

USING BIOSWALES TO IMPROVE THE QUALITY OF ROADWAY RUNOFF FROM I-294 IN NORTHERN COOK COUNTY, ILLINOIS

James J. Miner, Kathleen E. Bryant, Keith W. Carr, Jessica R. Ackerman, Eric T. Plankell, and Colleen M. Long

Open-File Series 2016-2a 2016



ILLINOIS STATE GEOLOGICAL SURVEY
Prairie Research Institute
University of Illinois at Urbana-Champaign

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EXECUTIVE SUMMARY

Over a 7-year period, the ISGS monitored roadway runoff before and after bioswale installation along I-294 between Touhy Ave. and Lake-Cook Rd in Cook County, Illinois. Runoff quantity and quality were measured to identify discharge volumes, constituents in runoff and their concentrations, mass of dissolved and suspended solids transported in runoff, and any improvements in the quality or quantity of runoff exiting the bioswales relative to input waters. Two different bioswale types (wet and dry) were monitored to determine the extent that design and other factors such as site hydrogeology influence bioswale performance.

Compared to runoff input quality measured at one site (TB7B), combined performance for all bioswales shows a 63% decrease in total suspended solids (TSS), a 42% decrease in total dissolved solids (TDS), a 44% decrease in chloride, and decreases in roadway metals of interest (chromium, copper, lead, nickel, and zinc) ranging from 36% to 81% with a mean of 71%. The constituents that showed percent increases at most bioswale outputs relative to the input location generally are those that relate to interactions with bioswale and ditch substrates, including aluminum, potassium, molybdenum, silica, thallium, alkalinity, nitrate, orthophosphate, and dissolved non-volatile organic carbon (dNVOC). Dry bioswales showed a slightly larger percent reduction in TSS (70%) than wet bioswales (59%) by infiltrating and filtering runoff through earth materials. Wet bioswales showed greater reductions than dry bioswales in almost all other major categories, including TDS (50% wet vs. 30% dry), chloride (52% vs. 33%), roadway metals of interest (81% vs. 59%), and nitrate (25% reduction versus 132% increase), due to extended storage and contact time and infiltration of runoff documented in at least one wet bioswale. Reduced performance at dry bioswales was related to unmonitored constituents discharging into the dry bioswale underdrain from groundwater, delayed vegetation establishment, decreased residence time for interactions with soils and biota, and oxidizing conditions that inhibit denitrification.

Wet bioswales contained temporarily to semi-permanently ponded segments, which slowed runoff, deposited sediment, and maintained reducing conditions that facilitated denitrification. Ponded segments caused long-term contact of runoff with soil, bacteria, and vegetation, all of which tended to transform, adsorb, and/or take up metals, nutrients, and other constituents. Wet bioswales were more effective at reducing dissolved solids and most roadway metals of interest, likely due to interaction with biota and infiltration.

Improvements in performance occurred at most sites during monitoring, and eventual TSS performance became similar at most sites by the end of the study. Chromium, copper, and zinc all had increased reductions through time at most bioswales. There were no obvious trends regarding which type of bioswale performed well; lowest performance at both the beginning and the end of the study included both wet and dry bioswales, depending on the specific metal.

Comparisons of pre-construction and post-construction conditions were limited, but showed increased loads at the bioswale input that was monitored (TB7B), including increases in TDS (33%) and chloride (31%). Increases in TDS outputs occurred at almost all sites due to increased loads such as road salt and new inputs of high-TDS groundwater. Decreases in TSS outputs occurred at all outputs other than TB7B, which was already functioning effectively to reduce sediment prior to being disturbed for bioswale construction; most sites were eroding ditches that exported sediment readily, so installation of bioswales stabilized the site and reduced erosion.

Improvements in water quality can be seen by comparing exceedances in water-quality standards. At inputs, exceedances of certain analytes increased after construction, such as chloride and ammonia. At all outputs, exceedances of water-quality standards for phosphorous increased after construction. Exceedances of roadway metals of interest often declined at both inputs and outputs, but sporadic increases were noted. Overall, data suggest bioswale installation reduced exceedances of most water-quality standards despite the increased pollutant load from increased roadway operations and lane-miles. No clear trends were seen based on bioswale type or setting.

The choice of bioswale type (wet or dry) typically is dependent on the specific runoff improvements wanted, such as reduction of dissolved or suspended solids. If TDS removal or reduction in concentration is most important, a wet bioswale may be preferred, especially in areas where runoff is able to infiltrate. Dry bioswales generally do not reduce TDS as well as wet bioswales, likely due to lack of residence time and treatment by soils and biota, plus high-solute groundwater from the roadway or backslope may discharge into the bioswale underdrain. Dry bioswales reduce TSS more reliably, but wet bioswales can be nearly as effective if site conditions and design allow long retention times and ponded conditions, and if sediment is not generated in the bioswale due to high-velocity runoff inputs. Wet bioswales are preferred for nutrient management because dry bioswales do not denitrify and they exported more ortho-phosphate. Reductions in roadway metals of interest were slightly larger in wet bioswales, but they varied widely depending on site and specific metal.

Factors that reduced bioswale performance in this study included hydrogeologic settings where groundwater discharged into underdrains or bioswales, fine-grained sediments that prevented infiltration, low storage capacity, high loading or runoff input velocity, poorly vegetated bioswales and side slopes, high slopes, presence of input structures to focus runoff, and lack of check dams.

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INTRODUCTION

In 2007, the Illinois State Geological Survey (ISGS) was contracted by the Illinois State Toll Highway Authority (Tollway) to monitor the impacts of bioswales to be installed during reconstruction of I-294 in northern Cook County, Illinois, USA. Bioswales are wide, flat ditches designed to reduce the quantity and improve the quality of runoff by slowing or infiltrating water and fostering contact of runoff with soils and vegetation (Mazer et al. 2001). From February 2008 through August 2010, the ISGS tested methods for monitoring the quantity and quality of runoff from I-294 in the existing roadside ditch system, and performed baseline monitoring in locations planned for bioswale construction. It should be noted that roadway construction was underway prior to the beginning of monitoring, so that any discussion of “pre-construction” refers to the construction of the bioswales, not the roadway. Discharge and water-quality results from the pre-existing roadway ditches were previously reported in Miner et al. (2012a). The bioswales were constructed in 2010, and annual post-construction monitoring results were presented in Miner et al. (2012b, 2013, and 2014). This report and companion reports that address other aspects of the larger study (Bryant et al. 2016, Carr et al. 2016, Ackerman et al. 2016, and Plankell et al. 2016) supersede all previous reports due to new methodologies developed during post-construction monitoring that resulted in recalculation of some previously reported results.

This report was prepared under contract #ITHA RR-07-9918 and #ITHA 2015-01230 MINER, and is limited to activities regarding bioswale construction and monitoring along the I-294 corridor between Touhy Avenue and Lake-Cook Road, and does not address other activities contained within the above-referenced contracts. Purpose and scope, methods, data, and conclusions are discussed.

PURPOSE AND SCOPE

The purpose and scope of the monitoring are detailed in previous reports (Miner et al. 2012a, Miner et al. 2012b). In summary, the quantity and quality of runoff discharging from each pre-construction ditch and each post-construction bioswale were monitored; impacts of the installation and operation of the bioswales were calculated by comparing outputs to measured input, as well as pre-construction conditions to post-construction conditions. Groundwater and soil-chemistry data were also collected to assess the transport and fate of pollutants and are presented in other reports in this series (e.g., Ackerman et al. 2016, Carr et al. 2016, Plankell et al. 2016). Discharge calculations and data used in this report are presented in Bryant et al. (2016).

The various bioswales installed for this project were grouped into two design types, “dry” and “wet” bioswales. Dry bioswales were designed to infiltrate runoff through a sand bed into a drainage pipe (underdrain) buried longitudinally along the bioswale (Figure 1), reducing suspended solids and their adsorbed metals. Wet bioswales are similar to dry bioswales, although they lack underdrains because they were designed to retain runoff at land surface; shallow ponding (less than one foot deep) was planned by

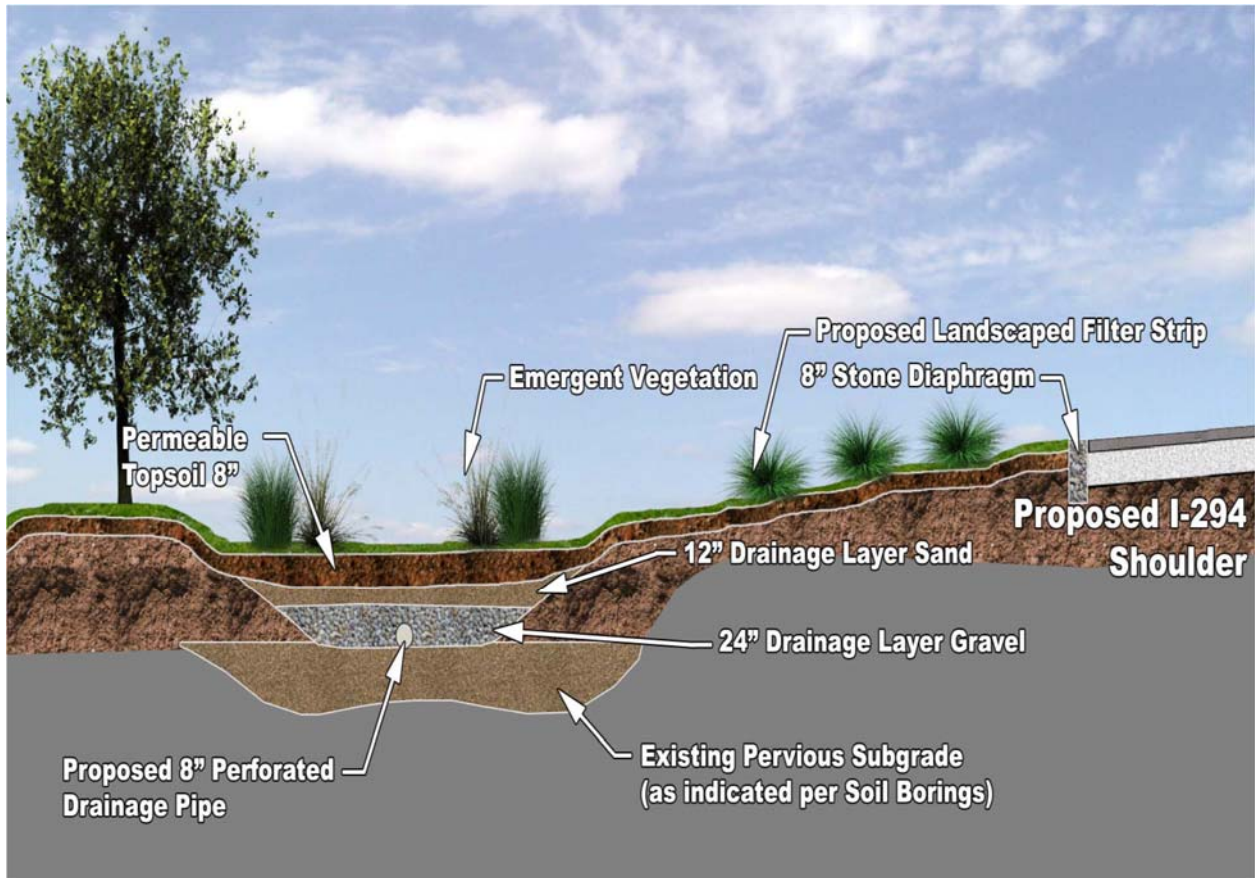


Figure 1. Schematic diagram of a dry bioswale. Dry and wet bioswales installed for this project lacked a gravel layer. Wet bioswales lack underdrains. Diagram was prepared by Huff and Huff, Incorporated and Transystems and is used by permission.

installing regularly spaced check dams. Wet bioswales were expected to have greater reductions of certain dissolved solids such as nutrients due to denitrification in the saturated conditions, as well as adsorption and transformation of pollutants by extended contact with biota and soil. Deposition of sediment was anticipated due to the slowing of runoff in ponded segments of the wet bioswales, but the efficiency of sediment removal compared to dry bioswales was unknown. Differences in performance of the two different types of bioswales are a focus of this report, including hydrogeologic factors that may influence performance.

The specific purpose of post-construction monitoring was to identify the effectiveness of bioswales in reducing the quantity and improving the quality of runoff. Previous bioswale research has focused on reductions in metals, especially chromium, copper, lead, nickel, and zinc, as well as suspended sediment, nutrients, and hydrocarbons (Crabtree et al. 2006, Herrera Environmental Consultants 2007, Mazer et al. 2001, Groves et al. [undated]). While this study does not address hydrocarbons, an extensive suite of cations and anions (including metals and nutrients) and other measures such as total dissolved solids (TDS) and total suspended solids (TSS) were collected to evaluate the effectiveness of bioswales at improving water quality (see Appendix A for a complete list).

For this study, the ISGS measured and compared the quantity and quality of runoff that entered and exited the bioswales. Discharge volume was measured and sampled, and masses of constituents being transported were calculated (Appendix B). The effectiveness of each bioswale for reducing the suite of measured constituents was evaluated by calculating the difference in mass between the inputs and outputs (Appendix C). The ISGS also compared water quality and discharge before and after bioswale construction in order to determine the overall effects of the bioswales given the increased runoff and pollutant loading due to the increased lane-miles and traffic on I-294.

METHODS

The ISGS collected data on the quantity and quality of runoff from seven locations in four bioswales (Figure 2) after they were constructed; before bioswale construction, five of those locations were among those monitored. Some sampling locations included runoff that was generated from more than one bioswale, but adjoining bioswale sections were treated as being continuous, and the name utilized for the sampling location was the bioswale number in which the sampling location is found (e.g., sampling location TB9A included bioswales TB7C through TB9A, but was located in TB9A). Six post-construction locations were outputs, including four surface-water outputs (TB7Bout, TB9A, TB15Bsw, and TB19sw), and two exit points for underdrains from dry bioswales (TB15Bgw, TB19gw). Only one location was an input (TB7Bin) where runoff was piped directly from a section of the roadway drained by a gutter; all outputs were compared to the quality of runoff at the sole input location. While it is anticipated that the load of pollutants may vary due to random events, the long time frame of the study is

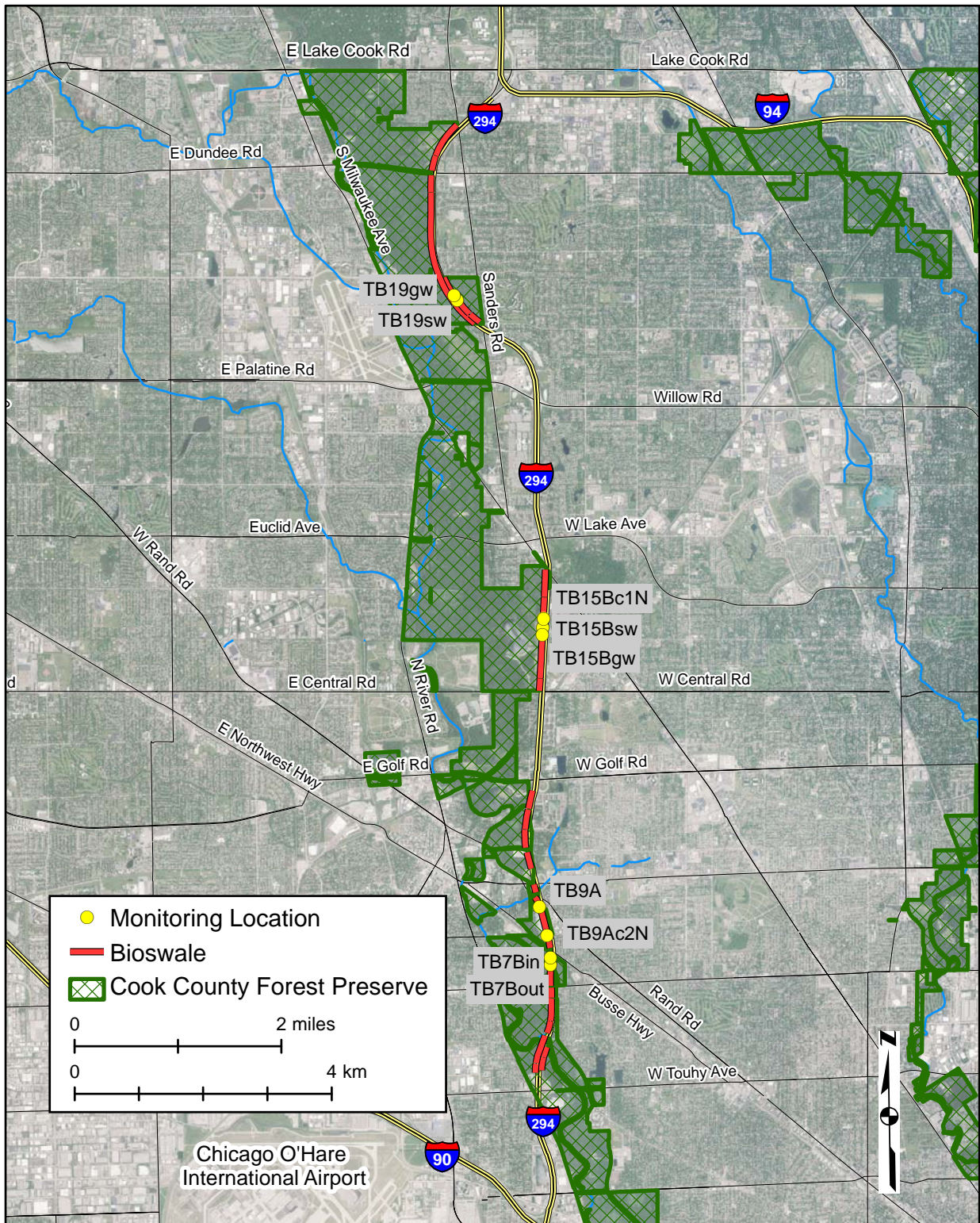


Figure 2. Location of bioswales and monitoring points discussed in this report.

anticipated to reduce the effects. Intentional uneven loading (e.g., road salting rates) will be discussed where results may be affected.

Inputs and outputs at site TB7B were the only locations that could be compared directly to determine bioswale performance. All other locations had runoff inputs that were not point sources, such as roadway segments where runoff flowed diffusely off the shoulder into the ditches, or where the inputs were too numerous (up to 5) to monitor feasibly. In those cases, data from the monitored input at TB7B were used as a substitute for comparisons, after standardizing the calculated mass by discharge for comparison.

SURFACE-WATER DISCHARGE VOLUME

In the post-construction period, the volume of runoff (discharge) initially was measured at all locations using Isco Avalanche refrigerated automated composite samplers equipped with Isco 750 area-velocity modules, which measured runoff velocity using Doppler-based acoustic sensors and water depth using built-in pressure transducers. Beginning in 2013, the area-velocity modules were replaced by Isco 730 bubbler modules to improve accuracy and stability of depth measurements. Discharge was then calculated using rating curves established by depth and discharge data previously collected by the 750 module and/or manual discharge measurements. Pre-construction discharge was measured using Isco 6712 samplers equipped with Isco 750 area-velocity modules. Results and detailed methods for calculating discharge are found in Bryant et al. (2016).

SURFACE-WATER DISCHARGE QUALITY

While bioswale performance was measured using other techniques such as dataloggers (Ackerman et al. 2016), this report addresses only results of laboratory analysis of surface-water samples collected manually as grab samples or using automated Isco samplers (Appendix A).

The Isco samplers (non-refrigerated 6712 before construction and refrigerated Avalanche after construction) collected a flow-integrated composite sample by collecting a 200-milliliter (mL) aliquot of runoff for every specified volume of runoff that passed the measurement point and placing the aliquot into a 10-liter (6712) or 20-L (Avalanche) polyethylene (HDPE) composite sample bottle for later analysis. The range of discharge volumes per aliquot among the sites was 25 to 1,000 cubic feet (ft³), and was individually optimized to collect sufficient samples for analysis during the two-week deployment without completely filling the sample bottle. While attempts were made to optimize the sampling rate to prevent the bottle from filling prior to the end of the two-week deployment, sample bottles occasionally filled if a heavy downpour or rainy period occurred, resulting in some runoff not being sampled. However, notable effects of unsampled runoff are not anticipated over the 5-year post-construction monitoring period. Details of discharge calculations for sample triggering and calculations of mass loadings are found in Bryant et al. (2016).

Every two weeks, the composite bottles were retrieved for subsampling. Subsamples were collected as discussed below, and sent to the Illinois State Water Survey Public Service Laboratory for analysis of metals, anions, TDS, TSS, orthophosphate, pH, alkalinity, ammonia-nitrogen, and total and dissolved non-volatile organic carbon (NVOC). Phosphorous values were determined via inductively coupled plasma spectroscopy (ICP) using U.S. EPA Method 200.7, and orthophosphate values were determined via colorimetry using U.S. EPA Method 365.1. Phosphorous values determined by ICP were found to be more variable than orthophosphate (Miner 2012b), so orthophosphate is utilized for analysis in this report, although phosphorous values also are presented in the appendices. Beginning in Year 2 of the post-construction period, total recoverable metals were determined using U.S. EPA Method 200.7, given that up to 83% of selected roadway metals has been found to be transported in particulate form or adsorbed to sediment rather than in dissolved form (Kayhanian et al. 2007). For this analysis, an unfiltered subsample was acidified in the laboratory to liberate metals prior to analysis, thus showing total recoverable metals content, whether dissolved or adsorbed. It should be noted that this is not a total digestion and some sediment typically remains undissolved after acidification, so that certain constituents such as alumina and silica, which make up the framework of many undissolved minerals (e.g., quartz), are presumed to be under-reported; therefore, no conclusions regarding those constituents are presented.

All water samples, including grab samples of surface water and subsamples of the Isco composite bottles, were collected using a peristaltic pump with silicone tubing connected to a flow-through cell. A Hydrolab Minisonde 5 data logger was attached to the flow-through cell and used to measure temperature, pH, and specific conductivity in all samples, and was used in wells to identify stabilization of those parameters prior to sampling. The pumping rate was approximately 0.5 L (0.13 gal) per minute or less in accordance with standard low-flow sampling procedures (ASTM Standard D6771-02 [ASTM 2002]). Samples collected for analysis of dissolved non-volatile organic carbon, dissolved metals, anions, TDS, and orthophosphate were filtered using a 0.45-micron disposable filter; all others were unfiltered. Samples for dissolved metals, total and dissolved non-volatile organic carbon (tNVOC and dNVOC), and ammonia were preserved with acid (0.2% nitric acid, 0.5% phosphoric acid, 0.5% phosphoric acid, and 0.2% sulfuric acid, respectively), and all others were unacidified. TSS subsamples collected from the composite bottle can be nonrepresentative due to settling of larger sediment particles during subsampling, but the entire contents of the bottle could not be submitted for analysis as required for the more definitive suspended sediment concentration (SSC) sampling. Therefore, TSS subsamples were collected using a protocol designed to increase the representativeness of the TSS subsample by continuous stirring to limit settling plus the movement of the hose orifice throughout the three dimensions of the composite bottle during subsample collection, offsetting any settling effects.

All grab samples and all post-construction composite samples were kept on ice at or refrigerated below 4°C until analysis. Grab samples generally were delivered to the

laboratory within the appropriate holding times for each type of sample, although some constituents, such as nutrients, whose samples are not filtered or preserved, have very short (48-hour) holding times that may have been exceeded occasionally by 24 hours or less. Biweekly sampling of composite bottles exceeded standard holding times for certain constituents, but as tested in Miner et al. (2012a), the use of refrigerated samplers greatly reduces sample alteration during storage in the composite bottles, and has been judged adequate to protect sample integrity for almost all constituents by minimizing redox changes due to bacterial activity, temperature-related degassing and associated pH changes, and others. Nitrogen results must be viewed cautiously due to potential loss to the atmosphere. Both nitrogen and phosphorous had the potential to convert from one reported species to another, so that results regarding partitioning those nutrients into species must also be viewed cautiously. Total metals analysis are not affected by any changes caused by holding time (e.g., adsorption, desorption, and/or precipitation in the sample bottle) because all metals are liberated during acidification. Pre-construction composite samples, which were not refrigerated, would have been susceptible to sample alterations as described above, and therefore use of data from non-refrigerated samples will be limited to comparisons of TDS, TSS, and chloride, which are unlikely to be altered in concentration. Field blank and duplicate samples were submitted for quality-control purposes and results will be discussed later (Appendices D and E).

Grab samples were collected primarily to compare runoff to Illinois water-quality standards. Isco composite samples do not represent actual concentrations in surface water at any specific point in time, and therefore cannot be used to evaluate whether runoff exceeds any standards. Water-quality exceedances were evaluated using grab samples (Appendix F), although datalogger data presented in Ackerman et al. (2016) will be used to model exceedances of TDS and chloride.

Isco discharge data were used to calculate the total masses of dissolved and suspended solids being transported in runoff. The concentrations (in mg/L) for each constituent in each subsample determined by laboratory analysis were multiplied by the total volume of runoff (in L) measured by the sampler in each sampling period (typically two weeks) to calculate the mass of each constituent that was transported in the sampling period.

The masses from each two-week period were summed to determine the total mass of each constituent in the runoff at each site for individual years (pre-construction period plus post-construction Years 1 through 5) when monitoring occurred. The masses and discharges also were summed for the entire pre-construction or post-construction period of record for the most comprehensive comparisons.

Masses were utilized for conclusions when possible because they are not subject to effects of changing discharge volume, which can greatly affect concentration data. However, masses can only be compared directly for sites of equal runoff contribution areas and for equal time periods. These conditions cannot be met for most sites, so the

total masses must be standardized for direct comparison to each other. We added the total mass calculated in runoff from each biweekly sampling period for the entire period of record at each site then divided by the total discharge to produce a discharge-standardized mass, herein termed a mean concentration (expressed in units of mg/L), which can be compared directly between any sites because it is independent of time and contribution area (Appendix B). Percent changes in mean concentration between sites can be easily calculated and compared. Comparison of mean concentrations assumes similar runoff and pollutant load per unit roadway area, which may vary and will be considered where appropriate. Only one input location (TB7Bin) could be monitored, so all output locations are compared to the mean concentrations at TB7Bin.

DATA AND ANALYSIS

Bioswale performance in water-quality improvement was calculated and compared in a number of ways to judge the overall performance of the entire project, particular bioswale designs, and individual bioswales. The performance of the bioswales through time is also discussed. For simplicity, we only present comparisons regarding the most important design difference among bioswales, which is whether they are wet (designed for ponding) or dry (designed with an underdrain for infiltration), and only the most effective or appropriate methods are utilized for comparisons.

COMBINED PERFORMANCE OF ALL STUDIED BIOSWALES

The overall impact of the four monitored bioswales was determined in order to evaluate whether the bioswale project had net positive effects. For this and the following analyses, results for metals are based on the total metals results from the Isco composite samples (Appendix A2), collected in Years 2 through 5. In order to assess the overall performance of all bioswales combined, the total mass of each constituent from all bioswale outlets was summed over the period of record, then divided by the sum of the discharge from all the bioswales over the same period. The result was a mean concentration for each constituent for discharge from all the bioswales (Appendix B), which was then compared to the mean concentration for the only monitored input, at TB7Bin, to identify any percent changes from input to output (Appendix C). Table 1 contains results that show widespread decreases in dissolved and suspended solids for selected constituents of interest. There was a percent decrease in total roadway metals of interest (chromium, copper, lead, nickel, and zinc) that ranged from 36 to 81%, with a mean of 71%. TSS decreased by 63% and TDS decreased by 42%. Chloride decreased by 44%. Results varied widely, so additional analysis is presented in later sections using different groupings, as well as by individual bioswale. Mechanisms for how bioswales reduce constituents also will be discussed later.

The only constituents that showed increases at many bioswale outputs relative to the input location are aluminum, potassium, molybdenum, silica, thallium, alkalinity, nitrate, orthophosphate, and dissolved non-volatile organic matter (dNVOC). Many of these increases may originate from runoff contact with the bioswale substrate and soils, rather

Table 1. Percent reductions in standardized concentrations of selected analytes in post-construction composite samples relative to input at TB7Bin. Increases shown in red.

	All bioswales	Wet bioswales	Dry bioswales	TB7Bout	TB9A	TB15B combined	TB19 combined	TB15Bgw	TB15Bsw	TB19gw	TB19sw
Al	-23.0	17.2	-68.3	45.3	18.8	-26.5	-127.2	-7.6	-283.8	-128.2	-118.8
Ca	24.9	38.9	9.2	75.0	37.9	20.5	-6.7	15.7	85.6	-14.8	63.6
Cr	75.3	80.5	69.5	87.7	80.8	74.6	62.3	76.6	47.1	64.0	47.6
Cu	80.9	81.1	80.6	88.9	81.2	83.1	77.1	83.9	72.5	78.0	69.7
Fe	54.1	65.2	41.6	76.8	65.9	55.2	22.6	60.2	-13.2	22.0	28.0
Na	46.2	50.6	41.2	90.4	48.2	40.3	42.4	36.8	88.3	37.0	88.9
Ni	36.1	87.7	-22.1	100.0	86.7	-108.8	100.0	-124.1	100.0	100.0	100.0
Pb	79.4	80.5	78.2	47.6	86.6	65.3	96.3	66.8	45.7	95.8	100.0
Si	-12.0	27.7	-57.0	55.3	28.8	-31.8	-92.4	-22.2	-162.4	-94.9	-71.2
Ti	33.7	45.7	20.1	64.5	46.7	37.0	-3.7	48.6	-121.1	0.7	-40.9
Zn	80.9	75.2	87.4	89.0	74.9	91.2	82.1	93.6	58.8	86.3	45.3
mean	70.5	81.0	58.7	82.6	82.1	41.1	83.5	39.3	64.8	84.8	72.5
(Cr, Cu, Ni, Pb, Zn)											
Alkalinity	-39.2	6.1	-102.9	55.9	3.7	-82.2	-134.5	-94.0	62.1	-147.8	-10.1
TDS, 180 C	41.6	49.9	30.0	82.6	47.6	29.8	30.4	24.9	89.0	24.5	85.1
TSS	63.4	58.9	69.9	45.3	63.3	71.4	67.6	84.1	-84.4	74.7	2.1
oPO4-P	-567.5	-294.0	-951.8	-179.8	-289.5	-876.8	-1066.0	-855.1	-1142.3	-913.0	-2496.5
NH3 -N	48.2	38.0	62.5	51.8	39.4	77.1	40.3	83.1	2.7	60.6	-149.0
F	37.3	38.6	35.5	65.1	38.0	35.9	34.9	32.2	81.4	32.5	57.6
Cl	43.9	51.5	33.2	85.6	48.9	32.5	34.4	27.8	89.7	28.6	88.8
NO3 -N	-40.0	25.2	-131.6	67.4	22.8	-65.8	-231.9	-75.0	47.6	-247.6	-84.9
SO4	47.1	45.5	49.4	54.5	47.2	47.2	52.6	43.5	92.2	49.1	85.6
Total NVOC	27.1	34.2	17.0	60.1	33.9	24.3	6.0	24.7	19.0	7.7	-9.7
Dissolved NVOC	-25.4	-5.7	-53.2	46.6	-7.9	-40.1	-73.1	-45.8	30.1	-74.2	-62.9

than being components of roadway runoff. Aluminum and silica are likely derived from erosion of bioswale materials and the foreslopes and backslopes (e.g., sand, silt, and clay). Increases in nitrate and orthophosphate likely derive from nitrification of ammonia in runoff, fertilizer application, wild animal activity, and/or the rooting medium installed in the bioswales during construction. Soil analysis (Plankell et al. 2016) showed a decrease in soil phosphorous levels, perhaps suggesting that the orthophosphate exported in the runoff may have been mobilized from the bioswale substrate. The increase in organic carbon (dNVOC) is likely from the organic material and biotic processes in the bioswale. Finally, increases in alkalinity are anticipated because roadway runoff, being derived from precipitation, is relatively low in alkalinity until it has contact with calcareous materials (such as local sediments), so increases at bioswale outlets are anticipated. Similarly, any groundwater inputs to the bioswales would tend to increase alkalinity.

