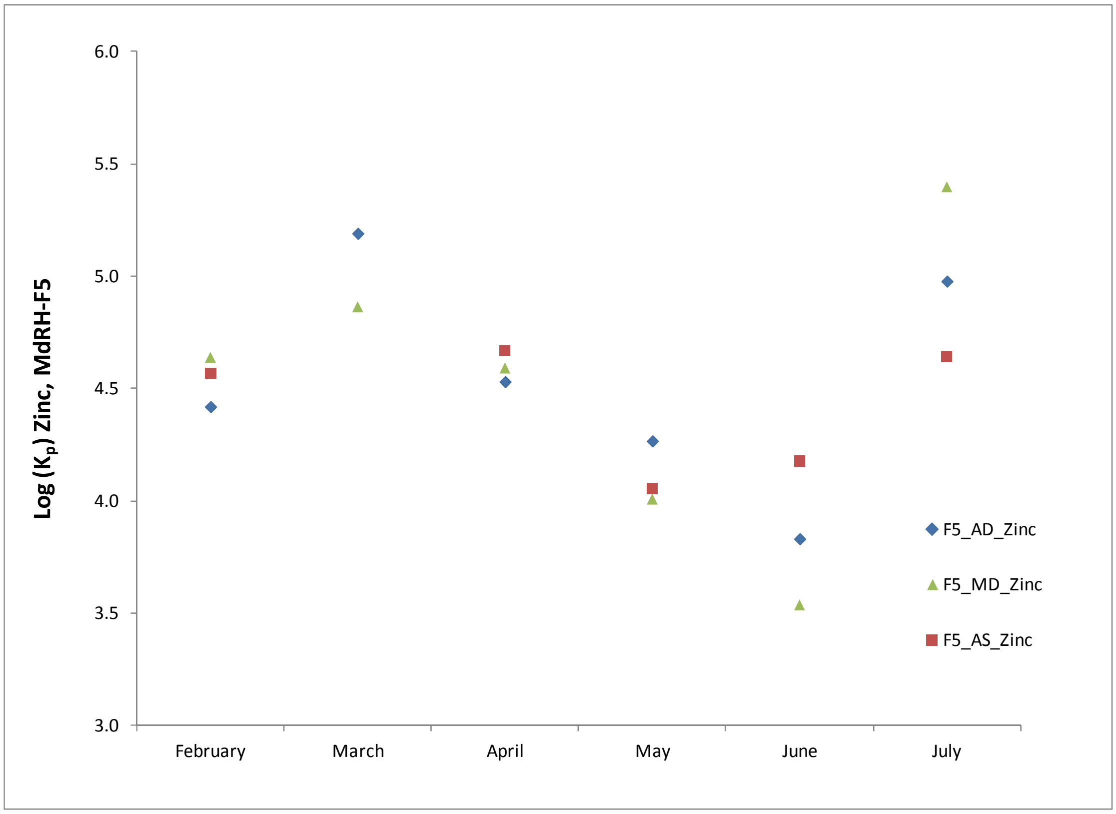


Figure G.30. Log K_p for Zinc for MdRH-F5.