PERFORMANCE OF WET BIOSWALES

As noted earlier, wet bioswales differ in design and expected performance from dry bioswales, and each group will be discussed separately. Wet bioswales were anticipated to improve the quality of runoff by any or all of the following methods. TSS, including particulate metals and sediment-bound constituents, may be removed by deposition that occurs when runoff velocity slows due to ponding of water and increased stem density of wetland vegetation. Reduction of dissolved constituents may occur through any of several processes: reducing conditions that transform some metals and nutrients or cause denitrification, wetland vegetation that may take up some dissolved constituents, soil bacteria that may transform or utilize constituents, and infiltration of surface water that may remove some mass of dissolved constituents from the system. Whether infiltration occurs would depend on favorable hydrogeologic conditions, which were not measured at all sites. Attenuation and dilution also may occur and reduce peak concentrations, but those will not reduce the total load of constituents being transported in runoff.

The two wet bioswales were grouped together to evaluate the effectiveness of wet bioswales relative to the entire set of bioswales discussed above, as well as later comparison to the dry bioswales. Because site-specific conditions may alter the performance between bioswales of the same type, the performance of individual bioswales also will be discussed later.

As described in previous volumes (Miner et al. 2012a), bioswales TB7B and TB9A are wet bioswales. Both wet bioswales have regular check dams that detain and regulate runoff, producing at least some segments that are almost permanently ponded and others that have ponding that is more seasonal. Similar to the previous analysis for the entire suite of bioswales, a mean concentration was made for both wet bioswales together by summing the total mass of constituents exiting both wet bioswale outlets then dividing by the total discharge from both bioswales; this mean concentration was compared to the mean concentration at TB7Bin, and percent change calculated for

individual constituents (Table 1, Appendix C). Results show that all constituents decreased at bioswale outlets relative to the input location other than manganese, orthophosphate, and dissolved non-volatile organic carbon (dNVOC); these increases are likely due to erosion of the bioswale substrate and/or fertilizer application, plus mobilization of manganese from fill or native materials under the reducing conditions of the wet bioswale. Notable reductions included TDS (50%), TSS (59%), and chloride (52%). Total roadway metals of interest (Cr, Cu, Ni, Pb, and Zn) were reduced by 75% to 88%, with a mean of 81%. Nitrate was reduced by 25%, likely due to denitrification in the reducing conditions of the wet bioswales, and ammonia was reduced by 38%.

Bioswales TB7B and TB9A have distinct similarities in performance, but they also have some differences due to hydrogeologic setting and design differences such as different areas of roadway that contribute runoff. For example, certain constituents had greater reductions at TB7B, including most roadway metals of interest (Figure 3), nutrients (Figure 4), and TDS, chloride, and sodium (Figure 5). At TB7B, groundwater flow is estimated to be toward the north-northeast, causing high-TDS groundwater from the roadway embankment to flow away from the bioswale. Also, some of the runoff infiltrated (Carr et al. 2016) rather than flowing overland to the bioswale outlet, thus removing mass from the bioswale. In contrast, at TB9A it was anticipated that groundwater discharge occurred at the northern end of the bioswale, and groundwater flow was likely to the north or northwest, such that high-TDS groundwater from the roadway was likely to have discharged into the bioswale, adding unmeasured constituents to the bioswales and thus decreasing the reductions seen at TB9A relative to those at TB7B. The potential for infiltration at TB9B was not measured but lack of infiltration was anticipated given the hydrogeologic setting. More details will be presented later.

PERFORMANCE OF DRY BIOSWALES

Bioswales TB15B and TB19 are dry bioswales. Each bioswale has two outlets that were monitored: the underdrain, which is termed the “gw” (groundwater) outlet, and a surface-water overflow from the bioswale, termed the “sw” (surface-water) outlet. Similar to the wet bioswales above, masses at all outputs from both dry bioswales were summed, then divided by the sum of discharges from all outputs to produce a mean concentration that combines all dry bioswale outlets. The mean concentration was then compared to the inlet mean concentration at TB7B. As noted in Bryant et al. (2016), total discharge from the surface-water outlets was small relative to the discharge from the groundwater outlets (7%-10%), so the overall performance of the dry bioswales was dominated by the results from the underdrain outlet.

Results show that dry bioswales reduced TDS by 30% and TSS by 70%. Chloride was reduced by 33%. Roadway metals of interest (Cr, Cu, Ni, Pb, and Zn) were reduced by 59% with individual metals reduced by 69% to 87% other than Ni, which increased by 22%. Ammonia was reduced by 63%, likely by nitrification to nitrate in the oxidizing conditions of the dry bioswale, adding to nitrate increases of 132%. Dry bioswales had

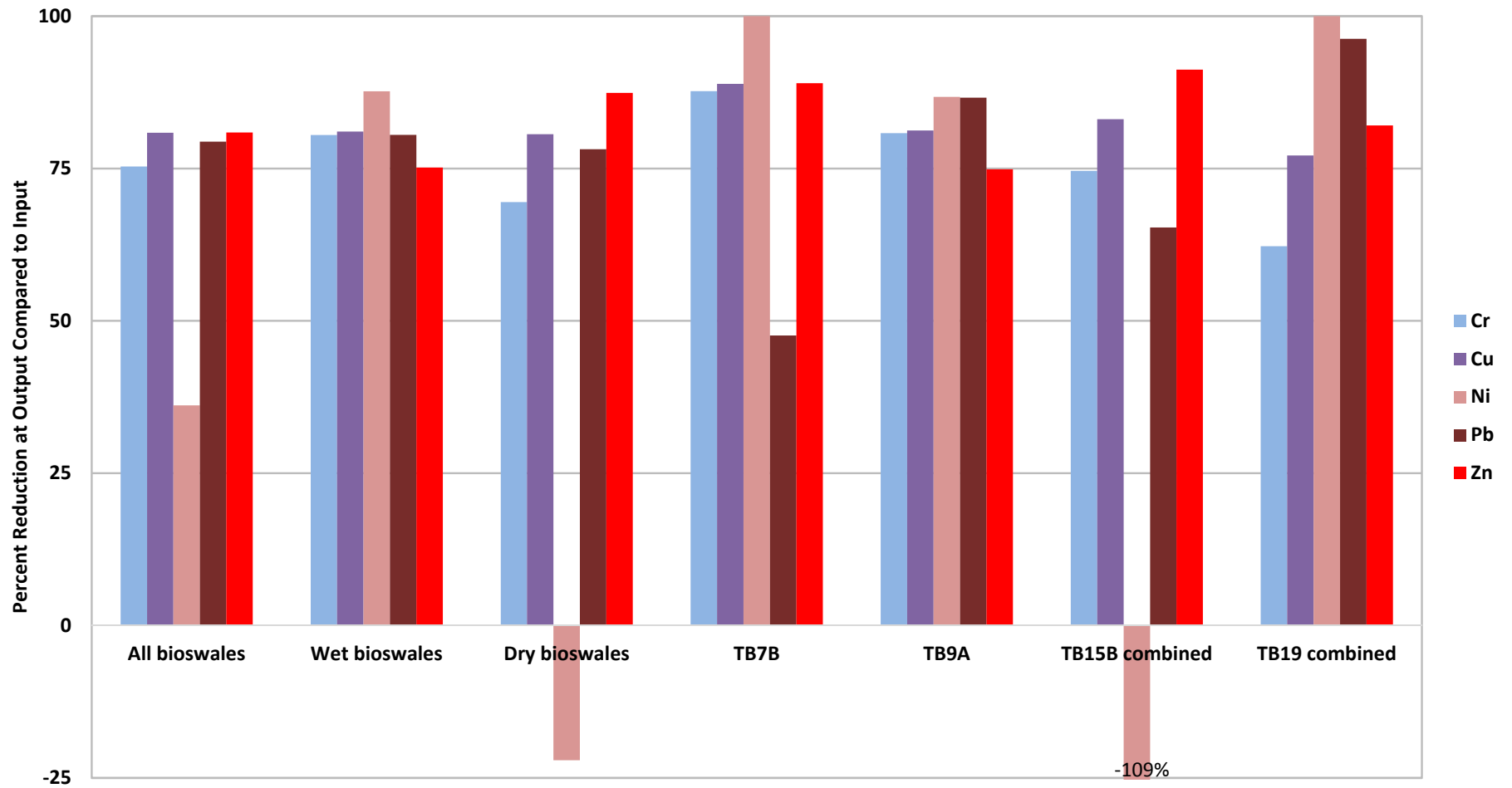


Figure 3. Percent reductions in roadway metals of interest measured in composite samples compared to input at TB7Bin (data from Table 1). Negative values indicate that levels in runoff increase after flowing through the bioswale. Values below -25% are labeled individually.

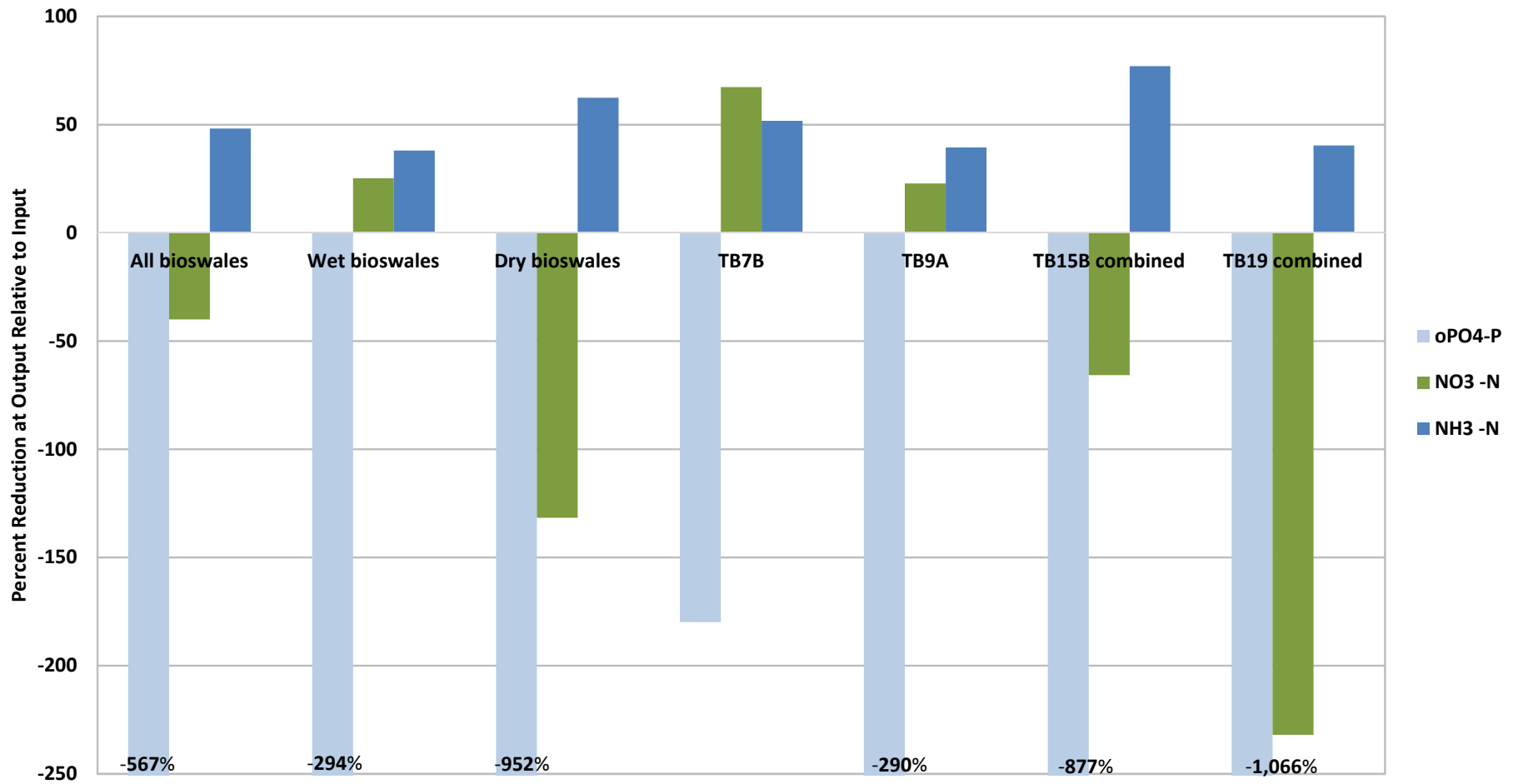


Figure 4. Percent reductions in nutrients measured in composite samples compared to input at TB7Bin (data from Table 1). Negative values indicate that levels of a constituent in runoff increase after flowing through the bioswale. Values below -250% are labeled individually.

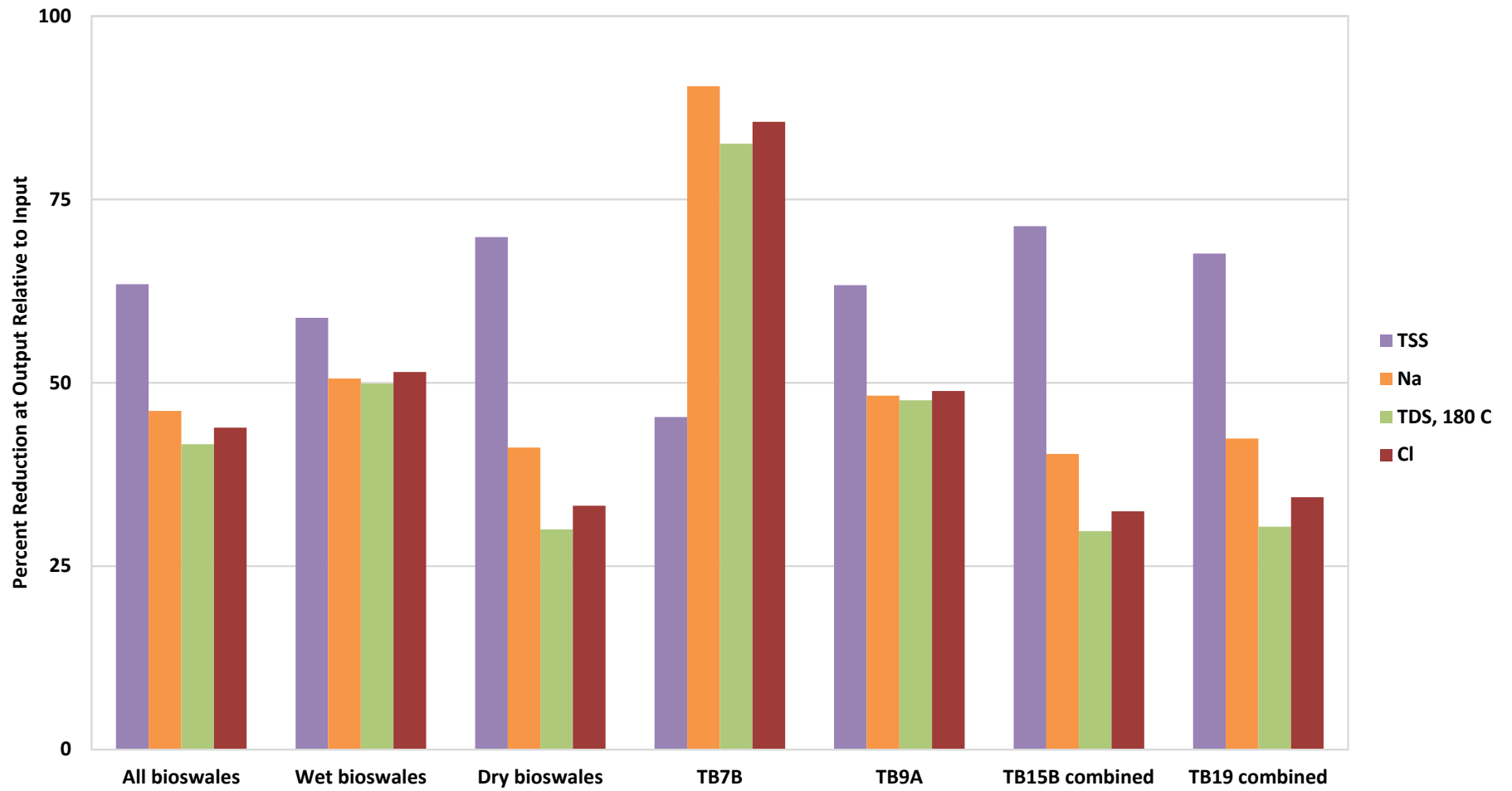


Figure 5. Percent reductions in TSS, TDS, sodium, and chloride measured in composite samples compared to input at TB7Bin (data from Table 1).

increases in other constituents, including aluminum, potassium, molybdenum, nickel, silica, and thallium, plus alkalinity, orthophosphate, and dissolved NVOC. Eroded bioswale substrate and adjacent slopes, fertilizer application, groundwater inputs, bioswale processes, and wildlife are anticipated to be the source of many of the above increases.

COMPARING WET AND DRY BIOSWALES

One aspect of this study was to assess whether bioswale design affects performance. This is important given that the two different bioswale designs, wet and dry, have different installation methods, costs, maintenance, and site requirements. Comparing the performance of bioswale types, dry bioswales showed somewhat greater reductions in TSS than wet bioswales (70% to 59%) (Figure 3). In contrast, wet bioswales showed greater reductions in all other major categories (Figures 4 and 5), including TDS (50% to 30%), chloride (52% to 33%), roadway metals (81% to 59%), and nitrate (25% reduction versus 132% increase).

Dry bioswales had enhanced TSS reduction by virtue of their basic design, which is to infiltrate runoff and utilize the natural filtration of the plant rooting medium and the sand bed to remove suspended sediment. Along with the sediment, adsorbed metals and other constituents were expected to be removed from the runoff. Dry bioswales reduced many nutrients and metals, although they performed less well than wet bioswales for almost all important categories other than TSS and ammonia; the dry conditions delayed full vegetative cover and allowed erosion of the bioswale substrate, decreased interactions with plants and possibly soil bacteria, and maintained oxidizing conditions that did not denitrify effectively. Ammonia was decreased, likely through nitrification by soil bacteria, which converted to nitrate under the oxidizing conditions. Additionally, deposited sediment and any adsorbed metals are at risk of re-eroding in the poorly vegetated dry bioswale and exiting via surface-water runoff. After infiltration to the underdrain, runoff flows rapidly to the discharge point without additional treatment by contact with soil, soil bacteria, or plants as shown by increases of discharge at the underdrain exits within minutes after precipitation events begin (Bryant et al. 2016). Also, groundwater input from adjacent areas added constituents to the underdrain where hydraulic gradients allowed groundwater infiltration into the underdrain (only measured at TB15B), thus reducing the calculated performance. In contrast, infiltrated water and any dissolved constituents are anticipated to have been lost to the system completely at wet bioswale TB7B, thus increasing the calculated reduction.

Wet bioswales had greater water-quality improvements than dry bioswales in the following ways. The lack of underdrains and the presence of check dams for additional ponding and storage created longer residence times for runoff; one observation of a downburst showed that it took more than 2 hours for runoff to fill both segments in TB7B prior to any runoff exiting the bioswale. Bioswale TB9A was the longest bioswale in the system, and likely had similar or even longer residence times. Ponded segments tended to foster reducing conditions that allowed denitrification similar to wetlands, thus

decreasing nitrate, as well as causing sediment deposition that decreased metals content, especially those in the form of particulates or adsorbed to sediment. Although semi-permanent ponding tended to reduce vegetation cover, wetter conditions generally tended to facilitate robust vegetation growth and produced greater water-quality improvements due to long-term contact with soil, bacteria, and vegetation, all of which can either transform, adsorb, and/or take up metals, nutrients, and other constituents. Wet bioswales were especially effective at reducing roadway metals, possibly assisted by infiltration documented at TB7B (Bryant et al. 2016, Carr et al. 2016). Pondered segments allowed sediment deposition by slowing runoff, although TSS reduction was not as high as in dry bioswales. Infiltration of runoff in wet bioswales would not have been measured, thus increasing the calculated bioswale performance for TDS and other dissolved solutes and transferring mass from surface water into the groundwater system for storage and possible movement to other locations. Whether the increases in these constituents in groundwater is acceptable likely depends on their concentrations and their ultimate destination.

Differences in water-quality improvements occurred between the two examples of each type of bioswale. For example, wet bioswale TB7B reduced TDS far better than the other wet bioswale, TB9A (Figure 5), likely due to site-specific issues such as a hydrogeologic setting favorable for infiltration, along with others. Differences among examples of each bioswale type will be discussed below.

RESULTS FROM INDIVIDUAL BIOSWALES

When bioswales are examined individually, water-quality improvements vary from those seen when bioswales are grouped all together or by design similarities. This is likely due to individual hydrogeologic and topographic settings, specific details of construction, loading rates, production of runoff from the contributing roadway area, and similar aspects. The following sections discuss each bioswale separately with the intention of identifying factors that influence performance other than basic bioswale design (wet or dry).

Mass Input Versus Mass Output at TB7B

The most accurate evaluation of bioswale performance is done by comparing the mass of constituents entering and exiting a bioswale, because mass is not affected by discharge volume, unlike concentrations. Only TB7B, a wet bioswale, had a single input and output (Figure 6) that could both be monitored. Therefore, the only direct comparison of mass of constituents entering and exiting is for TB7B. These comparisons will be considered the most definitive measurements of bioswale performance.

The mass of every detected constituent was reduced in runoff exiting bioswale TB7B relative to the runoff entering the bioswale, other than orthophosphate, which increased by 180%, likely due to sources within the bioswale such as fertilizing and the installation



Figure 6. Location of bioswales and monitoring points at TB7B.

of the plant growing medium (Table 1). TSS was reduced by 45%, TDS by 83%, chloride by 86%, nitrate by 67%, and roadway metals of interest (Cr, Cu, Ni, Pb, and Zn) by 83% (ranging from 48% to 100%). Runoff discharge volume was reduced by 31% (Bryant et al. 2016), likely due to infiltration and evapotranspiration, although unmeasured inputs for precipitation and runoff from adjacent slopes likely replaced some infiltration, so that actual infiltration of runoff was likely higher than calculated. Reductions of roadway metals are similar to those seen at the other wet bioswale (TB9A) (Figure 3), although reduction of TDS, certain dissolved species, and reduction of discharge were greater at TB7B (Figures 4 and 5), all likely due to infiltration at TB7B that was not anticipated at TB9A.

TB7B reduced TSS less effectively than TB9A (Figure 5). The lower rate is likely due to remobilization of some TSS deposited in the bioswale during erosive, high-flow, runoff events that overwhelm the capacity of the bioswale to store and infiltrate runoff. TB7B was also the shortest bioswale monitored, and it may have been unable to fully reduce the additional sediment generated during erosive inflows compared to TB9A, which was the longest bioswale. Alternatively, erosion of the sloped roadway berm may supply unmonitored sediment inputs.

As mentioned, no calculations were made of direct precipitation and runoff from adjacent foreslope and backslope areas. While some runoff from the steep foreslope along the bioswale was noted during very heavy rainfall events, the majority is expected to infiltrate or evapotranspire. Any estimate of this additional input is of low accuracy, and therefore is not included.

TB9A

Bioswale TB9A is a wet bioswale that contains 5 major inlets that bring runoff from the raised roadway embankment, which were too many to monitor feasibly. TB9A also has one surface-water outlet (TB9A) that was monitored with an Isco Avalanche sampler and dataloggers (Figure 7). At the output for TB9A, reductions were seen in mean concentration relative to TB7Bin were seen for all metals other than manganese, with a reduction of roadway metals of interest (Cr, Cu, Ni, Pb, and Zn) ranging from 75% to 87%, with a mean of 82% (Table 1). Reductions occurred in TSS (63%), TDS (48%), chloride (49%) and nitrate (23%), among others. Increases at TB9A relative to TB7Bin were noted in orthophosphate (290%), dissolved NVOC, and manganese, all likely derived from the bioswale substrate and/or fertilizer application.

Relative to water-quality improvements at TB7B, TSS reduction was higher at TB9A but reduction of TDS was lower (Figure 5). The reductions of roadway metals were similar at TB9A and TB7B (Figure 3), but the mean reduction of all metals was larger at TB7B (Table 1). Infiltration and the attendant loss of dissolved constituents were present at TB7B, but may not have been at TB9A based on the geomorphic setting. While groundwater was not studied at TB9A, it is estimated that groundwater flow was toward TB9A from the roadway, so that dissolved roadway-related constituents also may have



Figure 7. Location of bioswales and monitoring points at TB9A.

been delivered to the bioswale via groundwater, unlike at TB7B. Nitrate reductions were lower at TB9A, which is counter-intuitive due to the expected denitrification in the multiple, persistently ponded segments, perhaps due to lack of infiltration and greater wildlife usage. The greater ponding found at TB9A and greater bioswale length are likely reasons that TSS reduction was greater than at TB7B. Retention times and loading rates may be factors, but were not assessed because measurements of bioswale volume were not available.

Given that the water-quality improvements discussed above are based on changes to mean concentrations at TB9A relative to TB7Bin, some error is likely, as described previously (errors in roadway drainage area, runoff per unit area, volumes of unmonitored inputs, evapotranspiration, and/or infiltration rate and fate). However, the drainage areas being compared are directly adjacent to each other on an elevated stretch of roadway and have similar roadway designs (e.g., guttered drainage), so they likely have similar drainage characteristics and loading rates. Differences in accuracy of monitoring discharge may have contributed error; TB9A was regularly ponded during portions of the monitoring period and occasionally experienced backflow from the creek located just downstream, so adjustments had to be made for those conditions. The magnitude of these sources of error is not possible to estimate.

TB15B

Because dry bioswale TB15B has two outlets (underdrain and surface-water outlet) (Figure 8), a mean concentration that combines both outlets was calculated by adding the masses from each outlet then dividing by the sum of the discharges from each outlet. Table 1 shows the results of comparing the combined mean concentration to the inlet at TB7Bin. Also, in order to identify differences between discharge from the underdrain and discharge from the surface-water outlet, Table 1 shows the results of comparing each bioswale outlet to the inlet at TB7Bin.

The combined performance of both outlets at TB15B relative to TB7Bin showed reductions in TSS (71%), TDS (30%), chloride (33%), ammonia (77%), and roadway metals of interest (Cr, Cu, Ni, Pb, and Zn) that ranged between 65% and 91%, not including an increase seen in nickel of 109% (Table 1). Including nickel, roadway metals were reduced by a mean of 41%. A very large increase was noted in orthophosphate (877%), with lesser increases seen in nitrate (66%), dissolved NVOC (40%), alkalinity (82%), and a number of metals including aluminum and silica (Table 1). Many of these are likely to be derived from erosion of the bioswale substrate, fertilizer application, and remobilization of deposited TSS during erosive high flows. Increases in nitrate are likely due in part to conversion of ammonia in runoff to nitrate in the oxidizing conditions of the dry bioswale. Alkalinity increased likely due to contact of runoff with the subsurface during infiltration, as well as groundwater inputs.

Comparing the individual outlets at bioswale TB15B to inputs measured at TB7B, the quality of discharge from each outlet differs widely. Runoff generally only exited via the



Figure 8. Location of bioswales and monitoring points at TB15B.

surface-water outlet (TB15Bsw) during periods of heavy precipitation and dilution, thus the runoff resulted in greater calculated percent reductions than discharge from the underdrain for most dissolved species, notably alkalinity, TDS, chloride, nitrate, and sulfate. First-flush and low-flow runoff that contains much of the dissolved solids inputs likely infiltrated, leaving more-dilute runoff from the later parts of a runoff event to discharge through the surface-water outlet. Runoff through the surface-water outlet was higher than the underdrain outlet for TSS, silica, and aluminum, likely due to the erosion associated with the higher discharge needed to cause runoff to exit through the surface-water outlet.

Conversely, the underdrain outlet (TB15Bgw) flowed for weeks or months at a time, mostly lacking obvious turbidity other than during runoff events. Portions of the underdrain have been shown to be below the water table for months at a time (Carr et al. 2016), indicating groundwater discharged into the underdrain during those periods. Therefore, it is not surprising that discharge from the underdrain were higher in alkalinity, nitrate, orthophosphate, and dissolved NVOC than input at TB7B, likely due to infiltration of runoff prior to significant treatment by the dry bioswale, nitrification of ammonia, bioswale processes, direct contribution of groundwater from the roadway to the underdrain, and infiltration of fertilizer and dissolved organic matter from the bioswale. Modest reductions occurred in some dissolved constituents including TDS and chloride, although actual reductions were likely diminished by high-solute groundwater inputs to the underdrain; groundwater near the roadway was continuously high in chloride and TDS due to decades of infiltration of roadway runoff (Carr et al. 2016). Given that infiltration is the primary runoff treatment mechanism, TSS was reduced by 84% (Table 1) in the underdrain discharge.

The overall performance of TB15B was affected by the distribution of discharge through the different bioswale outlets and their individual performance. The vast majority of discharge (93%) exited the bioswale through the underdrain (“gw”) outlet, having been infiltrated in the bioswale. This limits the overall impact of discharge through the surface-water outlet despite the poor performance for some parameters (e.g., TSS).

TB19

Because dry bioswale TB19 has two outlets (underdrain and surface-water outlet) (Figure 9), a combined mean concentration was calculated by adding the sum of masses from each outlet divided by the sum of the discharge from each outlet. TB19 has no major point-source inlets, so roadway runoff flows diffusely into the bioswale over the shoulder. Therefore, outputs must be compared to the input at TB7B as shown in Table 1. Also, in order to identify differences between discharge from the underdrain and discharge from the surface-water outlet, Table 1 shows the results of comparing each bioswale outlet to the inlet at TB7Bin.

Water-quality improvements of the combined outlets showed reductions in TDS (30%), TSS (68%), chloride (34%), and roadway metals of interest that ranged from 62% to 100%, with a mean of 84% (Table 1). Constituents that increased relative to runoff



Figure 9. Location of bioswales and monitoring points at TB19.

inputs include alkalinity (135%), orthophosphate (1,066%), nitrate (232%), and dissolved NVOC (73%) relative to TB7Bin. Notable increases in metals included aluminum, calcium, and silica. Most of these increases are likely due to bioswale materials and processes, plus groundwater inputs.

Regarding runoff routed through each of the two bioswale exits, performance was similar to TB15B above. Relative to mean concentration of runoff input, the underdrain exit at TB19gw showed percent reductions in TDS, TSS, chloride, ammonia, and roadway metals of interest. Percent increases were seen in alkalinity, orthophosphate, nitrate, dissolved NVOC, and aluminum, calcium, and silica. At the surface-water exit (TB19sw), reductions were seen in roadway metals, TDS, and chloride. TSS was unchanged, and there were increases in alkalinity, orthophosphate, ammonia, nitrate, total and dissolved NVOC, and aluminum, silica, and titanium.

The surface-water outlets from both of the dry bioswales had very similar results for dissolved constituents, but TB15Bsw contributed more TSS and substrate metals such as aluminum and silica. The difference may be due to the three point-source inputs at TB15B, which may have channelized and accelerated runoff inputs, causing erosion, as opposed to the lack of point-source inputs at TB19. Likewise, TB15Bsw reduced nitrate, ammonia, and dissolved NVOC; perhaps observed ponding in and around roadway inlets caused better nutrient management.

POST-CONSTRUCTION TRENDS THROUGH TIME

It was anticipated that bioswale performance may change through time, either improving as vegetation became more fully established or perhaps declining as sediment accumulated or adsorption sites became full. Figures 10 through 14 show the annual mean of reduction percentages for notable constituents for each monitoring year at each site. Similar to the data discussed previously, the total available metals data were used for metals, and the overall performance of the dry bioswales was calculated by combining the discharge and masses from the surface-water and underdrain outlets.

For TDS (Figure 10), the wet bioswales (TB7B and TB9A) began with good performance, although TB9A declined slightly through time. The dry bioswales showed increasing TDS reductions beginning in Year 3, although they never reached the performance of TB7B. All bioswales showed increases in TSS reduction (Figure 11) through time, with wet bioswales improving in Year 2 and dry bioswales improving in Year 3. There was little difference between bioswale types (wet or dry) and TSS performance in years 4 and 5. It is reasonable to anticipate that TSS reduction would increase through time as the dry bioswales eventually vegetated and stabilized the soil of the bioswale; observations of vegetation suggested poor colonization of dry bioswales by plants in the early parts of the study. It is less clear why the dry bioswales had improved TDS performance through time. One possibility is that, once the underdrains were installed, high-solute groundwater adjacent to the roadways began to discharge into the underdrain. This high-TDS groundwater, which was affected by decades of roadway runoff infiltrating into the ditch and areas adjacent to the roadway,

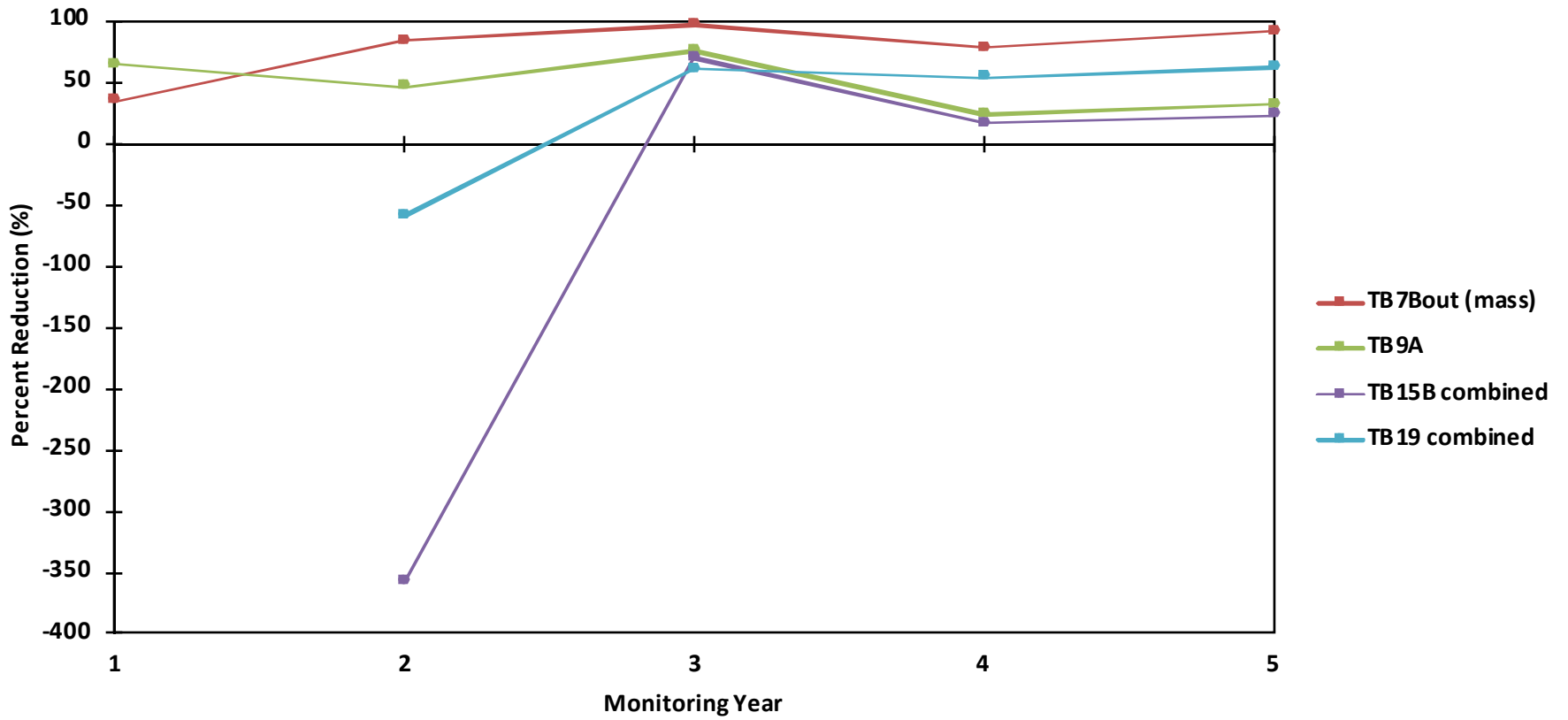


Figure 10. Mean annual percent reduction of total dissolved solids (TDS) at each bioswale outlet after construction relative to input at TB7Bin.

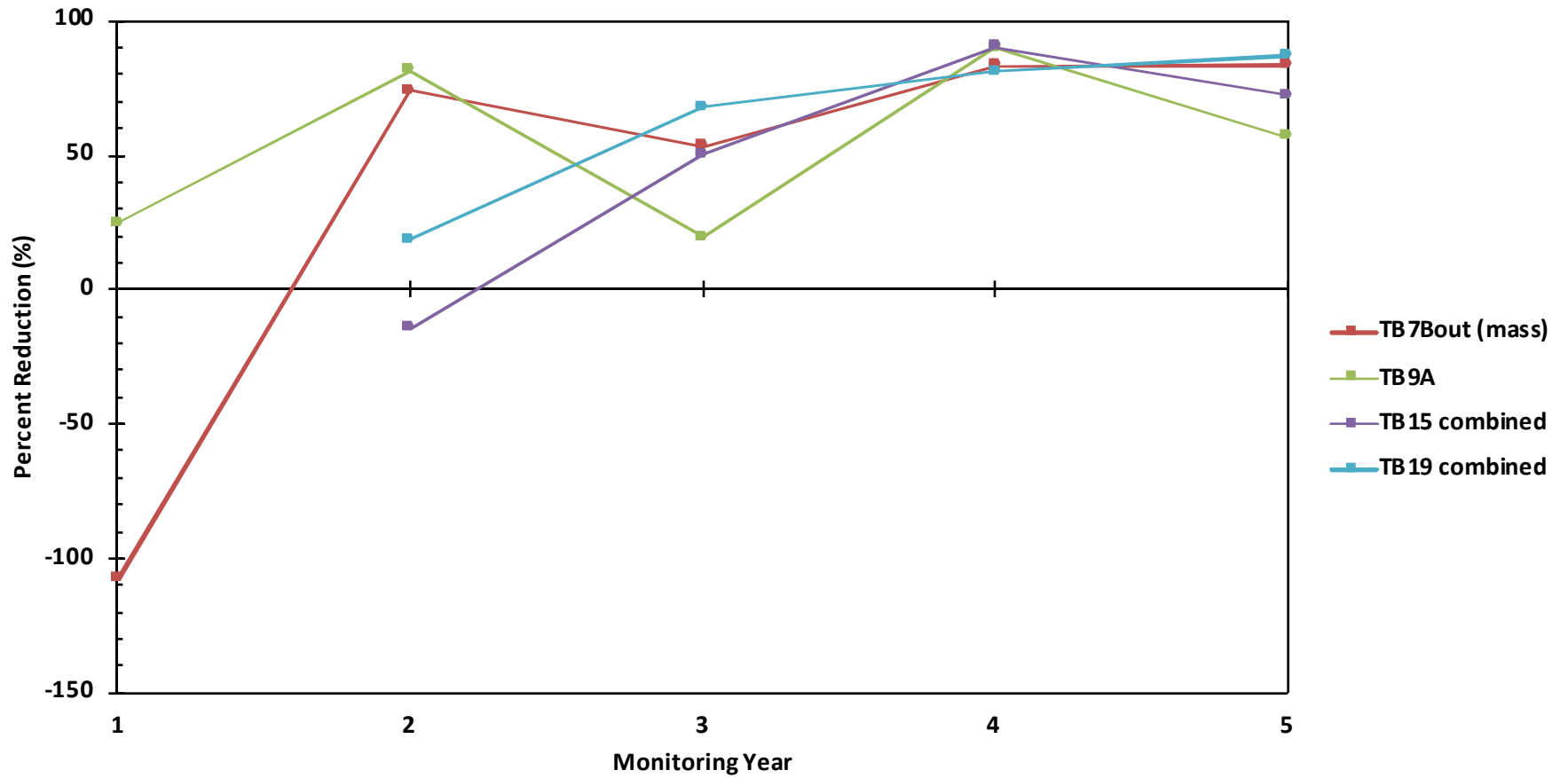


Figure 11. Mean annual percent reduction of total suspended solids (TSS) at each bioswale outlet after construction relative to input at TB7Bin.

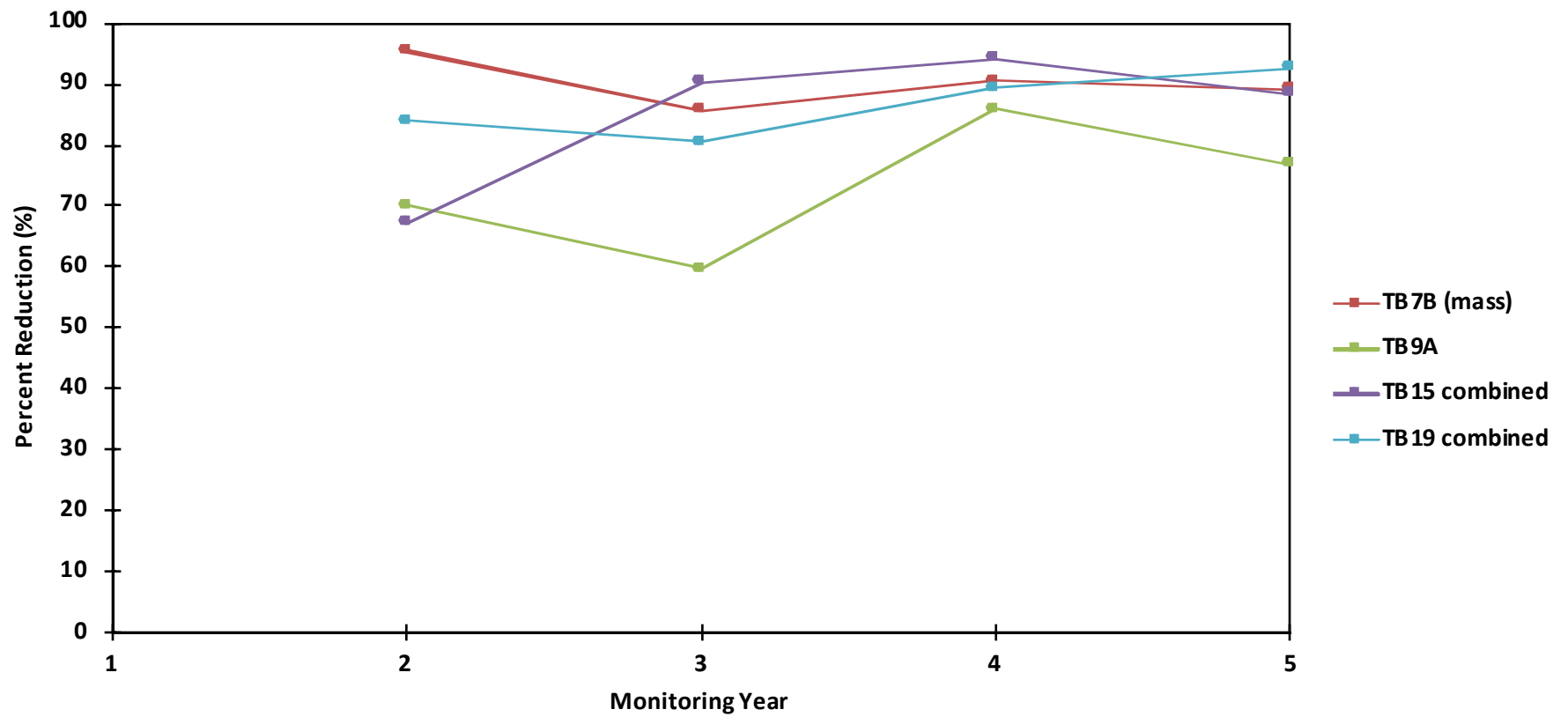


Figure 12. Mean annual percent reduction of zinc at each bioswale outlet after construction relative to inlet runoff at TB7Bin.

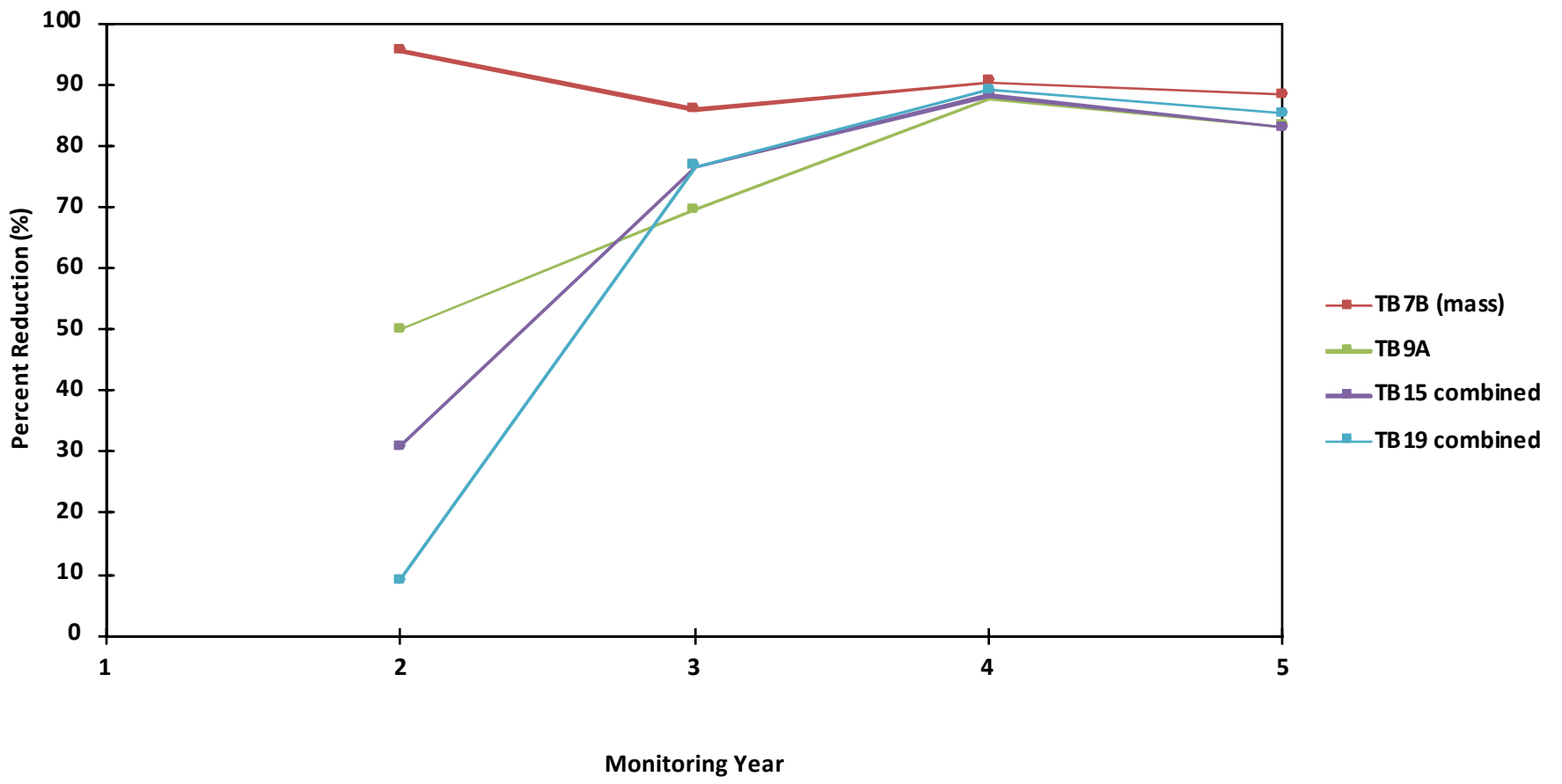


Figure 13. Mean annual percent reduction of copper at each bioswale outlet after construction relative to inlet runoff at TB7Bin.

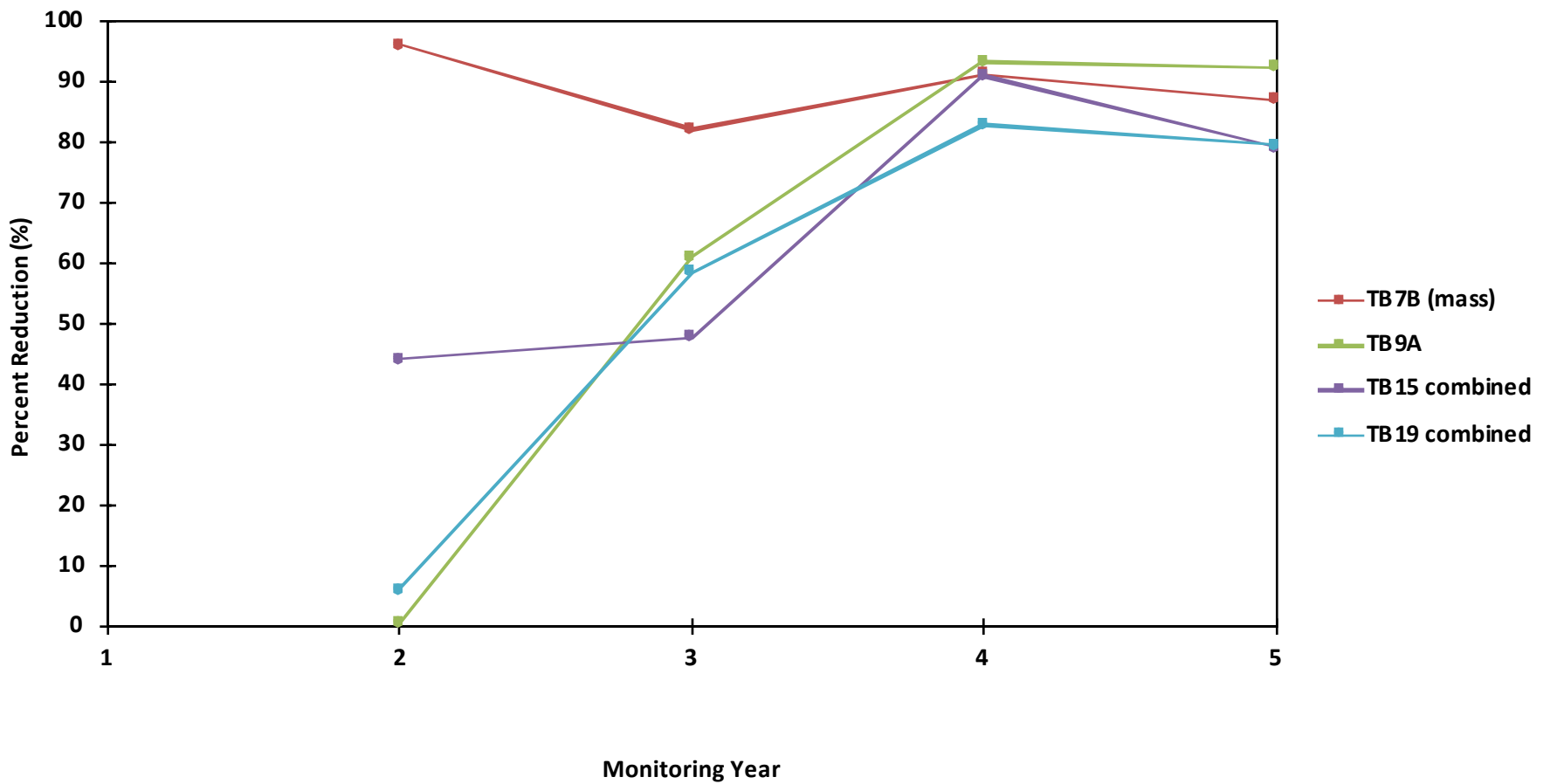


Figure 14. Mean annual percent reduction of chromium at each bioswale outlet after construction relative to inlet runoff at TB7Bin.

may have initially contributed unmeasured TDS to the discharge that suppressed the apparent percent reduction of TDS in the early monitoring years. In later years, the increased solute load may have declined as the high-TDS groundwater was partially depleted.

Roadway metals of interest were graphed to identify trends through time. Nickel and lead were not graphed due to lack of detections. All bioswales performed well for zinc (Figure 12), with little change in performance through time. Chromium and copper (Figures 13 and 14) had increasing reductions through time at some bioswales, other than bioswale TB7B, which had high performance for all metals from the start of monitoring. There were no obvious trends regarding which type of bioswale performed well at the start; low performers at the beginning of the monitoring period included both wet and dry bioswales, depending on the metal. Eventual performance in metals reduction varied, and highest performers included both wet and dry bioswales, depending on the constituent, although TB7B was typically high.

COMPARING PRE-CONSTRUCTION TO POST-CONSTRUCTION RUNOFF QUALITY

A major question of the bioswale research is the extent to which the bioswales may ameliorate the impacts to downstream surface waters from increased roadway runoff due to expansion of the tollway, given the attendant increased traffic and lane-miles. Therefore, pre-construction conditions were compared to post-construction conditions to determine the extent of changes to runoff quality. Runoff was compared using composite samples and grab samples.

Pre-construction Versus Post-Construction Composite Samples

Because composite samples are more likely to be representative, they will be used for comparisons of constituents and parameters that are unlikely to be affected by sample preservation issues discussed earlier. At TB7Bin, composite sampling found post-construction increases in TDS (33%) and chloride (31%), although there was an unexpected decline in TSS (63%), based on comparisons of mean concentrations (Table 2).

Table 2. Percent reductions in pre-construction versus post-construction composite samples.

%	TB7in	TB7out	TB9A	TB15B combined	TB19 combined
TDS	-32.8	-7.0	-168.2	-298.9	-22.2
TSS	63.4	-272.6	92.8	88.7	99.2
Cl	-30.5	-7.6	-205.0	-339.0	-21.3
Discharge	-0.7	7.1	16.7	5.1	0.5

The TSS decline may have been due to the sampling point being moved after bioswale construction from a location where erosion from the high-energy runoff input was

observed to erode the bioswale. Also, roadway construction was not synchronous with bioswale construction, so that earthwork or other construction activities likely affected TB7Bin during the “pre-construction” period before bioswales were constructed. The observed increasing trends in TDS and chloride were expected given that the increased lane-miles would require deicing, increasing the load of chloride and other constituents (e.g., Granato 1996).

At TB7Bout, composite samples showed post-construction increases in TDS (7%), chloride (8%), and TSS (273%). TSS is anticipated to have increased because the pre-construction ditch already had ponded segments choked with vegetation that slowed and stored runoff; after construction, establishment of vegetation was not immediate, allowing increased erosion. Also, erosion at the runoff input site was documented, leading to treatment with erosion mats during the post-construction period. Post-construction percent increases in the load of dissolved solids at the output from TB7B likely were lower than increases seen at the input to TB7B, likely due to infiltration of TDS-laden runoff.

At TB9A, post-construction composite samples showed increases in TDS (168%) and chloride (205%) and a decrease in TSS (93%) (Table 2). Decreased suspended solids were expected due to the replacement of the preexisting, eroding, earthen ditch with the ponded segments of the new bioswale, which slowed and stored water, allowing sediment deposition to take place. The dissolved solids increases are partially explained by increases in load due to the new lane-miles, but other factors are needed to fully explain the magnitude of the increase. Groundwater discharge is anticipated in the northern end of the bioswale, which may have increased after excavation of the bioswale and thus contributed additional unmeasured dissolved solids. Also, some measurement error is anticipated due to difficulties in measuring discharge in the pre-construction earthen channel, as well as the difficulty in determining periods of flow in the post-construction channel, which occasionally contained ponded water that was difficult to discriminate from flowing water when the Isco 730 bubbler module was being used. Water ponded at base flow is more likely to be high in TDS than storm-event runoff; if counted as flow, it would inaccurately increase the mean concentration at TB9A.

At TB15B, results of post-construction composite samples combining both outlets showed a decrease in TSS (89%), and increases in TDS (299%) and chloride (339%) (Table 2). These trends are likely due to effective filtering of TSS from runoff during infiltration, increased load of dissolved solids, and increased contribution of high-solute groundwater to the underdrain after construction. The dissolved solids increases are higher than anticipated given the magnitude of the increase in lane-miles, likely due to unmeasured, high-TDS groundwater input that was not present prior to construction.

At TB19, post-construction composite samples show reductions in TSS (99%) and increases in TDS (22%) and chloride (21%) (Table 2). TDS and chloride increases are proportional to the increase seen at TB7Bin due to added lanes, suggesting little or no input from unmeasured sources such as groundwater, as anticipated given the geomorphic setting. The previous ditch was in poor condition, eroding dramatically

during pre-construction monitoring and causing high TSS levels in the pre-construction period, thus allowing a high reduction percentage after bioswale construction and substrate stabilization.

For all sites other than TB7B, large decreases in TSS occurred after construction because pre-construction ditches were poorly vegetated and eroding. An increase in TSS was found only at TB7B, likely due to the already highly performing pre-construction ditch. For all sites, TDS increased after construction; increased solutes were likely due maintenance of the additional lane miles (e.g., road salting) and operations, and were not fully offset by bioswale performance. Increases in high-TDS groundwater input were also apparent at some sites. Only TB7Bout showed TDS percent increases that were low to negligible, likely due to unmonitored losses of high-TDS runoff due to infiltration in the bioswale.

Comparisons of TDS and TSS are anticipated to be valid to the extent of the accuracy of the discharge measurements, which are more tenuous for some sites in the pre-construction period due to measurement of discharge in problematic earthen channels, rather than hardened cross-sections like pipes and culverts.

Pre-Construction Versus Post-Construction Grab Samples

Grab samples were examined to determine the number of exceedances of Illinois General Use Water-Quality Standards (Illinois Pollution Control Board, undated) before and after construction. Pre-construction grab samples were collected biweekly in the preexisting ditch system at TB7Bin, TB7Bout, TB9A, TB15B, and TB19, and were compared to post-construction samples at the same locations. Due to the lack of samples available at TB15Bsw and TB19sw, pre-construction samples at TB15B and TB19 will be compared to post-construction samples at TB15Bgw and TB19gw, which is appropriate because they represent more than 90% of the total runoff from bioswales TB15B and TB19. Relatively few samples were collected at some sites, so that trends are difficult to identify for some analytes, so only the most clear trends are presented. The standards for chromium are for selected species of chromium, but our study only measured total chromium, so no comparisons are possible. Also, although the phosphorous standard only applies to runoff at the point of entry to a lake of a given size, and so therefore does not appear to apply to the bioswales, we calculate and discuss phosphorous exceedances because it is a nutrient of interest to the sensitive forest preserve lands that receive bioswale runoff.

Pre-construction results from the best-documented input location (TB7Bin) showed exceedances in pH, chloride, and most roadway metals of interest (copper, nickel, and zinc) (Appendix F). After construction, the number of exceedances of chloride increased from 20% of samples to 85% of samples and phosphorous exceedances increased from none to 66% of samples. Decreases in exceedances were noted in pH (20% of samples before construction to 5% of samples afterward), acute copper (40% before to 12% after), chronic copper (40% before to 15% after), and chronic nickel (40% before to none after). The post-construction decrease in pH exceedances was likely due to higher pH of

runoff during construction, when concrete was being removed and replaced, followed by normalization of pH levels after the construction was completed and the roadway initially weathered. The increase in phosphorous may indicate a higher load after roadway operations increased. Chloride exceedances likely increased due to increased wintertime road salting on the additional lanes. There is no anticipated reason for the reduction in exceedances for roadway metals of interest, so the trends are expected to be due to variability from the small number of detections of these metals.

At TB7Bout, there was only one exceedance in the pre-construction period, likely due to few samples being collected (6 total). Increases in post-construction period include chloride, which regularly exceeded standards (62% of samples versus none before), phosphorous (69% of samples after construction versus none before), and chronic copper (8% after versus none before). Exceedances of pH declined from 17% before to none after construction.

At TB9A, exceedances increased after construction for phosphorous (25% of samples before versus 72% after) and for acute copper (none before versus one instance after). Decreases in exceedances occurred after construction for pH (80% of samples before versus 3% after), acute ammonia (30% before versus none after), chronic copper (none before versus one instance after), and chronic nickel (80% before versus 2% after).

At TB15B, exceedances increased after construction for phosphorous (28% of samples before versus 79% afterward) and chronic lead (none before versus one instance afterward). Decreased exceedances were seen in pH (93% of samples before versus 27% of samples after), ammonia (31% before versus 7% after), acute copper (76% before versus 19% after), chronic copper (90% before versus 26% after), and chronic nickel (31% before versus 7% after).

At TB19, exceedances increased after construction in phosphorous (from 21% of samples before to 84% after). Decreases in exceedances after construction were noted in pH (48% of samples before to 1% after), chloride (88% before to 60% after), acute copper (6% before to none after), chronic copper (9% before to 4% after), chronic nickel (61% before to none after), and chronic lead (3% before to none after).

In general, phosphorous exceedances at outputs tended to increase dramatically after bioswale construction. Other constituents generally declined in exceedances, including pH, acute copper, and chronic nickel. Some constituents were mixed, with increased exceedances at inputs but reduced exceedances at most bioswale outputs, including chloride and ammonia. Roadway metals of interest (Cu, Cr, Ni, Pb, Zn) often had mixed results due to low numbers of detections, so small changes in exceedances must be viewed with caution. Phosphorous may be related to application during bioswale construction, and phosphorous was measured to have decreased in bioswale soils over the post-construction period (Plankell et al. 2016). Other than phosphorous, these data suggest bioswale installation improved the quality of runoff discharged to adjacent streams and lakes despite the increase in roadway operations and lane-miles of

pavement. Wet bioswales seemed to have fewer phosphorous exceedances, but few other obvious trends exist related to bioswale design (wet or dry).

GRAB SAMPLING VERSUS COMPOSITE SAMPLING

Biweekly grab sampling over a long period of time statistically is most likely to encounter the most common flow condition (low flows), not peak events that are brief but may transport significant masses of constituents. Observations of peak flows suggest that they cause erosion that produces increased TSS (and associated metals), but they are generally composed of low-solute precipitation and therefore are lower in TDS than low flows. Therefore, grab sampling may not adequately represent all runoff.

In order to assess the usefulness of grab sampling as an alternative method of determining bioswale performance, results of grab sampling were compared to composite sampling. For Year 5 at TB7Bin, TDS and TSS were summed and compared. TDS masses calculated using the grab samples were 79% higher than the mass calculated using the composite samples, and TSS mass calculated using the grab samples was 76% lower than the mass calculated using the composite samples (Table 3a). These results show that different phases of runoff contain dramatically different levels of TDS and TSS. More total TDS is transported during high-TDS, low-flow events that are the most common flow condition, and less total TDS is transported during the less frequent, high-flow events when base flow is diluted by low-solute precipitation, despite large discharge volumes. TSS was higher during high-flow events that can erode and transport sediment, but minimal during low-flow events that cannot transport or mobilize sediment as effectively. Therefore, grab sampling cannot be used to substitute for composite sampling.

Table 3.

a. Mass of TDS and TSS in grab samples versus composite samples at TB7Bin (Years 1-5).

	Grab (kg)	Isco (kg)	% difference (Isco-grab)
TDS	140,900	78,860	-78.7
TSS	550	2,326	76.3

b. Mass of total metals (TM) versus dissolved metals in composite samples at TB7Bin (Years 2-5).

	TM (kg)	Dissolved (kg)	% dissolved
chromium	0.378	0.040	10.5
copper	1.098	0.176	16.1
nickel	0.013	0.000	0.0
lead	0.082	0.015	18.8
zinc	4.567	0.844	18.5

DISSOLVED MASSES VERSUS TOTAL MASSES OF METALS

Metals were measured initially using filtered samples, beginning in the pre-construction period. In Year 2, total available metals (TM) samples also began to be collected and

analyzed as previously described in order to assess constituents that may be transported in adsorbed or particulate forms rather than dissolved.

To compare results of total available metals versus dissolved metals (Table 3b), the calculated mass of dissolved metals at TB7Bin for Years 2 through 5 was divided by the calculated mass of total metals to determine the percentage found in the dissolved phase of runoff. The dissolved fraction in Years 2-5 accounts for 11% of chromium, 16% of copper, 0% of nickel, 19% of lead, and 19% of zinc (Table 3b); the remainder was transported in non-dissolved forms, such as metallic particles or adsorbed onto sediment. Therefore, total metals data would address more of the metals load and likely therefore be more representative of overall bioswale performance.

RECOMMENDATIONS FOR FUTURE BIOSWALE DESIGNS

Bioswales constructed for this project were of two general designs: wet and dry. Wet bioswales were anticipated to improve water quality by impounding runoff at land surface, providing time for sediment to deposit and biota to interact with the runoff, adsorbing or transforming dissolved solids and nutrients. Dry bioswales were designed to infiltrate runoff, primarily for the purpose of sediment removal, along with any adsorbed metals.

The data presented in this report generally confirm these expectations. Dry bioswales were more reliable for sediment reduction (ranging from 68% to 71% reductions) than wet bioswales (45% to 63% reductions). Wet bioswales were generally more effective for improving most other aspects of water quality, with TDS reductions at wet bioswales ranging from 48% to 83%, versus dry bioswales that both reduced TDS by 30%. Nutrients (nitrogen and phosphorous compounds) and other were generally reduced by a greater percentage in wet bioswales (or had lower exports, if applicable). Reduction of roadway metals of interest was generally mixed, with different bioswale designs performing better, depending on the specific metal.

Given the above results, the selection of a future bioswale design initially would depend on the constituent that is most problematic in the runoff, although regulatory issues in the watershed or receiving stream, such as total maximum daily load (TMDL) limitations, may focus improvements on a specific analyte. However, water-quality improvements often varied even among bioswales of a given design, apparently related to the hydrogeologic setting of each individual bioswale. Therefore, site hydrogeology may limit or reduce potential water-quality improvements, making a particular bioswale design less effective. Other factors, such as site topography, may limit options, such as whether a dry bioswale can be installed at all because the underdrain outlet must emerge downstream in the ditch system.

Comparing differences among similar bioswale designs helps to identify important criteria for design selection. Better reduction of dissolved solids at bioswale TB7B likely stems from infiltration via a downward hydraulic gradient that did not occur at TB9A. About 48% of the runoff entering bioswale TB7B does not exit the bioswale, with

infiltration and evapotranspiration being the major losses. Infiltration would carry dissolved solids into the groundwater system, increasing the measured surface-water improvements relative to wet bioswale (TB9A). Given that TB7B performed better than any other bioswale for almost all items listed on Table 2 (notably excluding TSS and lead), it is apparent that infiltrating a sizeable portion of runoff assists in improving surface-water quality, leaving fewer analytes for treatment by the bioswale or possible future remobilization from the bioswale surface. Therefore, wet bioswales should be installed in sites that allow infiltration (downward hydraulic gradients). Dry bioswales do not have the same capacity for infiltration due to groundwater discharge to the underdrain, which redirects infiltration to back to the ditch system. For sites projected to receive groundwater inputs, redesigning the site to reduce infiltration or utilizing other types of best management practices (BMPs) may be more effective.

Another major factor affecting the selection of bioswale design relates to TSS reductions. Dry bioswales reliably reduced TSS due to their infiltration function. While wet bioswale TB9A performed almost as well as the dry bioswales, likely due to its length and number of ponded segments, TB7B did not reduce TSS as well as the other bioswales. Given its short length and the erosion observed at the input location due to the high input velocity of runoff, it seems likely that TB7B was unable to overcome the additional load of TSS eroded by incoming runoff. Performance would improve with greater length, as well as through erosion-reducing measures such as velocity reduction structures, hardened inputs, and forebays. On a related note, TSS was exported at the surface-water exit of one dry bioswale (TB15B) but not the other (TB19). The main difference between the two is that TB15B has inlet structures that concentrate runoff, but there are none at TB19, where runoff flows diffusely over the shoulder into the bioswale. This suggests runoff handling may greatly affect dry bioswale performance. Removing input structures (where possible) that focus and accelerate runoff, adding check dams to slow runoff velocity, and similar erosion-reducing measures may improve TSS reductions in dry bioswales.

Nutrient reductions were clearly affected by bioswale design. Dry bioswales exported nitrate and much more orthophosphate, while wet bioswales reduced nitrate. We anticipate that denitrification is a function of wet bioswales but not dry bioswales due to the reducing conditions similar to a wetland. Therefore, if consistent nutrient reductions are desired, wet bioswales are clearly preferred. Nitrate actually increased in dry bioswales, apparently due to the conversion of ammonia to nitrate in the oxidizing conditions of the bioswale. Determining the form of nitrogen least damaging to the specific system should be part of the design process.

Data on metals reductions did not provide useful comparisons to differentiate between bioswale designs, partly due to sporadic detections and low concentrations. Higher TSS reductions would be expected to correlate with high metals reductions, but dry bioswales did not outperform wet bioswales, perhaps due to the extended treatment time, contact with biota, and infiltration (at one site) in the wet bioswales.

While the discussion above relates to the reduction of mass of analytes from runoff, the concentration of a constituent is also of importance. Multiple ways can be used to dilute or attenuate runoff, including adding storage for mixing and diluting the first flush, adding runoff from non-roadway areas, and similar items, and those are not discussed in detail here.

WATER SAMPLING QUALITY CONTROL

Blank and duplicate samples were collected during sampling as quality-control measures. Field blank samples for the entire post-construction period are shown in Appendix D. Generally, no constituents of concern were noted in field blank samples, which were collected from deionized water using the same field collection equipment and procedures used for all other samples. A total of 5,289 analyses were performed (129 samples collected with 41 constituents per sample), and a total of 522 detections were recorded. The only constituents detected with a maximum level greater than 1 mg/L were calcium, magnesium, alkalinity total dissolved solids, chloride, total NVOC, and dissolved NVOC. The highest number of detections were dissolved NVOC (116), followed by calcium (112) and total NVOC (112). These detections and their values reflect the source of the blank waters, which were deionized from a calcium-bicarbonate dominated municipal water supply, plus constituents that derive from the filter material. The maximum number of detections in any sample was 9, and the minimum was 1. There were 4 detections of roadway metals of interest (only zinc and copper), with a maximum level of 0.03 mg/L. These results suggest that sample results are of sufficient quality for the purposes of this report, and no changes to methods were necessary.

Duplicate samples were included with every sampling trip. For metals, the dissolved metals sample was utilized for this analysis because samples were available from the beginning of the monitoring period, while the total recoverable metals sampling did not begin until later. Results of sample pairs are shown in Appendix E, with percent differences calculated for each pair of constituents. There were 124 pairs of samples, each with 41 constituents per sample, producing 5,084 individual comparisons. For all comparisons, the mean difference was 4.0%. The mean difference for roadway metals of interest was 12.6%. The largest mean difference for all constituents in any specific sample was 15.3%, and only 4 duplicate samples had mean differences greater than 10% for all constituents detected; several of those 4 samples had at least one constituent with a very large percent difference detected at very low levels that typically magnify percent differences. No sample had more than 5 instances of relative percent differences greater than 20%, and the mean number of instances was 0.9 per sample.

Constituents having at least 10 samples showing relative percent differences greater than 20% were, in order, titanium (19), phosphorous (16), aluminum (14), iron (11), and copper (10). Constituents having mean relative percent differences greater than 10% for all sample pairs include aluminum, cobalt, copper, phosphorous, selenium, titanium, thallium, zinc, and ammonium. Of these, copper and zinc are of the most concern to this study because they are roadway metals of interest, although the repeatability is judged to be acceptable for the purposes of this study. Potential causes of high variability

include low levels of detections for some constituents; low concentrations produce percent differences that are higher than samples with high concentrations given an equal magnitude of difference in sample pairs (i.e., the effects of small differences are magnified at low concentrations), skewing the results of percent difference analysis.

In general, constituents with high variability were cations that were often detected at relatively low levels. Results that are less than 10 times the method detection limit (MDL) can lead to large percent differences given the smaller concentrations and should be de-emphasized. The only quality-control action taken based on these results is that phosphorous was not utilized where orthophosphate values could be substituted, which had far greater repeatability due to the different technique used for analysis. Because certain constituents with higher percent differences in the duplicates analysis were not utilized significantly in the report, for example titanium, no additional analysis of impacts was performed. However, should those data be used in future analysis or studies, additional analysis may be warranted to ensure the suitability of the data for the proposed use.

FUTURE WORK

Monitoring of bioswales will continue through 2019 in order to confirm and follow trends over a longer period of time. However, monitoring will be limited to specific conductivity and turbidity dataloggers in surface-water inputs and outputs at bioswales TB7B and TB15B. Groundwater levels and specific conductivity will be monitored at TB15B. No water samples or analysis will be performed.

SUMMARY

The ISGS performed continuous sampling of roadway runoff both before and after bioswale installation along I-294 between Touhy Ave. and Lake-Cook Rd. over a 7-year period. Runoff quantity and quality were measured to identify discharge volumes, constituents in runoff and their concentrations, mass of dissolved and suspended solids transported in runoff, and any improvements in the quality or reductions in the quantity of runoff exiting the bioswales relative to input waters. Wet and dry types of bioswales were monitored to determine if design factors influence bioswale performance.

Prior to construction, runoff in the preexisting ditch system was monitored in 4 locations (TB7Bout, TB9A, TB15B, and TB19), along with one input for comparison (TB7Bin), to determine baseline conditions and water-quality impacts made by the ditch system. After construction, the same locations were monitored after bioswales were installed, and any water-quality improvements across the bioswales were identified, then compared to the pre-construction conditions.

The overall water-quality impact of the four monitored bioswales was determined based on the total metals results from the composite samples, collected in Years 2 through 5. Compared to the monitored inlet at TB7Bin, water-quality improvements for all bioswales combined shows combined shows a 63% decrease in total suspended solids (TSS), 42%

decrease in total dissolved solids (TDS), and a 44% decrease in chloride, and decreases in roadway metals of interest (chromium, copper, lead, nickel, and zinc) ranging from 36% to 81% with a mean of 71%. The only constituents that showed increases at many bioswale outputs relative to the input location are aluminum, potassium, molybdenum, silica, and thallium from the total metals analysis, plus alkalinity, nitrate, orthophosphate, and dissolved non-volatile organic matter (dNVOC) from the dissolved solids analyses. These increases generally relate to bioswale materials and processes plus groundwater input, rather than components of roadway runoff that were not treated by the bioswales.

Overall performance by the bioswales differs from individual results or when grouped by design (wet vs. dry). The combined performance of both wet bioswales shows that all constituents decreased at bioswale outlets relative to the input location other than manganese, orthophosphate, and dissolved non-volatile organic carbon (dNVOC); these increases are likely due to erosion of the bioswale substrate and/or fertilizer application, plus mobilization of manganese from fill or native materials under the reducing conditions of the wet bioswale. Notable percent reductions in wet bioswales included TDS (50%), TSS (59%), and chloride (52%). Total roadway metals of interest (Cr, Cu, Ni, Pb, and Zn) decreased by 81% with individual reductions ranging from 75% to 88%. Nitrate was reduced by 25% likely due to denitrification in the reducing conditions of the wet bioswales, and ammonia was reduced by 38%.

The combined performance of both dry bioswales showed reductions of TDS by 30%, TSS by 70%, and chloride by 33%. The mean reduction of roadway metals of interest was 59% with a range of 70% to 87% (other than nickel, which increased). Ammonia decreased, likely by nitrification to nitrate in the oxidizing conditions of the dry bioswale, adding to nitrate increases of 132%. Dry bioswales had increases in certain constituents, including aluminum, potassium, molybdenum, nickel, silica, and thallium, plus alkalinity, orthophosphate, nitrate, and dissolved NVOC. Eroded bioswale substrate and adjacent slopes, fertilizer application, groundwater inputs, biotic processes, and wildlife usage are anticipated to be the source of many of the above increases.

Comparing the performance of bioswale types, dry bioswales showed somewhat greater reductions in TSS than wet bioswales (70% to 59%). Wet bioswales showed greater reductions in all other major categories, including TDS (50% to 30%), chloride (52% to 33%), roadway metals (81% to 59%), and nitrate (25% reduction versus 132% increase). Some of the better performance for wet bioswales was due to infiltration of runoff that removed constituents from surface water in some wet bioswales (Bryant et al. 2016, Carr et al. 2016).

Dry bioswales had enhanced TSS reduction by virtue of their basic design, which is to infiltrate runoff through the plant rooting medium and the sand bed to remove suspended sediment. Along with the sediment, adsorbed metals and other constituents were expected to be removed from the runoff via infiltration. Dry bioswales reduced most nutrients and metals, although they performed less well than wet bioswales for almost all important categories other than TSS and ammonia. The dry conditions delayed full vegetation cover and reduced vegetation robustness, allowing erosion of the bioswale

substrate and any deposited sediment, decreasing interactions with plants and possibly soil bacteria, and maintaining oxidizing conditions that did not denitrify effectively, although they decreased ammonia, likely by converting it to nitrate. High-TDS groundwater discharged to the underdrain, and resulted in the addition of unmeasured constituents to the outputs, thus reducing the calculated effectiveness of runoff treatment. Rapid transfer of runoff through the dry bioswale system decreased potential contact and treatment time.

Wet bioswales have different processes that increased performance relative to dry bioswales in the following ways. The lack of underdrains and the presence of check dams for additional storage created very long residence times for runoff. Pondered segments maintained reducing conditions that facilitated denitrification similar to wetlands, thus reducing nitrate and likely causing sediment deposition containing some metals, either in the form of particulates or adsorbed to sediment. Other than semi-permanently pondered areas, wetter conditions generally facilitated vegetation robustness and long-term contact with soil, bacteria, and vegetation, all of which can either transform, adsorb, and/or take up metals, nutrients, and other constituents. Wet bioswales were especially effective at reducing roadway metals, enhanced by infiltration, although infiltration apparently did not occur at all wet bioswales. Pondered segments allowed sediment deposition by slowing runoff, although TSS reduction was not as high as in dry bioswales. Individual bioswales often had large differences in water-quality improvements, typically due to differences hydrogeologic settings.

Certain water-quality improvements increased through time, and differences between wet and dry bioswales reduced after a few years of operation. For TDS, the wet bioswales began with good performance that did not increase through time. The dry bioswales showed increased TDS reduction percentages beginning in Year 3, although they never reached the performance of the best wet bioswale. All bioswales showed increases in TSS reduction through time, with wet bioswales improving in Year 2 and dry bioswales improving in Year 3. Eventual TSS performance was similar in both types of bioswales. It is reasonable to anticipate that TSS reduction would increase through time as the dry bioswales eventually vegetated and stabilized the soil of the bioswale. It is less apparent why TDS reductions increased through time at the dry bioswales; one possibility is that, once the underdrains were installed, high-solute groundwater adjacent to the roadways began to discharge into the underdrain and was depleted through time. Chromium, copper, and zinc all had increasing reductions through time at some bioswales, other than bioswale TB7B, which had high performance for all metals from the start of monitoring. There were no obvious trends regarding which type of bioswale performed well at the start; low performers at the beginning included both wet and dry bioswales for certain metals. Eventual performance in metals reduction was similar in all of the bioswales, and highest performers included both wet and dry bioswales, depending on the constituent.

Comparisons of pre-construction to post-construction conditions from grab samples clearly show the impacts of the expansion of the roadway as well as the impacts from the bioswales. Water-quality exceedances increased at the best-documented input location

(TB7Bin); pre-construction exceedances occurred in pH, chloride, and most roadway metals of interest (copper, nickel, and zinc). After construction, the quality of runoff input was similar, although the number of exceedances of chloride increased by 327%, copper increased by 70% (acute) and by 63% (chronic), regular phosphorous exceedances began to occur (69% of samples), pH exceedances diminished by 76%, and there were no exceedances of nickel. At TB7Bout, there was only one exceedance in the pre-construction period, although there were few samples collected (6 total). In the post-construction period, chloride regularly exceeded standards (62% of samples). At TB9A, pre-construction exceedances included chloride (95% of samples), nickel (80%), pH (80%), ammonia (30%), chronic copper (25%), and phosphorous (25%). After construction, phosphorous exceedances increased by 190%, but there were almost no exceedances for pH, nickel, ammonia, or copper. At TB15B, pre-construction exceedances included pH (93% of samples), copper (acute [76%] and chronic [90%]), chloride (86%), nickel (31%), ammonia (31%), and phosphorous (28%). After construction, TB15Bgw phosphorous exceedances increased by 243%, but pH exceedances decreased by 93%, copper by 99% (acute) and 93% (chronic), and there were no exceedances of nickel and ammonia. At TB19, pre-construction exceedances included chloride (88% of samples), nickel (61%), pH (49%), and phosphorous (21%). After construction, exceedances increased for phosphorous (by 297%) and declined for nickel (by 100%), copper (acute [by 100%] and chronic [by 54%]), pH (by 98%), and chloride (by 32%). At outputs, phosphorous exceedances tended to increase dramatically, but most other constituents decreased, typically roadway metals of interest such as copper and nickel but also including pH, and ammonia; chloride performance varied. Other than phosphorous, these data suggest bioswale installation reduced exceedances of some water-quality standards despite the increase in loads of pollutants due to increased roadway operations. Wet bioswales seemed to have fewer phosphorous exceedances. Dry bioswales seem to have had larger decreases in roadway metals of interest. pH decreased at all outputs where it exceeded standards in the pre-construction period.

Comparison of pre-construction and post-construction composite data showed increased loads at bioswale inputs (TB7B), including increases in TDS (33%) and chloride (31%), although there was an unexpected decline in TSS (63%). At TB7Bout, samples showed post-construction increases in TDS (7%), chloride (8%), and TSS (273%). At TB9A, post-construction composite samples showed increases in TDS (168%) and chloride (205%) and a decrease in TSS (93%). At TB15B, post-construction composite samples (combining discharges from the underdrain and the surface-water outlets) showed a decrease in TSS (89%), and increases in TDS (299%) and chloride (339%). At TB19, post-construction composite samples show reductions in TSS (99%) and increases in TDS (22%) and chloride (21%). Increases in TDS occur at almost all sites due to increased loads from new lanes and new inputs of groundwater. Decreases in TSS occur at almost all sites other than TB7B, which was already functioning effectively to reduce TSS prior to bioswale installation; other sites typically were eroding ditches that were stabilized by bioswale construction.

The choice of bioswale type (wet or dry) typically is dependent on the specific runoff improvements needed, such as reduction of dissolved or suspended solids. If TDS reduction or attenuation is most important, a wet bioswale may be preferred due to high storage and mixing functions, especially in areas allowing runoff to infiltrate. A dry bioswale can reduce some dissolved solids similar to some types of wet bioswales, although only if high-solute groundwater from the roadway or backslope does not discharge into the bioswale underdrain. If TSS reduction is of highest importance, dry bioswales may reduce sediment more reliably, but wet bioswales can be equally effective if site conditions and design allow long retention times and ponded conditions, which facilitate sediment deposition. Dry bioswales are not possible at all locations because the site topography may not provide a lower outlet point for the underdrain to discharge back to the ditch system. Reduction of runoff velocity and additional erosion protection assists in reducing TSS for both bioswale designs.

Bioswales have several different mechanisms for improvement of runoff quality. Dissolved solids are expected to be reduced due to interaction with plants and soils or infiltration, and suspended solids are expected to be deposited as runoff slows and/or infiltrates. Specific factors that reduce bioswale performance include hydrogeologic settings where groundwater discharges into underdrains or bioswales, fine-grained sediments that prevent infiltration, low storage, high loading or runoff input rates, poorly vegetated bioswales and foreslopes, high slopes, runoff channeled into input structures, lack of check dams, and others. These and other factors influence choice of bioswale type as well as design parameters for individual sites.

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APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples

Lab Methodologies

Alkalinity:	Based on SM method 2320B
Anions (F, Cl, NO3, SO4):	Based on US EPA Method 300.0
Metals, normal, with digestion:	Based on US EPA Method 200.7
Ammonia/ammonium:	Based on US EPA Method 350.1
Orthophosphate:	Based on US EPA Method 365.1
Non-volatile organic carbon:	Based on SM method 5310B
Total Dissolved Solids:	Based on SM method 2540C
Total Suspended Solids:	Based on SM method 2540D
pH:	Based on US EPA method 150.1

SM - "Standard Methods for the Examination of Water and Wastewater"
 US EPA - methods by the US Environmental Protection Agency

Analytical Results

Date collected	Time collected (cst)	Field conductivity	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
9/8/09	1:42:00 PM	NA*	NA*	TB7Bin Isco	TOLLWAY 261	Results omitted due to sample preservation issues																				
10/21/09	7:55:00 AM	NA*	NA*	TB7Bin Isco	TOLLWAY 290																					
11/3/09	10:50:00 AM	510	NA*	TB7Bin Isco	TOLLWAY 296																					
12/1/09	10:15:00 AM	NA*	NA*	TB7Bin Isco	TOLLWAY 325																					
12/29/09	11:15:00 AM	24097	9.10	TB7Bin Isco	TOLLWAY 354																					
1/26/10	14:40:00 PM	NA*	NA*	TB7Bin Isco	TOLLWAY 391																					
4/13/10	13:20:00 PM	4401	8.22	TB7Bin Isco	TOLLWAY 483																					
5/11/10	14:15:00 PM	1734	8.23	TB7Bin Isco	TOLLWAY 520																					
5/24/10	14:20:00 PM	2300	6.76	TB7Bin Isco	TOLLWAY 540																					
6/7/10	13:50:00 PM	964	7.06	TB7Bin Isco	TOLLWAY 566																					
6/21/10	15:45:00 PM	1345	7.75	TB7Bin Isco	TOLLWAY 586																					
7/6/10	17:10:00 PM	750	8.25	TB7Bin Isco	TOLLWAY 610																					
7/19/10	16:40:00 PM	1297	8.13	TB7Bin Isco	TOLLWAY 624																					
8/16/10	13:50:00 PM	300	8.60	TB7Bin Isco	TOLLWAY 661																					
		NA*= not enough sample for field parameters																								
				TB7Bin Isco	min																					
				TB7Bin Isco	max																					
				TB7Bin Isco	mean																					
9/8/09	1:15:00 PM	NA*	NA*	TB7Bout Isco	TOLLWAY 262	Results omitted due to sample preservation issues																				
10/6/09	3:25:00 PM	NA*	NA*	TB7Bout Isco	TOLLWAY 275																					
10/21/09	8:21:00 AM	NA*	NA*	TB7Bout Isco	TOLLWAY 289																					
11/3/09	10:15:00 AM	891	NA*	TB7Bout Isco	TOLLWAY 297																					
12/1/09	10:00:00 AM	NA*	NA*	TB7Bout Isco	TOLLWAY 324																					
12/29/09	10:15:00 AM	5065	9.49	TB7Bout Isco	TOLLWAY 355																					
1/26/10	14:12:00 PM	NA*	NA*	TB7Bout Isco	TOLLWAY 392																					
3/16/10	14:25:00 PM	NA*	NA*	TB7Bout Isco	TOLLWAY 446																					
4/13/10	12:50:00 PM	2859	8.37	TB7Bout Isco	TOLLWAY 484																					
5/11/10	13:55:00 PM	1707	8.27	TB7Bout Isco	TOLLWAY 521																					
5/24/10	12:52:00 PM	890	7.03	TB7Bout Isco	TOLLWAY 541																					
6/7/10	13:25:00 PM	1099	7.02	TB7Bout Isco	TOLLWAY 567																					
6/21/10	14:45:00 PM	1043	7.85	TB7Bout Isco	TOLLWAY 587																					
7/6/10	16:46:00 PM	915	8.07	TB7Bout Isco	TOLLWAY 611																					
7/19/10	16:15:00 PM	798	8.33	TB7Bout Isco	TOLLWAY 625																					
8/3/10	12:45:00 PM	611	7.28	TB7Bout Isco	TOLLWAY 646																					
8/16/10	13:37:00 PM	1051	8.06	TB7Bout Isco	TOLLWAY 662																					
		NA*= not enough sample for field parameters																								
				TB7Bout Isco	min																					
				TB7Bout Isco	max																					
				TB7Bout Isco	mean																					

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Date collected	Time collected (cst)	Field conductivity	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO4-P mg/L	NH3 -N mg/L	F mg/L	Cl mg/L	NO3 -N mg/L	SO4 mg/L	total NVOC mg/L	dissolved NVOC mg/L		
					MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31		
9/8/09	1:42:00 PM	NA*	NA*	TB7Bin Isco	TOLLWAY 261	Results omitted due to sample preservation issues												839	no sample		355							
10/21/09	7:55:00 AM	NA*	NA*	TB7Bin Isco	TOLLWAY 290													1072	22.8	393								
11/3/09	10:50:00 AM	510	NA*	TB7Bin Isco	TOLLWAY 296													271	90.0	90.6								
12/1/09	10:15:00 AM	NA*	NA*	TB7Bin Isco	TOLLWAY 325													396	162	126								
12/29/09	11:15:00 AM	24097	9.10	TB7Bin Isco	TOLLWAY 354													14372	818	8768								
1/26/10	14:40:00 PM	NA*	NA*	TB7Bin Isco	TOLLWAY 391													4004	976	2410								
4/13/10	13:20:00 PM	4401	8.22	TB7Bin Isco	TOLLWAY 483													2365	748	1307								
5/11/10	14:15:00 PM	1734	8.23	TB7Bin Isco	TOLLWAY 520													911	148	491								
5/24/10	14:20:00 PM	2300	6.76	TB7Bin Isco	TOLLWAY 540													1213	102	636								
6/7/10	13:50:00 PM	964	7.06	TB7Bin Isco	TOLLWAY 566													500	169	229								
6/21/10	15:45:00 PM	1345	7.75	TB7Bin Isco	TOLLWAY 586													707	41.2	344								
7/6/10	17:10:00 PM	750	8.25	TB7Bin Isco	TOLLWAY 610													395	80.5	172								
7/19/10	16:40:00 PM	1297	8.13	TB7Bin Isco	TOLLWAY 624													684	61.0	328								
8/16/10	13:50:00 PM	300	8.60	TB7Bin Isco	TOLLWAY 661													161	20.0	50.1								
				NA* = not enough sample for field parameters																								
				TB7Bin Isco	min													161	20.00			50.05						
				TB7Bin Isco	max													14372	976.00			8768.42						
				TB7Bin Isco	mean													1992	264.48			1121.42						
9/8/09	1:15:00 PM	NA*	NA*	TB7Bout Isco	TOLLWAY 262	Results omitted due to sample preservation issues												370	no sample		118							
10/6/09	3:25:00 PM	NA*	NA*	TB7Bout Isco	TOLLWAY 275													267	no sample		91.5							
10/21/09	8:21:00 AM	NA*	NA*	TB7Bout Isco	TOLLWAY 289													417	no sample		133							
11/3/09	10:15:00 AM	891	NA*	TB7Bout Isco	TOLLWAY 297													489	7.2	142								
12/1/09	10:00:00 AM	NA*	NA*	TB7Bout Isco	TOLLWAY 324													434	9.2	141								
12/29/09	10:15:00 AM	5065	9.49	TB7Bout Isco	TOLLWAY 355													2815	22	1522								
1/26/10	14:12:00 PM	NA*	NA*	TB7Bout Isco	TOLLWAY 392													3230	19.2	1768								
3/16/10	14:25:00 PM	NA*	NA*	TB7Bout Isco	TOLLWAY 446													2421	18.8	1269								
4/13/10	12:50:00 PM	2859	8.37	TB7Bout Isco	TOLLWAY 484													1568	88.0	785								
5/11/10	13:55:00 PM	1707	8.27	TB7Bout Isco	TOLLWAY 521													912	10.4	450								
5/24/10	12:52:00 PM	890	7.03	TB7Bout Isco	TOLLWAY 541													471	16.0	206								
6/7/10	13:25:00 PM	1099	7.02	TB7Bout Isco	TOLLWAY 567													573	16.8	277								
6/21/10	14:45:00 PM	1043	7.85	TB7Bout Isco	TOLLWAY 587													552	25.2	244								
7/6/10	16:46:00 PM	915	8.07	TB7Bout Isco	TOLLWAY 611													490	70.0	200								
7/19/10	16:15:00 PM	798	8.33	TB7Bout Isco	TOLLWAY 625													420	59.0	168								
8/3/10	12:45:00 PM	611	7.28	TB7Bout Isco	TOLLWAY 646													335	15.6	112								
8/16/10	13:37:00 PM	1051	8.06	TB7Bout Isco	TOLLWAY 662													591	25.2	218								
				NA* = not enough sample for field parameters																								
				TB7Bout Isco	min	NA													267	7.20			91.51					
				TB7Bout Isco	max	NA													3230	88.00			1767.96					
				TB7Bout Isco	mean	NA													962	28.79			461.43					

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Date collected	Time collected (cst)	Field conductivity	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
8/25/09	2:57:00 PM	858	7.95	TB9A Isco	TOLLWAY 252																						
9/8/09	3:45:00 PM	742	6.96	TB9A Isco	TOLLWAY 259																						
10/6/09	3:35:00 PM	NA*	NA*	TB9A Isco	TOLLWAY 276																						
10/20/09	1:50:00 PM	NA*	NA*	TB9A Isco	TOLLWAY 288																						
11/3/09	8:55:00 AM	598	NA*	TB9A Isco	TOLLWAY 298																						
12/1/09	9:00:00 AM	NA*	NA*	TB9A Isco	TOLLWAY 323																						
12/29/09	9:00:00 AM	4847	9.68	TB9A Isco	TOLLWAY 353																						
4/14/10	8:00:00 AM	1445	8.91	TB9A Isco	TOLLWAY 482																						
5/11/10	12:50:00 PM	1688	8.16	TB9A Isco	TOLLWAY 522																						
5/26/10	9:25:00 AM	786	7.30	TB9A Isco	TOLLWAY 544																						
6/7/10	14:35:00 PM	1057	7.25	TB9A Isco	TOLLWAY 565																						
6/21/10	16:30:00 PM	1001	7.83	TB9A Isco	TOLLWAY 588																						
7/6/10	15:40:00 PM	730	8.47	TB9A Isco	TOLLWAY 608																						
7/19/10	15:35:00 PM	871	8.15	TB9A Isco	TOLLWAY 626																						
8/3/10	15:15:00 PM	259	7.30	TB9A Isco	TOLLWAY 647																						
8/16/10	13:18:00 PM	953	8.29	TB9A Isco	TOLLWAY 663																						
		NA* = not enough sample for field parameters																									
				TB9A Isco																							
				TB9A Isco																							
				TB9A Isco																							
4/1/09	11:20:00	5423	10.85	TB15B Isco	TOLLWAY 195																						
4/14/09	12:45:00	NA*	NA*	TB15B Isco	TOLLWAY 205																						
4/29/09	13:35:00	2275	8.51	TB15B Isco	TOLLWAY 211																						
5/11/09	14:30:00	1405	NA*	TB15B Isco	TOLLWAY 216																						
5/27/09	12:35:00	1530	NA*	TB15B Isco	TOLLWAY 220																						
6/10/09	14:15:00	1366	6.98	TB15B Isco	TOLLWAY 225																						
6/30/09	12:35:00	519	6.79	TB15B Isco	TOLLWAY 228																						
7/28/09	8:49:00	826	8.08	TB15B Isco	TOLLWAY 247																						
8/25/09	10:45:00	998	8.53	TB15B Isco	TOLLWAY 249																						
9/8/09	11:45:00	1385	6.77	TB15B Isco	TOLLWAY 257																						
10/6/09	13:50:00	NA*	NA*	TB15B Isco	TOLLWAY 278																						
11/2/09	14:40:00	823	NA*	TB15B Isco	TOLLWAY 299																						
12/2/09	8:30:00	NA*	NA*	TB15B Isco	TOLLWAY 322																						
12/29/09	12:45:00	4333	10.14	TB15B Isco	TOLLWAY 351																						
1/26/10	10:55:00	NA*	NA*	TB15B Isco	TOLLWAY 393																						
3/17/10	10:15:00	NA*	NA*	TB15B Isco	TOLLWAY 447																						
4/13/10	8:22:00	1576	8.88	TB15B Isco	TOLLWAY 485																						
5/11/10	16:00:00 PM	1185	8.27	TB15B Isco	TOLLWAY 523																						
5/25/10	12:20:00	610	7.13	TB15B Isco	TOLLWAY 542																						
6/7/10	12:50:00	1209	7.46	TB15B Isco	TOLLWAY 564																						
6/21/10	13:30:00 PM	1358	7.74	TB15B Isco	TOLLWAY 589																						
7/6/10	14:14:00 PM	901	8.41	TB15B Isco	TOLLWAY 609																						
7/19/10	14:05:00 PM	713	8.30	TB15B Isco	TOLLWAY 627																						
		NA* = not enough sample for field parameters																									
				TB15B Isco																							
				TB15B Isco																							
				TB15B Isco																							

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Date collected	Time collected (cst)	Field conductivity	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaC ₃	TDS, 180 C mg/L	TSS mg/L	oPO4-P mg/L	NH3 -N mg/L	F mg/L	Cl mg/L	NO3 -N mg/L	SO4 mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31	
8/25/09	2:57:00 PM	858	7.95	TB9A Isco	TOLLWAY 252												395	481								160	
9/8/09	3:45:00 PM	742	6.96	TB9A Isco	TOLLWAY 259												418	190								145	
10/6/09	3:35:00 PM	NA*	NA*	TB9A Isco	TOLLWAY 276												169	no sample								49.4	
10/20/09	1:50:00 PM	NA*	NA*	TB9A Isco	TOLLWAY 288												393	no sample								133	
11/3/09	8:55:00 AM	598	NA*	TB9A Isco	TOLLWAY 298												325	102								103	
12/1/09	9:00:00 AM	NA*	NA*	TB9A Isco	TOLLWAY 323												251	73.0								85.2	
12/29/09	9:00:00 AM	4847	9.68	TB9A Isco	TOLLWAY 353												2765	223								1527	
4/14/10	8:00:00 AM	1445	8.91	TB9A Isco	TOLLWAY 482												786	2240								386	
5/11/10	12:50:00 PM	1688	8.16	TB9A Isco	TOLLWAY 522												933	141								441	
5/26/10	9:25:00 AM	786	7.30	TB9A Isco	TOLLWAY 544												414	189								187	
6/7/10	14:35:00 PM	1057	7.25	TB9A Isco	TOLLWAY 565												548	1128								255	
6/21/10	16:30:00 PM	1001	7.83	TB9A Isco	TOLLWAY 588												525	304								242	
7/6/10	15:40:00 PM	730	8.47	TB9A Isco	TOLLWAY 608												377	166								170	
7/19/10	15:35:00 PM	871	8.15	TB9A Isco	TOLLWAY 626												456	76.5								222	
8/3/10	15:15:00 PM	259	7.30	TB9A Isco	TOLLWAY 647												140	27.6								51.9	
8/16/10	13:18:00 PM	953	8.29	TB9A Isco	TOLLWAY 663												499	50.0								235	
				NA* = not enough sample for field parameters																							
				TB9A Isco													140	27.60									49.45
				TB9A Isco													2765	2240.00									1527.33
				TB9A Isco													587	385.09									274.56
4/1/09	11:20:00	5423	10.85	TB15B Isco	TOLLWAY 195												2863	307								1712	
4/14/09	12:45:00	NA*	NA*	TB15B Isco	TOLLWAY 205												1955	562								1076	
4/29/09	13:35:00	2275	8.51	TB15B Isco	TOLLWAY 211												1206	201								622	
5/11/09	14:30:00	1405	NA*	TB15B Isco	TOLLWAY 216												735	335								376	
5/27/09	12:35:00	1530	NA*	TB15B Isco	TOLLWAY 220												832	421								411	
6/10/09	14:15:00	1366	6.98	TB15B Isco	TOLLWAY 225												731	264								364	
6/30/09	12:35:00	519	6.79	TB15B Isco	TOLLWAY 228												294	461								112	
7/28/09	8:49:00	826	8.08	TB15B Isco	TOLLWAY 247												443	994								189	
8/25/09	10:45:00	998	8.53	TB15B Isco	TOLLWAY 249												544	182								240	
9/8/09	11:45:00	1385	6.77	TB15B Isco	TOLLWAY 257												774	237								349	
10/6/09	13:50:00	NA*	NA*	TB15B Isco	TOLLWAY 278												809	no sample								372	
11/2/09	14:40:00	823	NA*	TB15B Isco	TOLLWAY 299												478	60.8								149	
12/2/09	8:30:00	NA*	NA*	TB15B Isco	TOLLWAY 322												519	no sample								211	
12/29/09	12:45:00	4333	10.14	TB15B Isco	TOLLWAY 351												2489	24								1460	
1/26/10	10:55:00	NA*	NA*	TB15B Isco	TOLLWAY 393												4189	95.6								2448	
3/17/10	10:15:00	NA*	NA*	TB15B Isco	TOLLWAY 447												2629	557								1500	
4/13/10	8:22:00	1576	8.88	TB15B Isco	TOLLWAY 485												831	319								422	
5/11/10	16:00:00 PM	1185	8.27	TB15B Isco	TOLLWAY 523												640	92.0								322	
5/25/10	12:20:00	610	7.13	TB15B Isco	TOLLWAY 542												320	167								142	
6/7/10	12:50:00	1209	7.46	TB15B Isco	TOLLWAY 564												619	38.0								303	
6/21/10	13:30:00 PM	1358	7.74	TB15B Isco	TOLLWAY 589												732	65.6								334	
7/6/10	14:14:00 PM	901	8.41	TB15B Isco	TOLLWAY 609												488	120								208	
7/19/10	14:05:00 PM	713	8.30	TB15B Isco	TOLLWAY 627												386	65.0								169	
				NA* = not enough sample for field parameters																							
				TB15B Isco													294	24.00									111.69
				TB15B Isco													4189	994.00									2448.31
				TB15B Isco													1109	265.13									586.51

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Date collected	Time collected (cst)	Field conductivity	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S		
						mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217		
3/5/08	10:30:00	6764	7.70	TB19 Isco	TOLLWAY 25																							
3/26/08	11:15:00	NA*	NA*	TB19 Isco	TOLLWAY 32																							
4/9/08	14:00:00	4695	7.86	TB19 Isco	TOLLWAY 38																							
4/14/08	11:20:00	2406	7.95	TB19 Isco	TOLLWAY 40																							
5/6/08	10:25:00	5540	7.90	TB19 Isco	TOLLWAY 46																							
5/20/08	9:02:00	2146	7.88	TB19 Isco	TOLLWAY 54																							
5/28/08	14:21:00	1951	7.93	TB19 Isco	TOLLWAY 57																							
6/9/08	15:02:00	1969	7.99	TB19 Isco	TOLLWAY 60																							
6/24/08	12:30:00	NA*	NA*	TB19 Isco	TOLLWAY 72																							
7/9/08	19:10:00	1861	7.76	TB19 Isco	TOLLWAY 80																							
7/22/08	15:40:00	NA*	NA*	TB19 Isco	TOLLWAY 90																							
8/6/08	7:45:00	NA*	NA*	TB19 Isco	TOLLWAY 101																							
9/17/08	10:25:00	549	8.16	TB19 Isco	TOLLWAY 120																							
10/15/08	14:47:00	NA*	NA*	TB19 Isco	TOLLWAY 143																							
12/2/08	14:02:00	NA*	NA*	TB19 Isco	TOLLWAY 153																							
12/16/08	15:10:00	3613	7.12	TB19 Isco	TOLLWAY 171																							
				TB19 Isco	min																							
				TB19 Isco	max																							
				TB19 Isco	mean																							
10/6/09	11:35:00 AM	NA*	NA*	TB19r Isco	TOLLWAY 277																							
10/20/09	11:45:00 AM	1856	7.64	TB19r Isco	TOLLWAY 286																							
11/3/09	11:40:00 AM	713	NA*	TB19r Isco	TOLLWAY 295																							
12/2/09	2:40:00 PM	831	7.11	TB19r Isco	TOLLWAY 320																							
12/16/09	8:40:00 AM	5908	7.52	TB19r Isco	TOLLWAY 340																							
12/29/09	12:15:00 PM	13217	10.17	TB19r Isco	TOLLWAY 352																							
1/26/10	15:40:00 PM	8870	9.35	TB19r Isco	TOLLWAY 389																							
3/16/10	13:46:00 PM	3980	8.03	TB19r Isco	TOLLWAY 444																							
3/31/10	12:04:00 PM	6074	8.80	TB19r Isco	TOLLWAY 465																							
4/14/10	9:05:00 AM	3070	8.79	TB19r Isco	TOLLWAY 486																							
5/11/10	15:10:00 PM	2989	8.13	TB19r Isco	TOLLWAY 524																							
5/25/10	16:00:00 PM	1235	7.07	TB19r Isco	TOLLWAY 543																							
		NA*= not enough sample for field parameters																										
				TB19r Isco	min																							
				TB19r Isco	max																							
				TB19r Isco	mean																							

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Date collected	Time collected (cst)	Field conductivity	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO4-P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31	
3/5/08	10:30:00	6764	7.70	TB19 Isco	TOLLWAY 25												3642									2134	
3/26/08	11:15:00	NA*	NA*	TB19 Isco	TOLLWAY 32												8486									5206	
4/9/08	14:00:00	4695	7.86	TB19 Isco	TOLLWAY 38												2496	6585								1460	
4/14/08	11:20:00	2406	7.95	TB19 Isco	TOLLWAY 40												1300	526								658	
5/6/08	10:25:00	5540	7.90	TB19 Isco	TOLLWAY 46												3033	362.5								1699	
5/20/08	9:02:00	2146	7.88	TB19 Isco	TOLLWAY 54												1147	570								691	
5/28/08	14:21:00	1951	7.93	TB19 Isco	TOLLWAY 57												1075	459								478	
6/9/08	15:02:00	1969	7.99	TB19 Isco	TOLLWAY 60												1072	770								304	
6/24/08	12:30:00	NA*	NA*	TB19 Isco	TOLLWAY 72												1338									691	
7/9/08	19:10:00	1861	7.76	TB19 Isco	TOLLWAY 80												1040	965								478	
7/22/08	15:40:00	NA*	NA*	TB19 Isco	TOLLWAY 90												664	1282								304	
8/6/08	7:45:00	NA*	NA*	TB19 Isco	TOLLWAY 101												519	1013								244	
9/17/08	10:25:00	549	8.16	TB19 Isco	TOLLWAY 120												298	1934								112	
10/15/08	14:47:00	NA*	NA*	TB19 Isco	TOLLWAY 143												463									178	
12/2/08	14:02:00	NA*	NA*	TB19 Isco	TOLLWAY 153												1652	no sample								896	
12/16/08	15:10:00	3613	7.12	TB19 Isco	TOLLWAY 171												1952	1360								1148	
				TB19 Isco	min												298.000	362.500								111.560	
				TB19 Isco	max												8486.000	6585.000								5206.023	
				TB19 Isco	mean												1886.063	1438.773								1056.454	
10/6/09	11:35:00 AM	NA*	NA*	TB19r Isco	TOLLWAY 277												2026	no sample								968	
10/20/09	11:45:00 AM	1856	7.64	TB19r Isco	TOLLWAY 286												1046	1108								465	
11/3/09	11:40:00 AM	713	NA*	TB19r Isco	TOLLWAY 295												371	425								135	
12/2/09	2:40:00 PM	831	7.11	TB19r Isco	TOLLWAY 320												468	230								163	
12/16/09	8:40:00 AM	5908	7.52	TB19r Isco	TOLLWAY 340												3180	115								1868	
12/29/09	12:15:00 PM	13217	10.17	TB19r Isco	TOLLWAY 352												7502	406								5089	
1/26/10	15:40:00 PM	8870	9.35	TB19r Isco	TOLLWAY 389												4974	129								2974	
3/16/10	13:46:00 PM	3980	8.03	TB19r Isco	TOLLWAY 444												2172	597								1214	
3/31/10	12:04:00 PM	6074	8.80	TB19r Isco	TOLLWAY 465												3265	132								1973	
4/14/10	9:05:00 AM	3070	8.79	TB19r Isco	TOLLWAY 486												1652	289								898	
5/11/10	15:10:00 PM	2989	8.13	TB19r Isco	TOLLWAY 524												1585	340								851	
5/25/10	16:00:00 PM	1235	7.07	TB19r Isco	TOLLWAY 543												657	273								293	
				NA* = not enough sample for field parameters																							
				TB19r Isco	min												371	114.80								135.36	
				TB19r Isco	max												7502	1108.00								5089.49	
				TB19r Isco	mean												2408	367.55								1407.63	

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Analytical Results

Date collected	Time collected (cst)	Field conductivity	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S			
					MDL:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
					TOLLWAY 677	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217			
8/30/10	12:00:00 PM	NA*	NA*	TB7B-in-isco	TOLLWAY 677				0.028		9.001				0.00596	0.0126	1.496		1.6034						17.86		2.85		
9/27/10	12:30:00 PM	NA*	NA*	TB7B-in-isco	TOLLWAY 702				0.034		20.872			0.00594	0.00377	0.0117	2.254		2.5414						44.26		8.10		
12/7/10	8:15:00 AM	NA*	NA*	TB7B-in-isco	TOLLWAY 731			0.028	0.027		12.656				0.00580	0.0086	1.531		1.8884	0.0036					27.48		4.99		
3/2/11	4:50:00 PM	NA*	NA*	TB7B-in-isco	TOLLWAY 733	0.045		0.024	0.051		43.233				0.00615		5.305		3.1308	0.0176					380.62		23.47		
3/28/11	2:15:00 PM	NA*	NA*	TB7B-in-isco	TOLLWAY 811	0.044		0.026	0.032		34.754			0.00833	0.00895	0.0758	1.775		1.5912	0.0198					109.39	0.085	21.11		
4/12/11	8:45:00 AM	2567	8.47	TB7B-in-isco	TOLLWAY 826	0.112		0.027	0.038		26.357			0.00697	0.00803		7.072		3.1384	0.0033					411.04		19.04		
4/27/11	11:35:00 AM	8009	6.88	TB7B-in-isco	TOLLWAY 854	0.050		0.045			53.065			0.01382	0.01330		31.047		15.5516	0.0056					1570.71	0.126	59.19		
5/10/11	9:45:00 AM	12001	8.76	TB7B-in-isco	TOLLWAY 869			0.094	0.070		117.649			0.00704	0.01018		42.733		37.9086	0.0103					2441.79	0.095	121.31		
5/24/11	11:30:00 AM	8663	7.90	TB7B-in-isco	TOLLWAY 909	0.052		0.078	0.055		85.734			0.00914	0.01040		31.826		26.5255	0.0147					1713.60	0.124	96.33		
6/8/11	11:05:00 AM	598	8.43	TB7B-in-isco	TOLLWAY 927	0.083			0.026		12.225				0.00326		3.233		1.4385	0.0032					112.58	0.104	6.60		
6/21/11	4:13:00 PM	714	7.76	TB7B-in-isco	TOLLWAY 967	0.074			0.025		12.163			0.00744	0.00416	0.0243	4.133		1.6194	0.0057					120.48	0.115	9.37		
8/1/11	1:50:00 PM	242	8.62	TB7B-in-isco	TOLLWAY 1043	0.094			0.019		9.784				0.00546	0.1965	1.237		1.3881	0.0128					34.39		4.81		
8/16/11	12:00:00 PM	2319	8.65	TB7B-in-isco	TOLLWAY 1062	0.039		0.062	0.028		39.346				0.00386		10.908		10.5584	0.0122					439.65	0.117	47.66		
		NA*= not enough sample for field parameters																											
					min	0.000	NA	0.000	0.000	NA	9.001	NA	NA	0.00000	0.00326	0.0000	1.237	NA	1.3881	0.0000	NA	17.86	NA	0.000	NA	2.85			
					max	0.112	NA	0.094	0.070	NA	117.649	NA	NA	0.01382	0.01330	0.1965	42.733	NA	37.9086	0.0198	NA	2441.79	NA	0.126	NA	121.31			
					mean	0.046	NA	0.030	0.033	NA	36.680	NA	NA	0.00451	0.00687	0.0254	11.119	NA	8.3757	0.0084	NA	571.07	NA	0.059	NA	32.68			
4/12/11	10:02:00 AM	3975	8.10	TB7B-out Isco	TOLLWAY 825			0.064	0.053		121.278			0.00679	0.00844		16.824		25.3062	0.0507					652.32	0.120	123.33		
4/27/11	11:40:00 AM	4715	6.99	TB7B-out Isco	TOLLWAY 855	0.042		0.048	0.060		101.344			0.00681	0.00989		18.814		21.2334	0.0189					845.47	0.157	102.22		
5/10/11	10:51:00 AM	3719	8.32	TB7B-out Isco	TOLLWAY 874			0.092	0.071		152.650				0.00826		13.219		29.4310	0.0075					602.90	0.127	160.94		
5/24/11	11:35:00 AM	1557	8.07	TB7B-out Isco	TOLLWAY 910			0.055	0.035		57.531				0.00947	0.0325	9.798		11.4186	0.0109					245.59	0.096	57.05		
6/8/11	11:00:00 AM	583	8.75	TB7B-out Isco	TOLLWAY 926	0.111		0.029	0.017		24.230				0.00400	0.0953	3.048		4.1752	0.0029					91.30	0.133	17.43		
6/21/11	4:32:00 PM	750	7.88	TB7B-out Isco	TOLLWAY 969	0.044		0.037	0.027		28.393				0.00661	0.0495	5.310		5.0470	0.0181					133.08	0.151	22.87		
8/1/11	1:31:00 PM	333	8.78	TB7B-out Isco	TOLLWAY 1044	0.785		0.029	0.014		21.686				0.00468	0.5543	3.200		3.1666	0.0161					35.80	0.163	14.03		
8/16/11	2:22:00 PM	687	7.98	TB7B-out Isco	TOLLWAY 1067	0.101		0.048	0.021		28.005				0.00439	0.1013	6.198		5.7743	0.0080					104.91	0.170	24.65		
					min	0.000	NA	0.029	0.014	NA	21.686	NA	NA	0.00000	0.00400	0.0000	3.048	NA	3.1666	0.0029	NA	35.80	NA	0.096	NA	14.03			
					max	0.785	NA	0.092	0.071	NA	152.650	NA	NA	0.00681	0.00989	0.5543	18.814	NA	29.4310	0.0507	NA	845.47	NA	0.170	NA	160.94			
					mean	0.135	NA	0.050	0.037	NA	66.889	NA	NA	0.00170	0.00697	0.1041	9.551	NA	13.1940	0.0167	NA	338.92	NA	0.140	NA	65.31			
6/21/11	4:23:00 PM	1422	7.71	TB9A Isco	TOLLWAY 968	0.098		0.037	0.041		20.430				0.00774	0.0955	12.903		3.6419	0.0319					265.39	0.139	10.83		
8/1/11	4:00:00 PM	1044	8.44	TB9A Isco	TOLLWAY 1045	0.067		0.033	0.034		18.148				0.00499	0.0887	11.221		3.3893	0.0256					163.03	0.141	12.58		
8/15/11	5:50:00 PM	1074	9.47	TB9A Isco	TOLLWAY 1053	0.095		0.040	0.037		19.560				0.00489	0.1399	14.633		4.4725	0.0092					205.13	0.189	12.04		
					min	0.067	NA	0.033	0.034	NA	18.148	NA	NA	NA	0.00489	0.0887	11.221	NA	3.3893	0.0092	NA	163.03	NA	0.139	NA	10.83			
					max	0.098	NA	0.040	0.041	NA	20.430	NA	NA	NA	0.00774	0.1399	14.633	NA	4.4725	0.0319	NA	265.39	NA	0.189	NA	12.58			
					mean	0.087	NA	0.037	0.037	NA	19.379	NA	NA	NA	0.00587	0.1080	12.919	NA	3.8346	0.0222	NA	211.18	NA	0.156	NA	11.82			
8/3/11	9:27:37	102.5	8.72	TB15B Isco	TOLLWAY 1042	0.221			0.006		5.718				0.00335	0.1531	1.768		1.1002	0.0020					12.57	0.194	1.72		
					min	0.221	NA	NA	0.006	NA	5.718	NA	NA	NA	0.00335	0.1531	1.768	NA	1.1002	0.0020	NA	12.57	NA	0.194	NA	1.72			
					max	0.221	NA	NA	0.006	NA	5.718	NA	NA	NA	0.00335	0.1531	1.768	NA	1.1002	0.0020	NA	12.57	NA	0.194	NA	1.72			
					mean	0.221	NA	NA	0.006	NA	5.718	NA	NA	NA	0.00335	0.1531	1.768	NA	1.1002	0.0020	NA	12.57	NA	0.194	NA	1.72			

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Date collected	Time collected (cst)	Field conductivity	Field pH	Sample location	Sample ID	Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO ₄ -P	NH ₃ -N	F	Cl	NO ₃ -N	SO ₄	total NVOC	dissolved NVOC			
					MDL:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO ₃	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
8/30/10	12:00:00 PM	NA*	NA*	TB7B-in-isco	TOLLWAY 677			0.92		0.05				0.0215	7.44	30	78	NA	0.01	0.14	0.20	19.12	0.46	7.98	9.78	NA			
9/27/10	12:30:00 PM	NA*	NA*	TB7B-in-isco	TOLLWAY 702			0.97		0.11				0.0118	7.69	50	179	NA	0.01	0.07	0.29	55.21	0.65	25.26	11.55	3.77			
12/7/10	8:15:00 AM	NA*	NA*	TB7B-in-isco	TOLLWAY 731			0.64		0.10				0.0140	8.11	54	119	44.00	0.01	0.15	0.32	35.77	0.52	13.82	3.43	2.80			
3/2/11	4:50:00 PM	NA*	NA*	TB7B-in-isco	TOLLWAY 733			0.50		0.32				0.0306	8.00	64	1129	396.00		0.05	0.23	592.09	0.46	63.19	34.01	3.92			
3/28/11	2:15:00 PM	NA*	NA*	TB7B-in-isco	TOLLWAY 811			0.55		0.24	0.00084			0.0188	7.89	45	372	586.70	0.01	0.31	0.56	144.26	0.62	60.01	39.70	6.26			
4/12/11	8:45:00 AM	2567	8.47	TB7B-in-isco	TOLLWAY 826			1.14		0.27					8.16	61	1098	171.00	0.01	0.30	0.34	575.60	0.38	52.68	18.29	5.95			
4/27/11	11:35:00 AM	8009	6.88	TB7B-in-isco	TOLLWAY 854			2.87		0.76					9.01	72	4274	98.40		0.70		2323.69	0.96	160.42	26.51	11.19			
5/10/11	9:45:00 AM	12001	8.76	TB7B-in-isco	TOLLWAY 869			4.31		1.33		0.023		0.0158	8.45	125	6745	7.20		0.38		3754.62	1.46	320.93	12.01	10.59			
5/24/11	11:30:00 AM	8663	7.90	TB7B-in-isco	TOLLWAY 909			4.01		0.95				0.0155	8.59	119	4806	63.60	0.01	0.36		2564.18	1.14	250.23	15.68	10.53			
6/8/11	11:05:00 AM	598	8.43	TB7B-in-isco	TOLLWAY 927			0.95		0.12					8.12	39	307	38.40	0.01	0.44	0.13	145.74	0.27	18.74	7.59	2.86			
6/21/11	4:13:00 PM	714	7.76	TB7B-in-isco	TOLLWAY 967			1.34		0.12					7.91	44	362	40.80		0.26	0.12	165.23	0.73	23.45	9.87	6.35			
8/1/11	1:50:00 PM	242	8.62	TB7B-in-isco	TOLLWAY 1043			0.57		0.09	0.00267			0.0216	6.84	21	129	29.60	0.01	0.17	0.25	46.98	0.29	13.04	6.66	3.89			
8/16/11	12:00:00 PM	2319	8.65	TB7B-in-isco	TOLLWAY 1062			2.10		0.39				0.0220	7.88	88	1324	6.40	0.01	0.11	0.33	621.61	0.58	134.62	9.02	8.16			
					NA*= not enough sample for field parameters																								
					min	NA	NA	0.50	NA	0.05	0.00000	0.000	NA	0.0000	6.84	21	78	6.40	0.00	0.05	0.00	19.12	0.27	7.98	3.43	2.80			
					max	NA	NA	4.31	NA	1.33	0.00267	0.023	NA	0.0306	9.01	125	6745	586.70	0.01	0.70	0.56	3754.62	1.46	320.93	39.70	11.19			
					mean	NA	NA	1.61	NA	0.37	0.00027	0.002	NA	0.0132	8.01	63	1609	134.74	0.01	0.26	0.21	849.54	0.66	88.03	15.70	6.36			
4/12/11	10:02:00 AM	3975	8.10	TB7B-out Isco	TOLLWAY 825			0.92		0.60				0.0129	7.73	85	2235	NA	0.02	0.15	0.37	987.27	0.26	347.02	15.24	12.88			
4/27/11	11:40:00 AM	4715	6.99	TB7B-out Isco	TOLLWAY 855			1.20		0.62				0.0159	7.88	85	2582	17.20	0.01	0.29	0.27	1264.65	0.31	284.72	19.51	13.48			
5/10/11	10:51:00 AM	3719	8.32	TB7B-out Isco	TOLLWAY 874			1.19		0.80				0.0121	8.13	130	2217	17.60	0.01	0.08	0.24	859.59		456.58	11.95	9.62			
5/24/11	11:35:00 AM	1557	8.07	TB7B-out Isco	TOLLWAY 910			0.98		0.32				0.0117	7.77	68	868	56.80	0.02	0.26	0.23	330.10	0.28	162.01	17.19	10.91			
6/8/11	11:00:00 AM	583	8.75	TB7B-out Isco	TOLLWAY 926			1.09		0.12	0.00260				8.01	58	320	455.00	0.02	0.39	0.16	108.73	0.15	50.18	16.51	5.20			
6/21/11	4:32:00 PM	750	7.88	TB7B-out Isco	TOLLWAY 969			0.96		0.16	0.00126				7.69	52	439	20.00	0.03	0.27	0.12	167.86	0.25	61.72	9.67	8.43			
8/1/11	1:31:00 PM	333	8.78	TB7B-out Isco	TOLLWAY 1044			1.98		0.08	0.02960				7.90	35	202	168.70	0.05	0.25	0.21	46.95	0.30	43.03	16.93	5.95			
8/16/11	2:22:00 PM	687	7.98	TB7B-out Isco	TOLLWAY 1067			1.33		0.15	0.00323				7.28	55	389	14.80	0.04	0.19	0.41	130.55	0.45	69.74	12.48	9.92			
					min	NA	NA	0.92	NA	0.08	0.00000	NA	NA	0.0000	7.28	35	202	14.80	0.01	0.08	0.12	46.95	0.00	43.03	9.67	5.20			
					max	NA	NA	1.98	NA	0.80	0.02960	NA	NA	0.0159	8.13	130	2582	455.00	0.05	0.39	0.41	1264.65	0.45	456.58	19.51	13.48			
					mean	NA	NA	1.21	NA	0.36	0.00459	NA	NA	0.0066	7.80	71	1157	107.16	0.02	0.23	0.25	486.96	0.25	184.38	14.94	9.55			
6/21/11	4:23:00 PM	1422	7.71	TB9A Isco	TOLLWAY 968			1.22		0.22	0.00273			0.0142	7.96	70	743	30.40	0.01	0.16	0.11	364.30	0.22	28.41	15.88	10.77			
8/1/11	4:00:00 PM	1044	8.44	TB9A Isco	TOLLWAY 1045			1.12		0.16	0.00226			0.0146	7.03	47	531	59.00	0.06	0.26	0.26	246.61	0.33	37.65	19.43	10.75			
8/15/11	5:50:00 PM	1074	9.47	TB9A Isco	TOLLWAY 1053			1.49		0.19	0.00366			0.0119	7.60	73	645	45.20	0.08	0.19	0.37	293.08	1.15	33.68	19.94	16.20			
					min	NA	NA	1.12	NA	0.16	0.00226	NA	NA	0.0119	7.03	47	531	30.40	0.01	0.16	0.11	246.61	0.22	28.41	15.88	10.75			
					max	NA	NA	1.49	NA	0.22	0.00366	NA	NA	0.0146	7.96	73	743	59.00	0.08	0.26	0.37	364.30	1.15	37.65	19.94	16.20			
					mean	NA	NA	1.28	NA	0.19	0.00288	NA	NA	0.0136	7.53	63	640	44.87	0.05	0.20	0.25	301.33	0.57	33.25	18.42	12.57			
8/3/11	9:27:37	102.5	8.72	TB15B Isco	TOLLWAY 1042			1.11		0.03	0.00580				7.08	28	67	286.00	0.10	0.06		10.55	0.23	4.68	19.47	5.94			
					min	NA	NA	1.11	NA	0.03	0.00580	NA	NA	NA	7.08	28	67	286.00	0.10	0.06	NA	10.55	0.23	4.68	19.47	5.94			
					max	NA	NA	1.11	NA	0.03	0.00580	NA	NA	NA	7.08	28	67	286.00	0.10	0.06	NA	10.55	0.23	4.68	19.47	5.94			
					mean	NA	NA	1.11	NA	0.03	0.00580	NA	NA	NA	7.08	28	67	286.00	0.10	0.06	NA	10.55	0.23	4.68	19.47	5.94			

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Analytical Results

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
8/16/11	12:00:00 PM	2319	8.65	TB7Bin Isco	TOLLWAY 1062	0.039		0.062	0.0277		39.35				0.00386		10.91		10.56	0.0122		439.7		0.117		47.66
9/28/11	16:30:00 PM	775	9.27	TB7Bin Isco	TOLLWAY 1148	0.081		0.033	0.0259		20.73				0.00928	0.114	3.72		3.82	0.0068		119.9				18.90
10/24/11	13:02:00 PM	1026	8.42	TB7Bin Isco	TOLLWAY 1186	0.061		0.030	0.0280		24.61				0.00731	0.033	5.53		4.83	0.0208		159.6		0.111		26.56
11/30/11	10:30:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1268	0.039		0.032	0.0234		21.16				0.00432		4.87		4.24	0.0052		143.1		0.079		22.52
1/19/12	14:44:00 PM	NA	NA	TB7Bin Isco	TOLLWAY 1369	0.040		0.060	0.2528		95.28				0.01844		24.05		16.58	0.0615		3657.4		0.079		69.53
2/2/12	9:15:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1394	0.057		0.036	0.0750		42.78				0.00810	0.059	6.62		4.88	0.0396		1983.9		0.105		27.04
2/29/12	9:45:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1452	0.630		0.046	0.1297		85.50			0.0089	0.02788	1.281	18.03		13.59	0.0518		1963.2		0.176		48.68
3/28/12	9:00:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1507			0.025	0.0392		34.09				0.00457		4.69		5.49	0.0188		385.1		0.109		21.68
4/26/12	10:26:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1572				0.0325		26.04				0.00730	0.031	2.73		3.27	0.0144		100.6		0.121		12.74
5/8/12	14:14:00 PM	261	8.14	TB7Bin Isco	TOLLWAY 1605				0.0151		10.29				0.00459	0.043	1.40		1.14	0.0122		40.5		0.094		4.58
6/5/12	8:30:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1650	0.055		0.028	0.0297		22.49			0.0086	0.01606	0.047	4.82		4.27	0.0305		149.6		0.115		14.31
6/20/12	8:47:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1672	0.052		0.139	0.0686		122.11				0.00732	0.031	24.91		36.25	0.0363		1189.1				124.06
7/3/12	13:00:00 PM	9232	7.55	TB7Bin Isco	TOLLWAY 1684	0.039		0.163	0.0827		180.88				0.00838	0.033	35.29		54.68	0.0470		1753.2		0.140		194.04
7/17/12	8:45:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1688	0.037		0.167	0.0840		189.58				0.00581	0.050	39.13		55.95	0.0544		1775.5		0.144		213.32
8/1/12	9:05:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1718				0.0179		9.50				0.00719	0.030	1.28		1.28	0.0178		28.4				4.36
8/13/12	11:55:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1721	0.040		0.035	0.0270		19.36				0.01587	0.054	3.09		3.22	0.0154		85.0				12.74
					min	0.037	NA	0.025	0.0151	NA	9.50	NA	NA	0.0086	0.00386	0.030	1.28	NA	1.14	0.0052	NA	28.4	NA	0.079	NA	4.36
					max	0.630	NA	0.167	0.2528	NA	189.58	NA	NA	0.0089	0.02788	1.281	39.13	NA	55.95	0.0615	NA	3657.4	NA	0.176	NA	213.32
					mean	0.097	NA	0.066	0.0600	NA	58.98	NA	NA	0.0088	0.00977	0.150	11.94	NA	14.00	0.0278	NA	873.4	NA	0.116	NA	53.92
8/16/11	14:22:00 PM	687	7.98	TB7Bout Isco	TOLLWAY 1067	0.101		0.048	0.0211		28.00				0.00439	0.101	6.20		5.774	0.0080		104.9		0.170		24.65
8/31/11	12:45:00 PM	535	7.25	TB7Bout Isco	TOLLWAY 1104	0.037		0.035	0.0195		23.64			0.0061	0.00512	0.046	4.36		4.957	0.0084		73.3		0.101		21.74
9/28/11	16:50:00 PM	561	8.88	TB7Bout Isco	TOLLWAY 1149	0.044		0.031	0.0187		24.49				0.00459	0.028	5.02		5.247	0.0021		75.8		0.115		23.11
10/24/11	13:25:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 1188				0.0169		25.11				0.01087	0.038	7.18		5.432	0.0091		82.8		0.159		22.38
11/8/11	12:15:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 1239	0.054		0.031	0.0195		22.95				0.00346	0.071	5.18		5.326	0.0218		62.3		0.139		20.34
11/30/11	12:22:00 PM	762	7.60	TB7Bout Isco	TOLLWAY 1274	0.080		0.038	0.0287		42.79				0.00440	0.088	5.81		9.871	0.0108		107.1		0.159		39.88
1/5/12	12:45:00 PM	918	8.17	TB7Bout Isco	TOLLWAY 1331	0.060		0.032	0.0310		38.35				0.00492	0.098	4.64		8.693	0.0064		133.4		0.152		36.66
2/2/12	14:00:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 1400			0.044	0.0623		88.64				0.00494		9.50		18.987	0.0418		1182.9		0.100		83.03
2/29/12	10:28:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1455			0.058	0.0794		118.54				0.00651	0.032	16.57		22.877	0.0327		1479.5		0.125		98.16
3/28/12	8:25:00 AM	725	7.94	TB7Bout Isco	TOLLWAY 1506	0.067		0.039	0.0267		41.19				0.00582	0.078	4.49		7.424	0.0166		240.1		0.199		37.70
4/26/12	10:33:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1573	0.042		0.037	0.0210		30.46				0.00794		4.34		5.246	0.0022		89.3		0.169		30.28
5/8/12	14:23:00 PM	534	7.80	TB7Bout Isco	TOLLWAY 1606	0.351		0.029	0.0215		25.43				0.00532	0.316	3.06		5.259	0.0138		73.8		0.137		21.14
6/5/12	8:15:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1649	0.043			0.0139		12.68				0.00791	0.076	2.63		2.228	0.0353		37.6		0.204		8.26
7/17/12	10:10:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1698	0.177		0.030	0.0155		8.52			0.0095	0.00901	0.036	2.89		0.965	0.0241		10.8		0.132		2.28
8/1/12	10:20:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1719	0.089			0.0118		7.89				0.00641	0.084	3.92		1.547	0.0053		28.9		0.131		4.20
					min	0.037	NA	0.029	0.0118	NA	7.89	NA	NA	0.0061	0.00346	0.028	2.63	NA	0.965	0.0021	NA	10.8	NA	0.100	NA	2.28
					max	0.351	NA	0.058	0.0794	NA	118.54	NA	NA	0.0095	0.01087	0.316	16.57	NA	22.877	0.0418	NA	1479.5	NA	0.204	NA	98.16
					mean	0.095	NA	0.038	0.0272	NA	35.91	NA	NA	0.0078	0.00611	0.084	5.72	NA	7.322	0.0159	NA	252.2	NA	0.146	NA	31.59

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO4-P mg/L	NH3 -N mg/L	F mg/L	Cl mg/L	NO3 -N mg/L	SO4 mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073			4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
8/16/11	12:00:00 PM	2319	8.65	TB7Bin Isco	TOLLWAY 1062			2.105		0.395				0.0220	7.875	88.0	1324	6.4	0.008	0.11	0.33	622	0.58	134.6	9.02	8.16	
9/28/11	16:30:00 PM	775	9.27	TB7Bin Isco	TOLLWAY 1148			1.306		0.166	0.00180			0.0325	7.249	49.3	394	102.5	0.004	0.04	0.93	153	0.44	47.7	21.72	12.20	
10/24/11	13:02:00 PM	1026	8.42	TB7Bin Isco	TOLLWAY 1186			1.692		0.198				0.0264	7.362	85.6	559	26.0	0.008	0.22	0.85	218	0.70	78.0	17.35	10.98	
11/30/11	10:30:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1268			1.386		0.166				0.0170	7.389	55.2	466	22.4	0.003	0.14	0.41	182	0.27	67.7	10.55	5.27	
1/19/12	14:44:00 PM	NA	NA	TB7Bin Isco	TOLLWAY 1369			2.228		0.814				0.1211	7.845	108.3	9637	172.7	0.011	0.64		5497	1.11	182.2	71.24	9.93	
2/2/12	9:15:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1394			0.822		0.349	0.00113			0.0565	7.465	57.0	5112	154.5	0.006	0.30	0.42	3003	0.36	72.6	38.91	4.29	
2/29/12	9:45:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1452			2.812	0.107	0.712	0.03111			0.1225	7.706	74.2	5288	144.0	0.027	0.39		3004	0.60	128.1	33.43	12.01	
3/28/12	9:00:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1507			0.847		0.267				0.0519	7.093	54.0	1136	192.0	0.005	0.12	0.56	602	0.34	59.8	33.86	4.57	
4/26/12	10:26:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1572			0.871		0.212				0.0248	7.719	43.0	NA	208.0		NA	0.34	149	1.84	37.3	NA	NA	
5/8/12	14:14:00 PM	261	8.14	TB7Bin Isco	TOLLWAY 1605			0.585		0.076				0.0427	7.276	30.7	148	64.4		0.34	0.23	54	0.52	13.0	21.19	4.88	
6/5/12	8:30:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1650			1.465		0.176				0.0398	7.426	60.4	505	58.7	0.004	0.40	0.70	222	0.61	43.7	27.41	14.89	
6/20/12	8:47:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1672			4.501		1.282				0.1197	7.757	165.6	3465	32.0	0.016	0.20	0.54	1729	0.75	319.8	31.29	18.09	
7/3/12	13:00:00 PM	9232	7.55	TB7Bin Isco	TOLLWAY 1684			4.857		1.934				0.0800	8.011	233.5	5466	52.4	0.074	0.65	0.52	2664	0.84	548.3	24.35	12.69	
7/17/12	8:45:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1688			5.099		2.043				0.0389	7.898	236.8	5408	48.8	0.069	0.49	0.28	2638	0.80	561.4	14.55	11.24	
8/1/12	9:05:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1718			0.528		0.060				0.0566	6.942	27.7	127	75.5		0.24	0.23	34	0.49	12.2	16.65	15.57	
8/13/12	11:55:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1721			1.591		0.146	0.00091			0.1254	7.014	46.3	310	47.2	0.029	0.22	0.62	107	1.09	35.6	38.11	19.87	
					min	NA	NA	0.528	0.107	0.060	0.00091	NA	NA	0.0170	6.942	27.7	127	6.4	0.003	0.04	0.23	34	0.27	12.2	9.02	4.29	
					max	NA	NA	5.099	0.107	2.043	0.03111	NA	NA	0.1254	8.011	236.8	9637	208.0	0.074	0.65	0.93	5497	1.84	561.4	71.24	19.87	
					mean	NA	NA	2.043	0.107	0.562	0.00874	NA	NA	0.0611	7.502	88.5	2623	88.0	0.020	0.30	0.50	1305	0.71	146.4	27.31	10.97	
8/16/11	14:22:00 PM	687	7.98	TB7Bout Isco	TOLLWAY 1067			1.330		0.1492	0.00323				7.28	54.7	389	14.8	0.045	0.19	0.41	131	0.45	69.74	12.48	9.92	
8/31/11	12:45:00 PM	535	7.25	TB7Bout Isco	TOLLWAY 1104			0.975		0.1270	0.00115				7.19	39.6	289	4.8	0.035	0.20	0.33	91	0.29	60.49	8.63	7.44	
9/28/11	16:50:00 PM	561	8.88	TB7Bout Isco	TOLLWAY 1149			1.071		0.1167					7.27	42.8	308	6.0	0.038	0.09	0.27	98	0.57	62.12	7.61	6.07	
10/24/11	13:25:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 1188			1.321		0.1222			0.0108		6.95	54.0	527		0.040	0.24	0.42	190	1.03	89.91	10.79	11.10	
11/8/11	12:15:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 1239			1.009		0.1049	0.00126				7.17	42.2	267	16.0	0.038	0.08	0.33	75	0.22	58.70	10.07	6.87	
11/30/11	12:22:00 PM	762	7.60	TB7Bout Isco	TOLLWAY 1274			1.614		0.1950	0.00241				7.32	63.5	474	1.6	0.023	0.26	0.33	75	0.22	58.70	10.07	6.87	
1/5/12	12:45:00 PM	918	8.17	TB7Bout Isco	TOLLWAY 1331			1.254		0.1632	0.00164		0.0105		7.25	53.4	514	27.6	0.036	0.08	0.32	182	0.35	102.11	10.14	4.88	
2/2/12	14:00:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 1400		0.22	1.300		0.4204		0.025		0.0257	7.84	74.1	3378	28.8	0.020	0.26	0.52	1799	0.42	225.41	12.89	5.94	
2/29/12	10:28:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1455		0.15	1.275		0.6636		0.021		0.0167	7.85	85.7	4282	31.6	0.010	0.10	0.56	2325	0.33	269.89	11.89	8.39	
3/28/12	8:25:00 AM	725	7.94	TB7Bout Isco	TOLLWAY 1506			1.013		0.2045	0.00140			0.0762	7.18	50.6	787	25.6	0.047	0.07	0.34	355	0.30	104.79	11.79	6.86	
4/26/12	10:33:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1573			0.857		0.1501				0.0113	7.78	45.7	NA	48.4	0.043	NA	0.36	113	1.24	91.69	NA	NA	
5/8/12	14:23:00 PM	534	7.80	TB7Bout Isco	TOLLWAY 1606			1.714		0.1360	0.01208			0.1034	7.66	49.0	330	99.5	0.028	0.24	0.21	98	0.45	61.01	23.41	7.86	
6/5/12	8:15:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1649			0.813		0.0617	0.00091			0.0170	7.41	32.3	156	8.0	0.094	0.13	0.28	46	0.18	25.57	7.84	7.79	
7/17/12	10:10:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1698			0.559		0.0357	0.00083			0.0464	7.28	28.5	75	43.2	0.108	0.50	0.20	11	0.72	6.77	14.11	12.85	
8/1/12	10:20:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1719			1.114		0.0428	0.00184			0.0275	7.20	31.5	125	17.2	0.114	0.13	0.20	33	0.47	11.73	12.34	8.86	
					min	NA	0.15	0.559	NA	0.0357	0.00083	0.021	NA	0.0105	6.95	28.5	75	1.6	0.010	0.07	0.20	11	0.18	6.77	7.30	4.88	
					max	NA	0.22	1.714	NA	0.6636	0.01208	0.025	NA	0.1034	7.85	85.7	4282	99.5	0.114	0.50	0.56	2325	1.24	269.89	23.41	12.85	
					mean	NA	0.19	1.148	NA	0.1795	0.00268	0.023	NA	0.0345	7.38	49.8	850	26.7	0.048	0.18	0.33	379	0.49	90.59	11.52	7.96	

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
4/26/12	10:35:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1574	1.597		0.034	0.0154		7.933				0.00704	1.012	4.24		2.342	0.0063		25.06		0.345		2.57
5/8/12	8:44:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1596	0.215		0.034	0.0119		8.634				0.00882	0.180	2.85		1.339	0.0033		34.75		0.136		4.42
6/4/12	18:00:00 PM	NA	NA	TB19sw Isco	TOLLWAY 1643	0.305			0.0074		8.107				0.00351	0.235	5.24		1.392	0.0032		8.32		0.242		0.99
6/19/12	12:39:00 PM	NA	NA	TB19sw Isco	TOLLWAY 1676	0.144		0.042	0.0083		10.738				0.00585	0.088	8.72		1.508	0.0016		10.50		2.385		2.13
7/2/12	11:57:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1686	0.061		0.086	0.0152		17.722				0.01196	0.025	20.44		2.491	0.0114		15.12		0.464		4.74
7/18/12	9:32:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1699	5.168		0.063	0.0214		38.399		0.01121		0.01776		11.48		0.531			6.41		0.108		4.83
7/30/12	16:04:00 PM	157	7.80	TB19sw Isco	TOLLWAY 1708	0.630			0.0109		10.733				0.00548	0.445	4.78		1.548	0.0051		18.55		0.334		2.59
8/14/12	11:15:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1732	0.190		0.062	0.0144		15.403				0.01239	0.196	13.04		2.199	0.0038		16.19		0.433		4.11
					min	0.061	NA	0.034	0.0074	NA	7.933	NA	NA	0.01121	0.00351	0.025	2.85	NA	0.531	0.0016	NA	6.41	NA	0.108	NA	0.99
					max	5.168	NA	0.086	0.0214	NA	38.399	NA	NA	0.01121	0.01776	1.012	20.44	NA	2.491	0.0114	NA	34.75	NA	2.385	NA	4.83
					mean	1.039	NA	0.054	0.0131	NA	14.709	NA	NA	0.01121	0.00910	0.311	8.85	NA	1.669	0.0050	NA	16.86	NA	0.556	NA	3.30
10/10/11	13:26:00 PM	1590	7.87	TB19gw Isco	TOLLWAY 1154			0.114	0.0705		79.811				0.00671		26.27		29.222	0.0086		246.31		0.199		47.16
10/26/11	8:05:00 AM	NA	NA	TB19gw Isco	TOLLWAY 1203	0.042		0.073	0.0639		80.237				0.00577		19.39		24.680	0.0209		217.22		0.078		42.02
11/8/11	16:31:00 PM	616	8.66	TB19gw Isco	TOLLWAY 1246	0.454		0.049	0.0340		41.440				0.00647	0.359	11.46		12.377	0.0207		112.86		0.149		14.31
11/30/11	8:35:00 AM	721	8.08	TB19gw Isco	TOLLWAY 1265	0.156		0.043	0.0264		38.360				0.00597	0.127	10.78		11.644	0.0084		99.34		0.163		14.42
1/3/12	14:17:00 PM	892	7.90	TB19gw Isco	TOLLWAY 1311	0.205		0.045	0.0357		52.869				0.00618	0.176	13.91		14.910	0.0045		123.76		0.156		14.07
2/1/12	14:31:00 PM	NA	NA	TB19gw Isco	TOLLWAY 1389			0.046	0.1557		175.903				0.00428		21.20		46.825	0.0126		614.81		0.162		17.20
2/16/12	8:49:00 AM	4793	7.83	TB19gw Isco	TOLLWAY 1422			0.058	0.1783		188.010				0.00482		31.68		53.767	0.0185		732.41		0.184		44.90
2/29/12	13:00:00 PM	NA	NA	TB19gw Isco	TOLLWAY 1460	0.105		0.045	0.1353		140.815				0.00611	0.074	26.64		34.412	0.0104		977.59		0.162		22.91
3/14/12	16:30:00 PM	NA	NA	TB19gw Isco	TOLLWAY 1462	0.066		0.052	0.1097		114.758				0.00786	0.056	26.61		31.921	0.0083		826.70		0.193		24.01
3/27/12	16:40:00 PM	2750	7.94	TB19gw Isco	TOLLWAY 1503	0.342		0.070	0.0856		82.521				0.01161	0.262	23.68		26.455	0.0077		557.98		0.214		25.17
4/11/12	9:46:00 AM	3490	8.32	TB19gw Isco	TOLLWAY 1539			0.080	0.1025		94.725				0.00948	0.058	28.60		34.479	0.0133		604.60		0.213		36.23
4/24/12	10:54:00 AM	1855	8.17	TB19gw Isco	TOLLWAY 1554	1.242		0.079	0.0648		59.234				0.01183	0.964	20.24		24.922	0.0139		308.02		0.290		22.24
5/8/12	8:26:00 AM	2753	7.98	TB19gw Isco	TOLLWAY 1595	0.405		0.077	0.0724		67.726				0.01184	0.321	19.56		24.794	0.0139	0.031	471.34		0.166		29.61
5/23/12	12:54:00 PM	3077	7.41	TB19gw Isco	TOLLWAY 1619	0.091		0.080	0.0627		63.885				0.01033	0.100	20.50		23.779	0.0101		396.47		0.215		31.11
6/4/12	18:12:00 PM	1678	8.02	TB19gw Isco	TOLLWAY 1644	0.891		0.055	0.0433		41.287		0.0070		0.01518	0.797	14.36		13.541	0.0152		280.19		0.250		19.38
6/19/12	12:15:00 PM	NA	NA	TB19gw Isco	TOLLWAY 1670	1.207		0.069	0.0430		39.767				0.01620	0.966	15.67		12.489	0.0142		261.42		0.116		21.86
7/18/12	9:31:00 AM	2258	7.64	TB19gw Isco	TOLLWAY 1691	0.116		0.090	0.0710		63.896				0.01251	0.109	24.60		20.063	0.0086		363.62		0.088		37.65
7/30/12	15:47:00 PM	1379	7.69	TB19gw Isco	TOLLWAY 1707	1.039		0.030	0.0576		51.754				0.01668	0.952	21.77		14.563	0.0195		222.73		0.100		22.55
8/14/12	11:04:00 AM	1976	7.34	TB19gw Isco	TOLLWAY 1731	0.076		0.093	0.0733		65.638				0.01143	0.101	23.28		19.372	0.0039		310.71		0.088		38.09
					min	0.042	NA	0.030	0.0264	NA	38.360	NA	NA	0.0070	0.00428	0.056	10.78	NA	11.644	0.004	0.031	99.34	NA	0.078	NA	14.07
					max	1.242	NA	0.114	0.1783	NA	188.010	NA	NA	0.0070	0.01668	0.966	31.68	NA	53.767	0.021	0.031	977.59	NA	0.290	NA	47.16
					mean	0.429	NA	0.066	0.0782	NA	81.191	NA	NA	0.0070	0.00954	0.362	21.06	NA	24.959	0.012	0.031	406.74	NA	0.168	NA	27.63

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO4-P mg/L	NH3 -N mg/L	F mg/L	Cl mg/L	NO3 -N mg/L	SO4 mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073			4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
4/26/12	10:35:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1574			4.726		0.0308	0.04014			0.0154	7.72	44.1	146	102	0.220		0.17	23.0	0.74	6.59	28.99	21.33	
5/8/12	8:44:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1596			2.817		0.0342	0.00728			0.0438	7.54	68.9	132	336	0.012	NA	0.19	20.7	0.92	9.37	NA	NA	
6/4/12	18:00:00 PM	NA	NA	TB19sw Isco	TOLLWAY 1643			1.820		0.0260	0.00924				7.42	41.1	69	101	0.124	0.08	0.11	5.8	0.17	2.95	NA	6.31	
6/19/12	12:39:00 PM	NA	NA	TB19sw Isco	TOLLWAY 1676			2.748		0.0356	0.00486			0.0133	7.39	48.0	89	53	0.244	0.04	0.15	8.1	0.37	5.76	14.48	9.77	
7/2/12	11:57:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1686			4.635		0.0643	0.00109			0.0909	7.69	75.7	182		0.348	0.97	0.46	10.3	1.16	12.31	43.06	40.44	
7/18/12	9:32:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1699			4.915		0.1190	0.00069				NA	NA	208	977	0.024	NA	0.23	6.9	1.88	14.76	NA	NA	
7/30/12	16:04:00 PM	157	7.80	TB19sw Isco	TOLLWAY 1708			2.679		0.0301	0.01006			0.0297	7.69	49.0	104	264	0.239	0.11	0.12	14.6	0.49	7.12	19.13	8.71	
8/14/12	11:15:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1732			3.791		0.0518	0.00705			0.0322	7.79	64.2	135	72	0.385	0.33	0.15	11.3	0.69	11.50	27.46	20.27	
					min	NA	NA	1.820	NA	0.0260	0.00069	NA	NA	0.0133	7.39	41.1	69	53	0.012	0.04	0.11	5.8	0.17	2.95	14.48	6.31	
					max	NA	NA	4.915	NA	0.1190	0.04014	NA	NA	0.0909	7.79	75.7	208	977	0.385	0.97	0.46	23.0	1.88	14.76	43.06	40.44	
					mean	NA	NA	3.516	NA	0.0490	0.01005	NA	NA	0.0375	7.61	55.9	133	272	0.200	0.31	0.20	12.6	0.80	8.79	26.62	17.80	
10/10/11	13:26:00 PM	1590	7.87	TB19gw Isco	TOLLWAY 1154			7.085		0.4983				0.0135	8.16	236.4	1028	8	0.008	0.75	0.31	351.0	1.61	134.79	19.95	18.76	
10/26/11	8:05:00 AM	NA	NA	TB19gw Isco	TOLLWAY 1203			5.990		0.4175				0.0184	8.32	221.3	922		0.013	0.15	0.37	314.0	1.30	108.90	17.95	16.69	
11/8/11	16:31:00 PM	616	8.66	TB19gw Isco	TOLLWAY 1246			4.903		0.1868	0.01196			0.0101	8.12	177.0	475	22	0.055		0.33	126.2	0.71	40.87	14.28	11.57	
11/30/11	8:35:00 AM	721	8.08	TB19gw Isco	TOLLWAY 1265			4.194		0.1778	0.00388				8.18	158.8	427	13	0.054	0.07	0.33	109.5	0.92	38.40	13.35	10.56	
1/3/12	14:17:00 PM	892	7.90	TB19gw Isco	TOLLWAY 1311			4.243		0.2478	0.00641				8.14	160.4	525	14	0.035		0.30	174.1	1.21	39.71	15.37	12.51	
2/1/12	14:31:00 PM	NA	NA	TB19gw Isco	TOLLWAY 1389			3.193		0.6808					8.06	129.1	2266	7	0.017		0.16	1266.6	1.49	49.85	10.41	9.06	
2/16/12	8:49:00 AM	4793	7.83	TB19gw Isco	TOLLWAY 1422		0.19	4.477		1.0541				0.1500	7.94	207.2	2708		0.027	0.05	0.36	1370.6	2.38	129.32	10.47	9.98	
2/29/12	13:00:00 PM	NA	NA	TB19gw Isco	TOLLWAY 1460			4.158		0.7820	0.00138				8.12	159.4	3136	6	0.020	0.09	0.27	1735.1	1.88	64.47	10.99	9.83	
3/14/12	16:30:00 PM	NA	NA	TB19gw Isco	TOLLWAY 1462			4.354		0.6360	0.00067			0.1002	8.16	191.3	2603	6	0.048	0.05	0.24	1355.8	2.68	66.68	10.69	9.41	
3/27/12	16:40:00 PM	2750	7.94	TB19gw Isco	TOLLWAY 1503			5.903		0.4618	0.00816				8.12	236.7	1795	10	0.060	0.05	0.30	860.2	1.93	67.90	18.68	15.25	
4/11/12	9:46:00 AM	3490	8.32	TB19gw Isco	TOLLWAY 1539			6.082		0.5963	0.00095				8.23	287.8	1942		0.036		0.21	906.4	2.44	99.20	12.75	12.02	
4/24/12	10:54:00 AM	1855	8.17	TB19gw Isco	TOLLWAY 1554			7.883		0.3330	0.03312				8.08	238.7	1095	53	0.103		0.35	432.4	2.51	59.95	25.64	19.42	
5/8/12	8:26:00 AM	2753	7.98	TB19gw Isco	TOLLWAY 1595			6.417		0.4348	0.01160			0.0642	8.06	272.7	1553	4	0.049	0.05	0.37	692.8	1.68	78.02	18.82	17.23	
5/23/12	12:54:00 PM	3077	7.41	TB19gw Isco	TOLLWAY 1619			6.459		0.3678	0.00225				8.23	321.4	1381		0.043	0.03	0.36	542.9	1.71	95.17	19.96	17.30	
6/4/12	18:12:00 PM	1678	8.02	TB19gw Isco	TOLLWAY 1644			7.029		0.2289	0.02448				8.22	203.5	943	26	0.082		0.44	371.4	1.11	57.24	24.97	14.29	
6/19/12	12:15:00 PM	NA	NA	TB19gw Isco	TOLLWAY 1670			7.791		0.2438	0.03174			0.1409	8.11	204.8	867	20	0.081	0.07	0.44	326.7	1.64	59.85	37.96	23.15	
7/18/12	9:31:00 AM	2258	7.64	TB19gw Isco	TOLLWAY 1691			6.656		0.4361	0.00220				8.06	246.2	1295	14	0.042		0.38	504.8	2.63	111.33	19.81	17.71	
7/30/12	15:47:00 PM	1379	7.69	TB19gw Isco	TOLLWAY 1707			8.879		0.2721	0.02750				7.93	230.4	790	18	0.054		0.37	258.7	2.32	65.57	24.89	17.72	
8/14/12	11:04:00 AM	1976	7.34	TB19gw Isco	TOLLWAY 1731			7.187		0.4077	0.00157				8.22	266.2	1126	3	0.055		0.35	406.2	2.19	110.71	19.34	19.43	
					min	NA	0.19	3.193	NA	0.1778	0.00067	NA	NA	0.0101	7.93	129.1	427	3	0.008	0.03	0.16	109.5	0.71	38.40	10.41	9.06	
					max	NA	0.19	8.879	NA	1.0541	0.03312	NA	NA	0.1500	8.32	321.4	3136	53	0.103	0.75	0.44	1735.1	2.68	134.79	37.96	23.15	
					mean	NA	0.19	5.941	NA	0.4454	0.01119	NA	NA	0.0710	8.13	218.4	1415	15	0.046	0.14	0.33	637.1	1.81	77.79	18.23	14.84	

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Analytical Results

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22	
8/29/12	9:34:00 AM	1496	7.44	TB7Bin Isco	TOLLWAY 1743	0.048		0.046	0.0366		32.33				0.00938				7.73								33.05
9/11/12	12:34:00 PM	2276	7.45	TB7Bin Isco	TOLLWAY 1765				0.076	0.0395	47.30			0.0060	0.00933				12.04								59.75
9/26/12	8:41:00 AM	2544	7.68	TB7Bin Isco	TOLLWAY 1780				0.066	0.0402	56.98				0.00999				10.36								69.76
10/9/12	15:00:00 PM	NA	NA	TB7Bin Isco	TOLLWAY 1792	0.105		0.067	0.0450		36.48				0.01758	0.072			6.55								37.49
10/22/12	13:00:00 PM	982	7.10	TB7Bin Isco	TOLLWAY 1811				0.047	0.0294	27.81				0.00999	0.044			4.83								27.44
11/6/12	11:08:00 AM	272	7.38	TB7Bin Isco	TOLLWAY 1837	0.050		0.023	0.0219		10.86				0.00599	0.040			2.00								6.98
11/19/12	13:41:00 PM	885	6.95	TB7Bin Isco	TOLLWAY 1850	0.049		0.056	0.0353		25.92				0.01426	0.086			5.26								25.42
12/4/12	13:53:00 PM	11274	6.90	TB7Bin Isco	TOLLWAY 1869				0.095	0.2780	87.27				0.00880	0.057			17.92								112.01
12/18/12	14:10:00 PM	1586	7.40	TB7Bin Isco	TOLLWAY 1896	0.050		0.045	0.0312		40.14				0.00719	0.047			6.80								50.32
1/7/13	13:17:00 PM	9143	7.76	TB7Bin Isco	TOLLWAY 1916	0.038		0.041	0.1984		44.56				0.00250				7.95								42.04
1/23/13	15:29:00 PM	10417	7.76	TB7Bin Isco	TOLLWAY 1936			0.129	0.1134		187.04					0.037			40.69		0.024						245.32
2/20/13	11:10:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1988	0.063		0.031	0.1842		94.37					0.034			14.01								37.37
3/20/13	13:31:00 PM	29635	7.17	TB7Bin Isco	TOLLWAY 2041			0.064	0.2170		175.31			0.0103	0.00941	0.051			41.73								107.90
4/16/13	13:28:00 PM	2465	7.95	TB7Bin Isco	TOLLWAY 2088			0.044	0.0382		42.70			0.0154	0.02426	0.028			5.52								39.45
4/29/13	12:56:00 PM	1531	7.82	TB7Bin Isco	TOLLWAY 2097	0.061		0.031	0.0240		37.99					0.041			5.02								35.89
5/15/13	10:37:00 AM	8446	7.35	TB7Bin Isco	TOLLWAY 2146			0.100	0.0728		123.97			0.0059	0.01191				22.97								117.39
5/24/13	10:00:00 AM	3558	7.05	TB7Bin Isco	TOLLWAY 2154			0.058	0.0395		60.15				0.00371	0.037			11.13								57.78
6/11/13	12:57:00 PM	2452	7.45	TB7Bin Isco	TOLLWAY 2202	0.052		0.053	0.0320		44.66				0.01113	0.048			7.46								39.00
6/25/13	13:39:00 PM	1056	7.65	TB7Bin Isco	TOLLWAY 2234	0.037		0.030	0.0354		23.99			0.0063	0.00866	0.025			4.10								18.61
7/9/13	12:50:00 PM	73	7.25	TB7Bin Isco	TOLLWAY 2262				0.0143		6.00				0.00169				0.61								2.27
7/23/13	13:02:00 PM	329	7.87	TB7Bin Isco	TOLLWAY 2284				0.0185		11.45				0.00773	0.042			1.76								6.89
8/7/13	10:22:00 AM	630	7.90	TB7Bin Isco	TOLLWAY 2317	0.069		0.025	0.0248		17.72				0.00839	0.063			2.63								12.23
8/19/13	11:48:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 2326	0.410		0.087	0.0612		38.17			0.0080	0.03529	0.085			6.62		0.024						37.11
					min	0.037	NA	0.023	0.0143	NA	6.00	NA	NA	0.0059	0.00169	0.025		NA	0.70	0.0049	0.024	8.4	NA	0.075	NA	2.27	
					max	0.410	NA	0.129	0.2780	NA	187.04	NA	NA	0.0154	0.03529	0.086		NA	56.59	0.0844	0.024	7219.7	NA	0.139	NA	245.32	
					mean	0.086	NA	0.058	0.0709	NA	55.35	NA	NA	0.0087	0.01086	0.049		NA	11.81	0.0196	0.024	998.6	NA	0.106	NA	53.11	
8/29/12	10:12:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1744	0.045		0.064	0.0272	0.003	10.54			0.0112	0.01234	0.047			4.77								6.98
9/12/12	12:50:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 1766	0.086			0.0149		9.80				0.00925				6.03								5.90
10/22/12	14:00:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 1812	0.068			0.0142		9.96				0.00685	0.071			4.04								7.11
11/6/12	12:01:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 1838	0.150			0.0124		10.36				0.00141	0.146			3.55								7.55
1/7/13	14:20:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 1900	0.037			0.0334		29.82				0.00226				4.23								25.70
1/23/13	16:00:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 1933				0.0237		18.17				0.00439	0.026			3.53								20.24
2/7/13	14:40:00 PM	1394	7.74	TB7Bout Isco	TOLLWAY 1965	0.311		0.026	0.0378		42.14				0.00554	0.300			5.08								33.77
2/20/13	11:42:00 AM	6174	8.01	TB7Bout Isco	TOLLWAY 1987			0.039	0.0744		85.89					0.029			10.33								69.13
5/15/13	10:45:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 2151	0.043		0.045	0.0270		26.63				0.00798	0.051			5.12								24.65
5/29/13	17:13:00 PM	513	7.55	TB7Bout Isco	TOLLWAY 2175	0.924		0.042	0.0234		21.03				0.00681	0.781			3.42								17.82
6/11/13	12:42:00 PM	610	7.80	TB7Bout Isco	TOLLWAY 2201	0.500		0.034	0.0200		19.91				0.00547	0.429			3.50								17.95
6/13/13	12:25:00 PM	449	6.85	TB7Bout Isco	TOLLWAY 2213	0.191		0.025	0.0138		13.52				0.00469	0.167			3.35								10.69
6/25/13	15:45:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 2239	0.070		0.030	0.0197		10.60				0.00999	0.064			2.91								7.13
7/9/13	14:55:00 PM	630	7.63	TB7Bout Isco	TOLLWAY 2268	0.065		0.045	0.0288		28.24				0.00432	0.063			3.05								22.30
7/23/13	15:03:00 PM	NA	NA	TB7Bout Isco	TOLLWAY 2289	0.052			0.0074		5.13				0.00508	0.055			3.57								3.18
8/7/13	11:40:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 2322	0.075		0.025	0.0150		9.54				0.00735	0.068			4.28								4.56
					min	0.037	NA	0.025	0.0074	0.003	5.13	NA	NA	0.0112	0.00141	0.026		NA	1.01	0.0019	NA	18.6	NA	0.119	NA	3.18	
					max	0.924	NA	0.064	0.0744	0.003	85.89	NA	NA	0.0112	0.01234	0.781		NA	17.28	0.0282	NA	1160.7	NA	0.316	NA	69.13	
					mean	0.187	NA	0.038	0.0246	0.003	21.95	NA	NA	0.0112	0.00625	0.164		NA	4.68	0.0100	NA	164.0	NA	0.161	NA	17.79	

APPENDIX A1: Results of Geochemical Analysis of Isco Surface-Water Samples (con't.)

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
8/28/12	13:26:00 PM	NA	NA	TB9A Isco	TOLLWAY 1740	0.037		0.041	0.0456		22.94				0.00817	0.093	15.05		4.10	0.0155		209.3		0.116		10.69
9/10/12	13:01:00 PM	889	7.92	TB9A Isco	TOLLWAY 1756			0.030	0.0391	0.00063	19.74				0.00655	0.100	11.81		3.53	0.0121		154.0		0.146		7.14
9/25/12	12:30:00 PM	NA	NA	TB9A Isco	TOLLWAY 1778			0.027	0.0677		38.53				0.00449	0.053	22.03		7.42	0.0071		365.2		0.077		12.15
10/8/12	15:45:00 PM	NA	NA	TB9A Isco	TOLLWAY 1789			0.075	0.0951		47.45				0.00638	0.050	28.52		9.16	0.0025		477.9		0.167		27.43
10/22/12	15:09:00 PM	1373	7.48	TB9A Isco	TOLLWAY 1815			0.041	0.0468		25.93				0.00575	0.055	14.67		5.11	0.0041		238.4		0.112		16.52
11/5/12	16:40:00 PM	1218	7.55	TB9A Isco	TOLLWAY 1835			0.042	0.0496		29.70				0.00361	0.031	10.54		7.25	0.0017		186.0				22.76
11/19/12	14:52:00 PM	3172	8.22	TB9A Isco	TOLLWAY 1852			0.059	0.0486		27.96				0.00590	0.059	19.03		5.67	0.0038		299.1				17.40
12/4/12	9:15:00 AM	NA	NA	TB9A Isco	TOLLWAY 1867			0.045	0.0682		37.26				0.00588	0.052	16.42		6.68	0.0062		589.8		0.162		16.60
12/18/12	12:38:00 PM	1954	7.81	TB9A Isco	TOLLWAY 1894	0.043		0.038	0.0520		36.58				0.00382	0.075	20.23		7.01	0.0056		350.5		0.103		25.81
1/7/13	15:58:00 PM	2737	7.73	TB9A Isco	TOLLWAY 1915			0.033	0.0927		58.55				0.038	0.038	14.86		15.27	0.0251		706.5		0.155		50.48
1/23/13	14:38:00 PM	4494	7.77	TB9A Isco	TOLLWAY 1935			0.031	0.1046		73.76				0.00294	0.035	21.59		17.60	0.1064		801.7		0.115		55.04
2/7/13	15:10:00 PM	3375	7.42	TB9A Isco	TOLLWAY 1967	0.045		0.031	0.0749		67.86				0.00538	0.066	10.95		14.86	0.0755		588.1		0.080		47.29
3/19/13	16:19:00 PM	NA	NA	TB9A Isco	TOLLWAY 2034			0.040	0.0989		128.17				0.00406	0.030	14.35		33.44	0.1919		1319.0				78.43
4/4/13	NA	NA	NA	TB9A Isco	TOLLWAY 2065			0.049	0.3011		255.03				0.00614		71.64		40.68	0.1600		3245.4		0.083		93.41
4/17/13	9:51:00 AM	5337	8.05	TB9A Isco	TOLLWAY 2090			0.052	0.1197		99.10				0.00931	0.045	20.89		21.08	0.2601		1026.0		0.112		58.96
4/29/13	15:24:00 PM	814	7.44	TB9A Isco	TOLLWAY 2103	0.058		0.047	0.0204		24.99				0.00242	0.076	2.14		6.85	0.0069		132.3				19.72
5/14/13	13:00:00 PM	NA	NA	TB9A Isco	TOLLWAY 2141	0.037		0.054	0.0731		42.77				0.00577	0.145	22.44		6.90	0.1811		768.0		0.121		19.88
5/29/13	11:06:00 AM	839	7.61	TB9A Isco	TOLLWAY 2168	0.255		0.037	0.0326		21.47				0.00435	0.243	4.17		4.08	0.0280		146.4		0.095		12.25
6/11/13	15:12:00 PM	1625	7.17	TB9A Isco	TOLLWAY 2207			0.038	0.0483		33.10				0.00365	0.072	7.42		6.11	0.0560		280.7		0.122		17.78
6/26/13	11:47:00 AM	572	7.67	TB9A Isco	TOLLWAY 2241	0.131		0.025	0.0235		14.93				0.00321	0.093	3.13		3.07	0.0367		96.7		0.091		8.17
7/10/13	10:56:00 AM	790	7.23	TB9A Isco	TOLLWAY 2270	0.074		0.050	0.0513		28.08				0.02371	0.276	3.67		7.11	0.0311		128.5				19.12
7/22/13	15:39:00 PM	1303	8.14	TB9A Isco	TOLLWAY 2280			0.048	0.0458		26.00				0.00603	0.057	13.26		3.68	0.0054		253.5		0.169		15.97
8/6/13	12:37:00 PM	858	8.34	TB9A Isco	TOLLWAY 2311	0.057		0.036	0.0279		16.25				0.00510	0.095	8.36		2.37	0.0112		144.4		0.162		7.77
					min	0.037	NA	0.025	0.0204	0.00063	14.93	NA	NA	NA	0.00242	0.030	2.14	NA	2.37	0.0017	NA	96.7	NA	0.077	NA	7.14
					max	0.255	NA	0.075	0.3011	0.00063	255.03	NA	NA	NA	0.02371	0.276	71.64	NA	40.68	0.2601	NA	3245.4	NA	0.169	NA	93.41
					mean	0.082	NA	0.042	0.0708	0.00063	51.14	NA	NA	NA	0.00603	0.084	16.40	NA	10.39	0.0536	NA	543.8	NA	0.122	NA	28.73
2/7/13	15:58:00 PM	712	7.61	TB15Bsw Isco	TOLLWAY 1971	0.157			0.0171		13.96				0.00821	0.136	3.84		1.67	0.0118		126.4		0.185		6.50
4/16/13	9:51:00 AM	499	8.17	TB15Bsw Isco	TOLLWAY 2076	5.338		0.030	0.0252		7.09				0.00824	2.904	4.68		2.08	0.0118		67.8		0.170		4.57
4/30/13	14:55:00 PM	333	7.73	TB15Bsw Isco	TOLLWAY 2112	0.629		0.037	0.0102		6.96				0.00240	0.391	1.72		0.73	0.0027		61.0				4.29
5/28/13	14:04:00 PM	119	8.01	TB15Bsw Isco	TOLLWAY 2160	0.074			0.0052		3.96				0.00337	0.070	1.22		0.66			20.5		0.138		2.14
6/11/13	8:30:00 AM	NA	NA	TB15Bsw Isco	TOLLWAY 2190	0.545		0.027	0.0706		10.44				0.00812	0.373	2.17		2.73	0.0519		27.5		0.157		3.05
6/25/13	8:46:00 AM	NA	NA	TB15Bsw Isco	TOLLWAY 2222	0.989		0.028	0.1425		6.45				0.00763	0.644	3.70		1.41	0.0038		19.7		0.160		3.26
7/9/13	8:23:00 AM	81	7.29	TB15Bsw Isco	TOLLWAY 2253	0.212			0.0060		3.76				0.00302	0.155	1.87		0.79	0.0025		12.7				1.27
					min	0.074	NA	0.027	0.0052	NA	3.76	NA	NA	NA	0.00240	0.070	1.22	NA	0.66	0.0025	NA	12.7	NA	0.138	NA	1.27
					max	5.338	NA	0.037	0.1425	NA	13.96	NA	NA	NA	0.00824	2.904	4.68	NA	2.73	0.0519	NA	126.4	NA	0.185	NA	6.50
					mean	1.135	NA	0.030	0.0395	NA	7.52	NA	NA	NA	0.00585	0.668	2.74	NA	1.44	0.0141	NA	47.9	NA	0.162	NA	3.58

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Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097		4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
8/28/12	13:26:00 PM	NA	NA	TB9A Isco	TOLLWAY 1740			1.553		0.242	0.00076			0.0151	7.86	84	668	20.8	0.075	0.14	0.38	309	0.20	29.11	19.38	16.37
9/10/12	13:01:00 PM	889	7.92	TB9A Isco	TOLLWAY 1756			1.198		0.188	0.00166			0.0148	7.60	74	496	6.0	0.133	0.18	0.28	225	0.33	20.00	17.09	13.56
9/25/12	12:30:00 PM	NA	NA	TB9A Isco	TOLLWAY 1778			1.111		0.375	0.00150			0.2216	8.27	151	1146	30.4	0.039	0.09	0.42	593	0.77	36.63	19.45	18.03
10/8/12	15:45:00 PM	NA	NA	TB9A Isco	TOLLWAY 1789			1.130		0.498	0.00071			0.0203	8.22	165	1504		0.087	0.04	0.51	738	4.06	80.06	38.81	17.72
10/22/12	15:09:00 PM	1373	7.48	TB9A Isco	TOLLWAY 1815			1.351		0.257					7.75	93	730	12.8	0.037	0.06	0.33	342	0.11	46.44	15.67	10.49
11/5/12	16:40:00 PM	1218	7.55	TB9A Isco	TOLLWAY 1835			1.126		0.258			0.0099	7.63	78	604	11.2	0.026	0.10	0.25	259	0.30	67.21	12.06	8.21	
11/19/12	14:52:00 PM	3172	8.22	TB9A Isco	TOLLWAY 1852			0.894		0.283	0.00073			0.0109	7.88	104	927	62.4	0.026	0.05	0.43	440	0.34	52.50	16.05	15.02
12/4/12	9:15:00 AM	NA	NA	TB9A Isco	TOLLWAY 1867			0.639		0.401				0.0200	7.61	85	1743		0.025	0.10	0.51	967	0.34	44.55	16.33	10.56
12/18/12	12:38:00 PM	1954	7.81	TB9A Isco	TOLLWAY 1894			1.249		0.350			0.1254	7.85	105	1046	62.9	0.017	0.07	0.48	509	0.32	70.34	18.91	11.86	
1/7/13	15:58:00 PM	2737	7.73	TB9A Isco	TOLLWAY 1915			1.591		0.564			0.0548	7.42	86	2018	11.1	0.021	0.24	0.11	1066	0.83	130.79	11.09	7.82	
1/23/13	14:38:00 PM	4494	7.77	TB9A Isco	TOLLWAY 1935			1.033		0.667			0.0761	7.51	89	2417	26.6	0.024	0.16	0.11	1301	0.60	141.23	13.62	8.06	
2/7/13	15:10:00 PM	3375	7.42	TB9A Isco	TOLLWAY 1967			1.624		0.559	0.00137			0.0628	7.02	68	1783	34.0	0.024	0.31	0.29	956	0.61	119.66	16.33	7.88
3/19/13	16:19:00 PM	NA	NA	TB9A Isco	TOLLWAY 2034			1.858		1.105			0.0329	7.81	76	3788	10.8	0.009	0.25	0.34	2155	0.39	214.03	9.68	6.84	
4/4/13	NA	NA	NA	TB9A Isco	TOLLWAY 2065		0.172	0.102		2.581			0.0638	8.01	90	9442		0.022	0.24	0.23	5495	0.55	231.02	22.54	17.04	
4/17/13	9:51:00 AM	5337	8.05	TB9A Isco	TOLLWAY 2090			0.392		0.962			0.0690	7.97	83	2997	42.4	0.008	0.11	0.26	1692	0.18	155.14	17.53	11.62	
4/29/13	15:24:00 PM	814	7.44	TB9A Isco	TOLLWAY 2103			0.985		0.181	0.00234		0.0131	7.87	55	440	172.0	0.013	0.11	0.21	190	0.21	56.55	14.44	3.97	
5/14/13	13:00:00 PM	NA	NA	TB9A Isco	TOLLWAY 2141			0.774		0.552	0.00080		0.0833	7.93	89	2131		0.013	0.25	0.33	1213	1.06	53.53	25.58	19.87	
5/29/13	11:06:00 AM	839	7.61	TB9A Isco	TOLLWAY 2168			1.446		0.188	0.00978		0.0172	7.67	48	451	36.8	0.028	0.22	0.14	211	0.27	34.71	10.79	6.88	
6/11/13	15:12:00 PM	1625	7.17	TB9A Isco	TOLLWAY 2207			1.194		0.284	0.00115		0.0134	7.86	84	833	34.4	0.027	0.08	0.14	414	0.19	49.02	16.51	9.50	
6/26/13	11:47:00 AM	572	7.67	TB9A Isco	TOLLWAY 2241			1.173		0.119	0.00455		0.0151	7.52	45	317	33.2	0.024	0.11	0.10	138	0.20	22.93	12.51	6.78	
7/10/13	10:56:00 AM	790	7.23	TB9A Isco	TOLLWAY 2270			1.569		0.202	0.00132		0.0829	7.68	75	431	62.0	0.014	0.32	0.11	167	0.43	55.08	11.25	5.49	
7/22/13	15:39:00 PM	1303	8.14	TB9A Isco	TOLLWAY 2280			1.580		0.246	0.00066		0.0128	7.81	72	705	24.0	0.129	0.22	0.22	343	0.39	44.47	24.62	14.11	
8/6/13	12:37:00 PM	858	8.34	TB9A Isco	TOLLWAY 2311			1.370		0.148	0.00148		0.1096	7.70	45	450	11.6	0.115	0.16	0.21	206	4.61	20.92	18.25	11.56	
					min	NA	0.172	0.102	NA	0.119	0.00066	NA	NA	0.0099	7.02	45	317	6.0	0.008	0.04	0.10	138	0.11	20.00	9.68	3.97
					max	NA	0.172	1.858	NA	2.581	0.00978	NA	NA	0.2216	8.27	165	9442	172.0	0.133	0.32	0.51	5495	4.61	231.02	38.81	19.87
					mean	NA	0.172	1.171	NA	0.487	0.00206	NA	NA	0.0520	7.76	85	1612	37.1	0.041	0.16	0.28	866	0.75	77.21	17.33	11.27
2/7/13	15:58:00 PM	712	7.61	TB15Bsw Isco	TOLLWAY 1971			1.313		0.0883	0.00403		0.0212	6.85	36	363	214.7	0.111	0.30	0.09	182	0.28	16.65	38.53	5.29	
4/16/13	9:51:00 AM	499	8.17	TB15Bsw Isco	TOLLWAY 2076			11.226		0.0355	0.07153		0.0248	7.71	48	228	378.0	0.187	0.18	0.17	64	0.81	13.61	40.21	10.53	
4/30/13	14:55:00 PM	333	7.73	TB15Bsw Isco	TOLLWAY 2112			2.143		0.0470	0.01271			7.78	36	200	137.3	0.065	0.13	0.17	74	0.25	12.68	15.80	3.35	
5/28/13	14:04:00 PM	119	8.01	TB15Bsw Isco	TOLLWAY 2160			0.929		0.0243	0.00191			7.39	29	76	181.0	0.071	0.09		19	0.19	6.29	5.66		
6/11/13	8:30:00 AM	NA	NA	TB15Bsw Isco	TOLLWAY 2190			3.051		0.0469	0.01557		0.0760	6.38	5	166		0.055	0.11	0.10	21	15.01	8.47	32.49	10.74	
6/25/13	8:46:00 AM	NA	NA	TB15Bsw Isco	TOLLWAY 2222			3.175		0.0313	0.02400		0.0432	7.41	36	106		1.672	0.21	0.17	15	0.84	9.04	65.63	12.07	
7/9/13	8:23:00 AM	81	7.29	TB15Bsw Isco	TOLLWAY 2253			1.163		0.0222	0.00538		0.0117	7.30	22	59	68.4	0.085	0.04		10	0.15	3.65	9.08	5.48	
					min	NA	NA	0.929	NA	0.0222	0.00191	NA	NA	0.0117	6.38	5	59	68.4	0.055	0.04	0.09	10	0.15	3.65	9.08	3.35
					max	NA	NA	11.226	NA	0.0883	0.07153	NA	NA	0.0760	7.78	48	363	378.0	1.672	0.30	0.17	182	15.01	16.65	65.63	12.07
					mean	NA	NA	3.286	NA	0.0422	0.01930	NA	NA	0.0353	7.26	30	171	195.9	0.321	0.15	0.14	55	2.50	10.06	33.62	7.59

APPENDIX A2: Results of Geochemical Analysis of Total Metals for Isco Surface-Water Samples

Analytes and Laboratory Methodologies

SM = "Standard Methods for the Examination of Water and Wastewater": APHA, AWWA, & WEF
 US EPA = methods by the US Environmental Protection Agency

Parameter	Analytes	Analytical Methodology
Alkalinity	Alkalinity	Based on SM method 2320B - Titrimetric
Anions	F, Cl, NO ₃ , SO ₄	Based on US EPA Method 300.0 - Ion Chromatography
Metals, dissolved	Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Se, Si, Sn, Sr, Ti, Tl, V, Zn	Based on US EPA Method 200.7 - Inductively Coupled Plasma (ICP)
Metals, total recoverable	Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, S, Sb, Se, Si, Sn, Sr, Ti, Tl, V, Zn	Based on US EPA Method 200.7 - Inductively Coupled Plasma (ICP)
Ammonia/ammonium	NH ₃ -N	Based on US EPA Method 350.1 - Colorimetry
Orthophosphate	oPO ₄ -P	Based on US EPA Method 365.1 - Colorimetry
Non-volatile organic carbon	total NVOC, dissolved NVOC	Based on SM method 5310B - High temperature combustion
Total Dissolved Solids	TDS, 180 C	Based on SM method 2540C - Dried at 180° C
Total Suspended Solids	TSS	Based on SM method 2540D - Dried at 103-105° C
pH	pH	Based on US EPA method 150.1 - Electrometric

Analytical Results

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.0024	0.016	0.011	0.0027	0.0015	0.022	0.026	0.043	0.073	0.041	0.217	
TB7Bin Dissolved Metals																											
7/17/12	8:45:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1688	0.04		0.167	0.084		190.0				0.006	0.050	39.1		55.9	0.054		1780.0		0.144		213.00	
8/1/12	9:05:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1718				0.018		9.5				0.007	0.030	1.3		1.3	0.018		28.4				4.36	
8/13/12	11:55:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1721	0.04		0.035	0.027		19.4				0.016	0.054	3.1		3.2	0.015		85.0				12.70	
8/29/12	9:34:00 AM	1496	7.44	TB7Bin Isco	TOLLWAY 1743	0.05		0.046	0.037		32.3				0.009		7.7		7.9	0.006		261.0				33.00	
					min	0.04	NA	0.035	0.018	NA	9.5	NA	NA	NA	0.006	0.030	1.3	NA	1.3	0.006	NA	28.4	NA	0.144	NA	4.36	
					max	0.05	NA	0.167	0.084	NA	190.0	NA	NA	NA	0.016	0.054	39.1	NA	55.9	0.054	NA	1780.0	NA	0.144	NA	213.00	
					mean	0.04	NA	0.083	0.041	NA	62.8	NA	NA	NA	0.010	0.045	12.8	NA	17.1	0.023	NA	539.0	NA	0.144	NA	65.80	
TB7Bin Total Metals																											
7/17/12	8:45:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1688 TOT	0.50		0.167	0.094		190.0			0.0095	0.021	1.020	39.3		56.1	0.039		1770.0		0.395		208.00	
8/1/12	9:05:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1718 TOT	1.13			0.070		24.3			0.0146	0.048	2.620	1.6		8.0	0.085		29.0		0.105		4.82	
8/13/12	11:55:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1721 TOT	0.64		0.037	0.055		22.0			0.0115	0.037	1.300	3.4		4.4	0.039		85.6		0.104		13.00	
8/29/12	9:34:00 AM	1496	7.44	TB7Bin Isco	TOLLWAY 1743 TOT	0.41		0.053	0.052		35.7			0.0092	0.022	0.975	7.7		9.3	0.028		261.0				33.50	
					min	0.41	NA	0.037	0.052	NA	22.0	NA	NA	0.0092	0.021	0.975	1.6	NA	4.4	0.028	NA	29.0	NA	0.104	NA	4.82	
					max	1.13	NA	0.167	0.094	NA	190.0	NA	NA	0.0146	0.048	2.620	39.3	NA	56.1	0.085	NA	1770.0	NA	0.395	NA	208.00	
					mean	0.67	NA	0.086	0.068	NA	68.0	NA	NA	0.0112	0.032	1.480	13.0	NA	19.4	0.048	NA	536.0	NA	0.201	NA	64.80	
TB7Bout Dissolved Metals																											
7/17/12	10:10:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1698	0.18		0.030	0.016		8.5			0.0095	0.009	0.036	2.9		1.0	0.024		10.8		0.132		2.28	
8/1/12	10:20:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1719	0.09			0.012		7.9				0.006	0.084	3.9		1.6	0.005		28.9		0.131		4.20	
8/29/12	10:12:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1744	0.05		0.064	0.027	0.0032	10.5			0.0112	0.012	0.047	4.8		2.3	0.006		68.4				6.98	
					min	0.05	NA	0.030	0.012	0.0032	7.9	NA	NA	0.0095	0.006	0.036	2.9	NA	1.0	0.005	NA	10.8	NA	0.131	NA	2.28	
					max	0.18	NA	0.064	0.027	0.0032	10.5	NA	NA	0.0112	0.012	0.084	4.8	NA	2.3	0.024	NA	68.4	NA	0.132	NA	6.98	
					mean	0.10	NA	0.047	0.018	0.0032	9.0	NA	NA	0.0103	0.009	0.056	3.9	NA	1.6	0.012	NA	36.0	NA	0.132	NA	4.49	
TB7Bout Total Metals																											
7/17/12	10:10:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1698 TOT	1.26		0.031	0.033		11.3			0.0170	0.021	1.150	3.3		2.4	0.057		11.3		0.217		2.42	
8/1/12	10:20:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1719 TOT	0.54			0.019		9.1				0.010	0.571	4.1		2.3	0.029		29.8		0.188		4.27	
8/29/12	10:12:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1744 TOT	0.76		0.065	0.044	0.0033	13.7			0.0188	0.024	1.400	5.3		4.0	0.041		72.3		0.151		7.28	
					min	0.54	NA	0.031	0.019	0.0033	9.1	NA	NA	0.0170	0.010	0.571	3.3	NA	2.3	0.029	NA	11.3	NA	0.151	NA	2.42	
					max	1.26	NA	0.065	0.044	0.0033	13.7	NA	NA	0.0188	0.024	1.400	5.3	NA	4.0	0.057	NA	72.3	NA	0.217	NA	7.28	
					mean	0.85	NA	0.048	0.032	0.0033	11.4	NA	NA	0.0179	0.018	1.040	4.2	NA	2.9	0.042	NA	37.8	NA	0.185	NA	4.66	

APPENDIX A2: Results of Geochemical Analysis of Total Metals for Isco Surface-Water Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO3	TDS, 180 C mg/L	TSS mg/L	oPO4-P mg/L	NH3-N mg/L	F mg/L	Cl mg/L	NO3-N mg/L	SO4 mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.131	0.066	0.059	0.00037	0.00056	0.017	0.047	0.0097		4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31	
TB7Bin Dissolved Metals																											
7/17/12	8:45:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1688			5.10		2.040				0.039	7.90	237.0	5410.0	48.8	0.069	0.488	0.283	2640.0	0.802	561.0	14.6	11.2	
8/1/12	9:05:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1718			0.53		0.060				0.057	6.94	27.7	127.0	75.5		0.235	0.232	34.5	0.494	12.2	16.7	15.6	
8/13/12	11:55:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1721			1.59		0.146	0.0009			0.125	7.01	46.3	310.0	47.2	0.029	0.223	0.618	107.0	1.090	35.6	38.1	19.9	
8/29/12	9:34:00 AM	1496	7.44	TB7Bin Isco	TOLLWAY 1743			2.26		0.327				0.035	7.55	73.8	804.0	18.8		0.145	0.305	361.0	0.534	94.8	13.7	8.5	
					min	NA	NA	0.53	NA	0.060	0.0009	NA	NA	0.035	6.94	27.7	127.0	18.8	0.029	0.145	0.232	34.5	0.494	12.2	13.7	8.5	
					max	NA	NA	5.10	NA	2.040	0.0009	NA	NA	0.125	7.90	237.0	5410.0	75.5	0.069	0.488	0.618	2640.0	1.090	561.0	38.1	19.9	
					mean	NA	NA	2.37	NA	0.643	0.0009	NA	NA	0.064	7.35	96.2	1660.0	47.6	0.049	0.273	0.360	786.0	0.730	176.0	20.8	13.8	
TB7Bin Total Metals																											
7/17/12	8:45:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1688 TOT			6.04		2.030	0.0144			0.102													
8/1/12	9:05:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1718 TOT			2.40		0.080	0.0335			0.314													
8/13/12	11:55:00 AM	NA	NA	TB7Bin Isco	TOLLWAY 1721 TOT			3.39		0.152	0.0372			0.215													
8/29/12	9:34:00 AM	1496	7.44	TB7Bin Isco	TOLLWAY 1743 TOT			3.03		0.331	0.0146			0.114													
					min	NA	NA	2.40	NA	0.080	0.0144	NA	NA	0.102													
					max	NA	NA	6.04	NA	2.030	0.0372	NA	NA	0.314													
					mean	NA	NA	3.72	NA	0.648	0.0249	NA	NA	0.186													
TB7Bout Dissolved Metals																											
7/17/12	10:10:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1698			0.56		0.036	0.0008			0.046	7.28	28.5	75.0	43.2	0.108	0.500	0.199	11.3	0.721	6.8	14.1	12.9	
8/1/12	10:20:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1719			1.11		0.043	0.0018			0.028	7.20	31.5	125.0	17.2	0.114	0.129	0.199	32.8	0.466	11.7	12.3	8.9	
8/29/12	10:12:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1744			1.03		0.077	0.0039			0.087	7.41	38.4	222.0	44.0	0.057		0.377	85.0	0.976	20.7	20.5	14.5	
					min	NA	NA	0.56	NA	0.036	0.0008	NA	NA	0.028	7.20	28.5	75.0	17.2	0.057	0.129	0.199	11.3	0.466	6.8	12.3	8.9	
					max	NA	NA	1.11	NA	0.077	0.0039	NA	NA	0.087	7.41	38.4	222.0	44.0	0.114	0.500	0.377	85.0	0.976	20.7	20.5	14.5	
					mean	NA	NA	0.90	NA	0.052	0.0022	NA	NA	0.054	7.30	32.8	141.0	34.8	0.093	0.314	0.258	43.0	0.721	13.1	15.6	12.1	
TB7Bout Total Metals																											
7/17/12	10:10:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1698 TOT			2.01		0.040	0.0262			0.097													
8/1/12	10:20:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1719 TOT			2.03		0.045	0.0163			0.054													
8/29/12	10:12:00 AM	NA	NA	TB7Bout Isco	TOLLWAY 1744 TOT			2.77		0.084	0.0328			0.160													
					min	NA	NA	2.01	NA	0.040	0.0163	NA	NA	0.054													
					max	NA	NA	2.77	NA	0.084	0.0328	NA	NA	0.160													
					mean	NA	NA	2.27	NA	0.056	0.0251	NA	NA	0.104													

APPENDIX A2: Results of Geochemical Analysis of Total Metals for Isco Surface-Water Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.0024	0.016	0.011	0.0027	0.0015	0.022	0.026	0.043	0.073	0.041	0.217	
TB9A Dissolved Metals																											
7/18/12	2:46:00 PM	NA	NA	TB9A Isco	TOLLWAY 1697	0.08		0.042	0.020		10.4			0.006	0.008	0.069	6.2		1.7	0.031		63.0		0.123		4.25	
7/31/12	4:10:00 PM	1097	7.23	TB9A Isco	TOLLWAY 1715	0.04		0.046	0.045		24.1				0.010	0.121	13.6		4.0	0.031		187.0		0.119		7.29	
8/13/12	2:56:00 PM	1330	7.68	TB9A Isco	TOLLWAY 1725			0.037	0.051		24.9				0.008	0.075	16.4		4.6	0.013		235.0		0.135		10.50	
8/28/12	1:26:00 PM	NA	NA	TB9A Isco	TOLLWAY 1740	0.04		0.042	0.046		22.9				0.008	0.093	15.1		4.1	0.016		209.0		0.116		10.70	
					min	0.04	NA	0.037	0.020	NA	10.4	NA	NA	0.006	0.008	0.069	6.2	NA	1.7	0.013	NA	63.0	NA	0.116	NA	4.25	
					max	0.08	NA	0.046	0.051	NA	24.9	NA	NA	0.006	0.010	0.121	16.4	NA	4.6	0.031	NA	235.0	NA	0.135	NA	10.70	
					mean	0.05	NA	0.041	0.040	NA	20.6	NA	NA	0.006	0.008	0.090	12.8	NA	3.6	0.023	NA	174.0	NA	0.123	NA	8.18	
TB9A Total Metals																											
7/18/12	2:46:00 PM	NA	NA	TB9A Isco	TOLLWAY 1697 TOT	0.38		0.050	0.029		12.4			0.031	0.012	0.414	7.6		2.2	0.072		73.1		0.184		5.13	
7/31/12	4:10:00 PM	1097	7.23	TB9A Isco	TOLLWAY 1715 TOT	0.41		0.048	0.056		27.1			0.012	0.013	0.504	13.9		4.5	0.116		188.0		0.201		7.42	
8/13/12	2:56:00 PM	1330	7.68	TB9A Isco	TOLLWAY 1725 TOT	0.23		0.036	0.057		25.2				0.010	0.328	15.8		4.8	0.095		226.0		0.197		10.10	
8/28/12	1:26:00 PM	NA	NA	TB9A Isco	TOLLWAY 1740 TOT	0.23		0.043	0.056		26.2			0.008	0.012	0.564	15.4		5.1	0.103		214.0		0.213		10.90	
					min	0.23	NA	0.036	0.029	NA	12.4	NA	NA	0.008	0.010	0.328	7.6	NA	2.2	0.072	NA	73.1	NA	0.184	NA	5.13	
					max	0.41	NA	0.050	0.057	NA	27.1	NA	NA	0.031	0.013	0.564	15.8	NA	5.1	0.116	NA	226.0	NA	0.213	NA	10.90	
					mean	0.31	NA	0.044	0.049	NA	22.7	NA	NA	0.017	0.012	0.452	13.2	NA	4.1	0.096	NA	175.0	NA	0.199	NA	8.39	
TB15gw Dissolved Metals																											
7/18/12	12:25:00 PM	NA	NA	TB15gw Isco	TOLLWAY 1694	0.44		0.075	0.064		55.7				0.014	0.369	16.4		10.5	0.013		377.0		0.169		25.30	
7/31/12	12:59:00 PM	1857	7.53	TB15gw Isco	TOLLWAY 1713	0.27		0.065	0.061		58.0				0.014	0.240	14.6		9.7	0.005		325.0		0.133		22.90	
8/14/12	10:00:00 AM	2026	7.37	TB15gw Isco	TOLLWAY 1729	0.27		0.048	0.062		56.5				0.009	0.221	14.1		9.0	0.003		353.0				23.50	
8/28/12	9:29:00 AM	1818	7.36	TB15gw Isco	TOLLWAY 1735	0.16		0.046	0.055		54.9				0.007	0.147	14.5		8.3	0.003		312.0		0.128		20.50	
					min	0.16	NA	0.046	0.055	NA	54.9	NA	NA	NA	0.007	0.147	14.1	NA	8.3	0.003	NA	312.0	NA	0.128	NA	20.50	
					max	0.44	NA	0.075	0.064	NA	58.0	NA	NA	NA	0.014	0.369	16.4	NA	10.5	0.013	NA	377.0	NA	0.169	NA	25.30	
					mean	0.29	NA	0.058	0.061	NA	56.3	NA	NA	NA	0.011	0.244	14.9	NA	9.4	0.006	NA	342.0	NA	0.143	NA	23.00	
TB15gw Total Metals																											
7/18/12	12:25:00 PM	NA	NA	TB15gw Isco	TOLLWAY 1694 TOT	5.82		0.081	0.083		59.3			0.008	0.020	4.330	18.1		11.3	0.084		391.0		0.260		26.40	
7/31/12	12:59:00 PM	1857	7.53	TB15gw Isco	TOLLWAY 1713 TOT	3.60		0.065	0.078		61.0			0.007	0.017	2.940	15.2		10.3	0.074		320.0		0.328		22.40	
8/14/12	10:00:00 AM	2026	7.37	TB15gw Isco	TOLLWAY 1729 TOT	1.86		0.049	0.070		56.4				0.011	1.540	14.4		8.9	0.036		348.0		0.134		23.30	
8/28/12	9:29:00 AM	1818	7.36	TB15gw Isco	TOLLWAY 1735 TOT	0.97		0.045	0.059		56.3				0.008	0.878	14.0		8.7	0.025		304.0		0.168		20.80	
					min	0.97	NA	0.045	0.059	NA	56.3	NA	NA	0.007	0.008	0.878	14.0	NA	8.7	0.025	NA	304.0	NA	0.134	NA	20.80	
					max	5.82	NA	0.081	0.083	NA	61.0	NA	NA	0.008	0.020	4.330	18.1	NA	11.3	0.084	NA	391.0	NA	0.328	NA	26.40	
					mean	3.06	NA	0.060	0.072	NA	58.2	NA	NA	0.008	0.014	2.420	15.4	NA	9.8	0.055	NA	341.0	NA	0.223	NA	23.20	

APPENDIX A2: Results of Geochemical Analysis of Total Metals for Isco Surface-Water Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO3	TDS, 180 C mg/L	TSS mg/L	oPO4-P mg/L	NH3-N mg/L	F mg/L	Cl mg/L	NO3-N mg/L	SO4 mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.131	0.066	0.059	0.00037	0.00056	0.017	0.047	0.0097		4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31	
TB9A Dissolved Metals																											
7/18/12	2:46:00 PM	NA	NA	TB9A Isco	TOLLWAY 1697			0.84		0.086	0.0007			0.025	7.61	35.7	232.0	7.6	0.095	0.508	0.234	93.0	0.536	12.7	15.6	15.4	
7/31/12	4:10:00 PM	1097	7.23	TB9A Isco	TOLLWAY 1715			1.47		0.203	0.0011			0.015	7.89	84.1	595.0	6.0	0.085	0.146	0.238	276.0	0.224	20.6	18.8	15.6	
8/13/12	2:56:00 PM	1330	7.68	TB9A Isco	TOLLWAY 1725			1.24		0.250	0.0006			0.016	7.84	79.4	711.0	11.2	0.109	0.124	0.283	353.0	0.428	29.0	22.2	16.4	
8/28/12	1:26:00 PM	NA	NA	TB9A Isco	TOLLWAY 1740			1.55		0.242	0.0008			0.015	7.86	84.3	668.0	20.8	0.075	0.139	0.385	309.0	0.201	29.1	19.4	16.4	
					min	NA	NA	0.84	NA	0.086	0.0006	NA	NA	0.015	7.61	35.7	232.0	6.0	0.075	0.124	0.234	93.0	0.201	12.7	15.6	15.4	
					max	NA	NA	1.55	NA	0.250	0.0011	NA	NA	0.025	7.89	84.3	711.0	20.8	0.109	0.508	0.385	353.0	0.536	29.1	22.2	16.4	
					mean	NA	NA	1.27	NA	0.195	0.0008	NA	NA	0.018	7.80	70.9	552.0	11.4	0.091	0.229	0.285	258.0	0.347	22.8	19.0	16.0	
TB9A Total Metals																											
7/18/12	2:46:00 PM	NA	NA	TB9A Isco	TOLLWAY 1697 TOT			1.46		0.104	0.0078			0.041													
7/31/12	4:10:00 PM	1097	7.23	TB9A Isco	TOLLWAY 1715 TOT			2.18		0.209	0.0189			0.033													
8/13/12	2:56:00 PM	1330	7.68	TB9A Isco	TOLLWAY 1725 TOT			1.51		0.247	0.0071			0.040													
8/28/12	1:26:00 PM	NA	NA	TB9A Isco	TOLLWAY 1740 TOT			2.06		0.254	0.0085			0.046													
					min	NA	NA	1.46	NA	0.104	0.0071	NA	NA	0.033													
					max	NA	NA	2.18	NA	0.254	0.0189	NA	NA	0.046													
					mean	NA	NA	1.80	NA	0.204	0.0106	NA	NA	0.040													
TB15gw Dissolved Metals																											
7/18/12	12:25:00 PM	NA	NA	TB15gw Isco	TOLLWAY 1694			6.33		0.350	0.0090			0.102	7.94	216.0	1210.0	18.4	0.114	0.031	0.409	512.0	2.800	72.9	20.9	16.8	
7/31/12	12:59:00 PM	1857	7.53	TB15gw Isco	TOLLWAY 1713			5.88		0.294	0.0071				8.12	210.0	1050.0	15.2	0.112		0.336	426.0	2.060	66.7	20.9	15.7	
8/14/12	10:00:00 AM	2026	7.37	TB15gw Isco	TOLLWAY 1729			5.52		0.316	0.0058				8.16	197.0	1100.0		0.095		0.351	484.0	1.250	66.9	17.0	15.2	
8/28/12	9:29:00 AM	1818	7.36	TB15gw Isco	TOLLWAY 1735			5.28		0.307	0.0037				7.95	209.0	1020.0	6.8	0.091		0.338	425.0	0.882	58.6	14.9	12.6	
					min	NA	NA	5.28	NA	0.294	0.0037	NA	NA	0.102	7.94	197.0	1020.0	6.8	0.091	0.031	0.336	425.0	0.882	58.6	14.9	12.6	
					max	NA	NA	6.33	NA	0.350	0.0090	NA	NA	0.102	8.16	216.0	1210.0	18.4	0.114	0.031	0.409	512.0	2.800	72.9	20.9	16.8	
					mean	NA	NA	5.75	NA	0.317	0.0064	NA	NA	0.102	8.04	208.0	1100.0	13.5	0.103	0.031	0.359	462.0	1.750	66.3	18.4	15.1	
TB15gw Total Metals																											
7/18/12	12:25:00 PM	NA	NA	TB15gw Isco	TOLLWAY 1694 TOT			15.10		0.368	0.1040			0.106													
7/31/12	12:59:00 PM	1857	7.53	TB15gw Isco	TOLLWAY 1713 TOT			12.80		0.298	0.0882			0.016													
8/14/12	10:00:00 AM	2026	7.37	TB15gw Isco	TOLLWAY 1729 TOT			9.12		0.314	0.0495																
8/28/12	9:29:00 AM	1818	7.36	TB15gw Isco	TOLLWAY 1735 TOT			7.06		0.287	0.0250																
					min	NA	NA	7.06	NA	0.287	0.0250	NA	NA	0.016													
					max	NA	NA	15.10	NA	0.368	0.1040	NA	NA	0.106													
					mean	NA	NA	11.00	NA	0.317	0.0667	NA	NA	0.061													

APPENDIX A2: Results of Geochemical Analysis of Total Metals for Isco Surface-Water Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L		
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.0024	0.016	0.011	0.0027	0.0015	0.022	0.026	0.043	0.073	0.041	0.217		
TB19sw Dissolved Metals																												
7/18/12	9:32:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1699	5.17		0.063	0.021		38.4			0.011	0.018		11.5		0.5			6.4		0.108		4.83		
7/30/12	4:04:00 PM	1570	7.80	TB19sw Isco	TOLLWAY 1708	0.63			0.011		10.7				0.005	0.445		4.8	1.6	0.005		18.6		0.334		2.59		
8/14/12	11:15:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1732	0.19		0.062	0.014		15.4				0.012	0.196		13.0	2.2	0.004		16.2		0.433		4.11		
8/27/12	3:44:00 PM	NA	NA	TB19sw Isco	TOLLWAY 1754	0.09		0.050	0.015	0.0006	15.3				0.009	0.082		14.9	2.0	0.004		9.8		0.469		2.78		
					min	0.09	NA	0.050	0.011	0.0006	10.7	NA	NA	0.011	0.005	0.082		4.8	NA	0.5	0.004	NA	6.4	NA	0.108	NA	2.59	
					max	5.17	NA	0.063	0.021	0.0006	38.4	NA	NA	0.011	0.018	0.445		14.9	NA	2.2	0.005	NA	18.6	NA	0.469	NA	4.83	
					mean	1.52	NA	0.058	0.015	0.0006	20.0	NA	NA	0.011	0.011	0.241		11.0	NA	1.6	0.004	NA	12.8	NA	0.336	NA	3.58	
TB19sw Total Metals																												
7/18/12	9:32:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1699 TOT	18.90		0.100	0.295		219.0			0.032	0.050	9.770		13.4	63.4	0.434		6.9		0.915		6.81		
7/30/12	4:04:00 PM	1570*	7.80	TB19sw Isco	TOLLWAY 1708 TOT	17.20		0.160	0.160		47.6			0.027	0.030	10.500		9.6	15.4	0.265		18.5		0.686		2.74		
8/14/12	11:15:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1732 TOT	5.88		0.072	0.070		25.8			0.012	0.028	4.530		15.6	5.9	0.083		16.5		1.040		4.23		
8/27/12	3:44:00 PM	NA	NA	TB19sw Isco	TOLLWAY 1754 TOT	2.13		0.051	0.050	0.0007	24.5				0.016	1.660		15.1	4.1	0.054		9.5		0.924		2.80		
					min	2.13	NA	0.051	0.050	0.0007	24.5	NA	NA	0.012	0.016	1.660		9.6	NA	4.1	0.054	NA	6.9	NA	0.686	NA	2.74	
					max	18.90	NA	0.160	0.295	0.0007	219.0	NA	NA	0.032	0.050	10.500		15.6	NA	63.4	0.434	NA	18.5	NA	1.040	NA	6.81	
					mean	11.00	NA	0.096	0.144	0.0007	79.2	NA	NA	0.024	0.031	6.620		13.4	NA	22.2	0.209	NA	12.8	NA	0.891	NA	4.15	
TB19gw Dissolved Metals																												
7/18/12	9:31:00 AM	2258	7.64	TB19gw Isco	TOLLWAY 1691	0.12		0.090	0.071		63.9				0.013	0.109		24.6	20.1	0.009		364.0		0.088		37.60		
7/30/12	3:47:00 PM	1379	7.69	TB19gw Isco	TOLLWAY 1707	1.04		0.030	0.058		51.8				0.017	0.952		21.8	14.6	0.020		223.0		0.100		22.50		
8/14/12	11:04:00 AM	1976	7.34	TB19gw Isco	TOLLWAY 1731	0.08		0.093	0.073		65.6				0.011	0.101		23.3	19.4	0.004		311.0		0.088		38.10		
8/27/12	3:41:00 PM	99	7.74	TB19gw Isco	TOLLWAY 1753	0.07		0.077	0.060	0.0007	56.2				0.010	0.073		20.8	15.0	0.004		249.0				28.50		
					min	0.07	NA	0.030	0.058	0.0007	51.8	NA	NA	NA	0.010	0.073		20.8	NA	14.6	0.004	NA	223.0	NA	0.088	NA	22.50	
					max	1.04	NA	0.093	0.073	0.0007	65.6	NA	NA	NA	0.017	0.952		24.6	NA	20.1	0.020	NA	364.0	NA	0.100	NA	38.10	
					mean	0.32	NA	0.072	0.066	0.0007	59.4	NA	NA	NA	0.013	0.309		22.6	NA	17.3	0.009	NA	287.0	NA	0.092	NA	31.70	
TB19gw Total Metals																												
7/18/12	9:31:00 AM	2258	7.64	TB19gw Isco	TOLLWAY 1691 TOT	2.41		0.096	0.082		66.4			0.006	0.015	2.010		25.4	21.8	0.047		369.0		0.139		38.60		
7/30/12	3:47:00 PM	1379	7.69	TB19gw Isco	TOLLWAY 1707 TOT	5.39		0.100	0.087		63.4			0.011	0.025	4.700		23.6	16.2	0.108		226.0		0.263		23.30		
8/14/12	11:04:00 AM	1976	7.34	TB19gw Isco	TOLLWAY 1731 TOT	2.28		0.095	0.082		66.6			0.007	0.015	1.690		24.2	19.4	0.039		313.0		0.101		38.10		
8/27/12	3:41:00 PM	99	7.74	TB19gw Isco	TOLLWAY 1753 TOT	1.16		0.084	0.067	0.0007	59.1				0.013	0.956		21.1	17.0	0.036		250.0		0.122		29.10		
					min	1.16	NA	0.084	0.067	0.0007	59.1	NA	NA	0.006	0.013	0.956		21.1	NA	16.2	0.036	NA	226.0	NA	0.101	NA	23.30	
					max	5.39	NA	0.100	0.087	0.0007	66.6	NA	NA	0.011	0.025	4.700		25.4	NA	21.8	0.108	NA	369.0	NA	0.263	NA	38.60	
					mean	2.81	NA	0.094	0.080	0.0007	63.9	NA	NA	0.008	0.017	2.340		23.6	NA	18.6	0.057	NA	290.0	NA	0.156	NA	32.30	

APPENDIX A2: Results of Geochemical Analysis of Total Metals for Isco Surface-Water Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO3	TDS, 180 C mg/L	TSS mg/L	oPO4-P mg/L	NH3-N mg/L	F mg/L	Cl mg/L	NO3-N mg/L	SO4 mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.131	0.066	0.059	0.00037	0.00056	0.017	0.047	0.0097		4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31	
TB19sw Dissolved Metals																											
7/18/12	9:32:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1699			4.92		0.119	0.0007						208.0	977.0	0.024		0.228	6.9	1.880	14.8			
7/30/12	4:04:00 PM	1570*	7.80	TB19sw Isco	TOLLWAY 1708			2.68		0.030	0.0101			0.030	7.69	49.0	104.0	264.0	0.239	0.11	0.123	14.6	0.486	7.1	19.1	8.7	
8/14/12	11:15:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1732			3.79		0.052	0.0071			0.032	7.79	64.2	135.0	71.5	0.385	0.33	0.150	11.3	0.690	11.5	27.5	20.3	
8/27/12	3:44:00 PM	NA	NA	TB19sw Isco	TOLLWAY 1754			3.82		0.052	0.0042			0.111	7.50	59.1	126.0	100.0	0.420	0.31	0.203	10.7	0.502	7.9	28.5	17.9	
					min	NA	NA	2.68	NA	0.030	0.0007	NA	NA	0.030	7.50	49.0	104.0	71.5	0.024	0.11	0.123	6.9	0.486	7.1	19.1	8.7	
					max	NA	NA	4.92	NA	0.119	0.0101	NA	NA	0.111	7.79	64.2	208.0	977.0	0.420	0.33	0.228	14.6	1.880	14.8	28.5	20.3	
					mean	NA	NA	3.80	NA	0.063	0.0055	NA	NA	0.058	7.66	57.4	143.0	353.0	0.267	0.25	0.176	10.9	0.890	10.3	25.0	15.6	
TB19sw Total Metals																											
7/18/12	9:32:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1699 TOT			31.10		0.322	0.6110			0.337													
7/30/12	4:04:00 PM	1570*	7.80	TB19sw Isco	TOLLWAY 1708 TOT			32.40		0.086	0.4530			0.424													
8/14/12	11:15:00 AM	NA	NA	TB19sw Isco	TOLLWAY 1732 TOT			16.70		0.078	0.2100			0.182													
8/27/12	3:44:00 PM	NA	NA	TB19sw Isco	TOLLWAY 1754 TOT			8.02		0.071	0.0685			0.264													
					min	NA	NA	8.02	NA	0.071	0.0685	NA	NA	0.182													
					max	NA	NA	32.40	NA	0.322	0.6110	NA	NA	0.424													
					mean	NA	NA	22.10	NA	0.139	0.3360	NA	NA	0.302													
TB19gw Dissolved Metals																											
7/18/12	9:31:00 AM	2258	7.64	TB19gw Isco	TOLLWAY 1691			6.66		0.436	0.0022				8.06	246.0	1300.0	13.6	0.042		0.378	505.0	2.630	111.0	19.8	17.7	
7/30/12	3:47:00 PM	1379	7.69	TB19gw Isco	TOLLWAY 1707			8.88		0.272	0.0275				7.93	230.0	790.0	18.0	0.054		0.366	259.0	2.320	65.6	24.9	17.7	
8/14/12	11:04:00 AM	1976	7.34	TB19gw Isco	TOLLWAY 1731			7.19		0.408	0.0016				8.22	266.0	1130.0	3.2	0.055		0.353	406.0	2.190	111.0	19.3	19.4	
8/27/12	3:41:00 PM	99	7.74	TB19gw Isco	TOLLWAY 1753			6.87		0.331	0.0022		0.011		8.16	257.0	924.0	4.4	0.054	0.06	0.288	300.0	2.530	83.2	16.9	16.0	
					min	NA	NA	6.66	NA	0.272	0.0016	NA	NA	0.011	7.93	230.0	790.0	3.2	0.042	0.06	0.288	259.0	2.190	65.6	16.9	16.0	
					max	NA	NA	8.88	NA	0.436	0.0275	NA	NA	0.011	8.22	266.0	1300.0	18.0	0.055	0.06	0.378	505.0	2.630	111.0	24.9	19.4	
					mean	NA	NA	7.40	NA	0.362	0.0084	NA	NA	0.011	8.09	250.0	1040.0	9.8	0.051	0.06	0.346	368.0	2.420	92.7	20.2	17.7	
TB19gw Total Metals																											
7/18/12	9:31:00 AM	2258	7.64	TB19gw Isco	TOLLWAY 1691 TOT			11.20		0.448	0.0515			0.011													
7/30/12	3:47:00 PM	1379	7.69	TB19gw Isco	TOLLWAY 1707 TOT			18.90		0.310	0.1490			0.024													
8/14/12	11:04:00 AM	1976	7.34	TB19gw Isco	TOLLWAY 1731 TOT			12.00		0.412	0.0598			0.010													
8/27/12	3:41:00 PM	99	7.74	TB19gw Isco	TOLLWAY 1753 TOT			9.34		0.337	0.0327			0.020													
					min	NA	NA	9.34	NA	0.310	0.0327	NA	NA	0.010													
					max	NA	NA	18.90	NA	0.448	0.1490	NA	NA	0.024													
					mean	NA	NA	12.90	NA	0.377	0.0732	NA	NA	0.016													

APPENDIX A2: Results of Geochemical Analysis of Total Recoverable Metals for Isco Surface-Water Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097	
TB15sw Isco Total Metals																																				
10/16/13	8:52:00 AM	65	8.39	TB15Bsw Isco	TOLLWAY 2417 TOT	2.623			0.0254		4.40			0.0077	0.0069	2.009	3.92		1.79	0.0347		8.7		0.370		1.36						6.867	0.018	0.10107		0.0417
11/22/13	8:48:00 AM	NA	NA	TB15Bsw Isco	TOLLWAY 2461 TOT	22.579		0.095	0.2090	0.001	37.79			0.0502	0.0834	15.544	15.31		14.05	0.4164		40.4		2.694	0.049	17.45					32.140	0.157	0.36070		0.7942	
3/4/14	14:18:00 PM	2166	7.30	TB15Bsw Isco	TOLLWAY 2592 TOT	0.848			0.0347		19.33			0.0072	0.893	6.42			2.92	0.0263		442.4		0.521		11.16					3.290	0.104	0.03380		0.0703	
4/30/14	10:04:00 AM	NA	NA	TB15Bsw Isco	TOLLWAY 2707 TOT	44.191		0.090	0.3431	0.001	64.94			0.0623	0.0918	34.941	20.55		25.78	0.5200		205.7		1.631	0.050	13.19				115.423	0.153	0.87226		0.062	0.6455	
5/14/14	8:24:00 AM	192.3	8.14	TB15Bsw Isco	TOLLWAY 2735 TOT	12.977		0.032	0.0791		11.55			0.0193	0.0258	8.468	4.35		4.56	0.1053		35.5		0.317		3.23				33.256	0.050	0.24636		0.1581		
6/25/14	8:30:00 AM	80.9	7.84	TB15Bsw Isco	TOLLWAY 2813 TOT	4.307			0.0357		8.37			0.0073	0.0120	3.582	3.38		3.85	0.0559		12.3		0.189		1.61				10.344	0.028	0.15542		0.0573		
7/8/14	8:48:00 AM	60.9	7.47	TB15Bsw Isco	TOLLWAY 2833 TOT	7.089		0.030	0.0532		6.74			0.0087	0.0112	4.649	4.10		3.19	0.0631		9.0		0.128		1.01				18.246	0.028	0.29001		0.0597		
8/5/14	9:17:00 AM	92.2	8.28	TB15Bsw Isco	TOLLWAY 2881 TOT	6.030			0.0440		11.45			0.0106	0.0103	4.319	4.65		5.86	0.0518		12.8		0.195		1.70				14.089	0.024	0.21462		0.0472		
					min	0.848	NA	0.030	0.0254	0.001	4.40	NA	NA	0.0073	0.0069	0.893	3.38	NA	1.79	0.0263	NA	8.7	NA	0.128	0.049	1.01	NA	NA	3.290	NA	0.0185	0.03380	NA	0.062	0.0417	
					max	44.191	NA	0.095	0.3431	0.001	64.94	NA	NA	0.0623	0.0918	34.941	20.55	NA	25.78	0.5200	NA	442.4	NA	2.694	0.050	17.45	NA	NA	115.423	NA	0.1566	0.87226	NA	0.062	0.7942	
					mean	12.581	NA	0.062	0.1030	0.001	20.57	NA	NA	0.0237	0.0311	9.301	7.83	NA	7.75	0.1592	NA	95.8	NA	0.756	0.050	6.34	NA	NA	29.207	NA	0.0702	0.28428	NA	0.062	0.2343	
TB15sw Isco Dissolved Metals																																				
10/16/13	8:52:00 AM	65	8.39	TB15Bsw Isco	TOLLWAY 2417	0.328			0.0055		3.00				0.0021	0.232	3.02		0.83	0.0026		8.6		0.277		1.32				1.229	0.013	0.00851				
11/22/13	8:48:00 AM	NA	NA	TB15Bsw Isco	TOLLWAY 2461	0.413			0.0207		13.53				0.0053	0.321	8.62		2.93	0.0031		36.7		0.355		5.37				2.990	0.053	0.01267			0.0307	
3/4/14	14:18:00 PM	2166	7.30	TB15Bsw Isco	TOLLWAY 2592	0.059			0.0241		18.11				0.0039	0.062	6.20		2.43	0.0134		450.1		0.377		11.32				1.269	0.102	0.00102			0.0294	
4/30/14	10:04:00 AM	NA	NA	TB15Bsw Isco	TOLLWAY 2707	0.961		0.041	0.0412		31.40				0.0308	0.618	11.31		6.39	0.0157		191.1		0.346		11.59				4.221	0.095	0.02581			0.0959	
5/14/14	8:24:00 AM	192.3	8.14	TB15Bsw Isco	TOLLWAY 2735	1.442		0.023	0.0143		5.87			0.0077	0.0077	0.934	1.93		1.13	0.0091		35.5		0.155		3.04				4.179	0.034	0.04330			0.0142	
6/25/14	8:30:00 AM	80.9	7.84	TB15Bsw Isco	TOLLWAY 2813	0.162			0.0044		3.35				0.0027	0.148	1.71		0.59	0.0029		12.6		0.100		1.56				0.917	0.018	0.00393				
7/8/14	8:48:00 AM	60.9	7.47	TB15Bsw Isco	TOLLWAY 2833	0.711			0.0075		3.30				0.0033	0.441	1.76		0.82	0.0040		8.4				0.90				2.291	0.017	0.02617				
8/5/14	9:17:00 AM	92.2	8.28	TB15Bsw Isco	TOLLWAY 2881	1.768			0.0145		3.89				0.0047	1.186	3.18		1.18	0.0131		12.2		0.157		1.55				4.512	0.017	0.05811			0.0128	
					min	0.059	NA	0.023	0.0044	NA	3.00	NA	NA	0.0077	0.0021	0.062	1.71	NA	0.59	0.0026	NA	8.4	NA	0.100	NA	0.90	NA	NA	0.917	NA	0.0131	0.00102	NA	NA	0.0128	
					max	1.768	NA	0.041	0.0412	NA	31.40	NA	NA	0.0077	0.0308	1.186	11.31	NA	6.39	0.0157	NA	450.1	NA	0.377	NA	11.59	NA	NA	4.512	NA	0.1016	0.05811	NA	NA	0.0959	
					mean	0.731	NA	0.032	0.0165	NA	10.31	NA	NA	0.0077	0.0076	0.493	4.72	NA	2.04	0.0080	NA	94.4	NA	0.252	NA	4.58	NA	NA	2.701	NA	0.0435	0.02244	NA	NA	0.0366	
					difference in means multiplier	11.850	NA	0.030	0.0865	NA	10.26	NA	NA	0.0160	0.0235	8.808	3.12	NA	5.71	0.1512	NA	1.4	NA	0.503	NA	1.76	NA	NA	26.506	NA	0.0267	0.26184	NA	NA	0.1976	
						17.219	NA	1.932	6.2391	NA	2.00	NA	NA	3.0855	4.1079	18.882	1.66	NA	3.80	19.9285	NA	1.0	NA	2.992	NA	1.38	NA	NA	10.813	NA	1.6141	12.66855	NA	NA	6.3989	

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.108	0.023	0.0009	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
TB7B-in-Isco Total Metals																											
9/4/14	8:40:00 AM	920	7.19	TB7B-in-Isco	TOLLWAY 2955 TOT	5.352		0.060	0.1338		237.96			0.04	0.08488	10.030	4.71		112.24	0.7663		168.1		0.894		20.82	
9/16/14	8:40:00 AM	1003	7.68	TB7B-in-Isco	TOLLWAY 2967 TOT	2.863		0.050	0.0851		39.13			0.02	0.09200	3.745	4.89		11.68	0.0965		178.1				17.87	
10/1/14	8:11:00 AM	NA	NA	TB7B-in-Isco	TOLLWAY 3002 TOT	1.540		0.083	0.1071		51.55			0.02	0.12336	3.010	7.89		14.45	0.1142		394.4		0.101	0.043	42.77	
10/14/14	9:35:00 AM	2286	7.58	TB7B-in-Isco	TOLLWAY 3020 TOT	1.824		0.085	0.0726		91.44			0.01	0.07294	3.021	7.97		29.36	0.1376		405.6		0.129		65.82	
10/28/14	13:25:00 PM	3667	7.73	TB7B-in-Isco	TOLLWAY 3047 TOT	0.659		0.190	0.0501		146.41				0.01882	0.871	12.34		48.49	0.0336		649.1		0.710		174.52	
11/11/14	13:54:00 PM	NA	NA	TB7B-in-Isco	TOLLWAY 3064 TOT	2.064		0.038	0.1090		30.26			0.02	0.08903	4.574	3.85		9.36	0.0819		76.1		0.188		9.79	
12/2/14	13:57:00 PM	NA	NA	TB7B-in-Isco	TOLLWAY 3096 TOT	0.368		0.061	0.0620		54.80				0.02855	0.631	8.52		14.41	0.0421		450.9		0.115		49.16	
3/17/15	8:14:00 AM	22059	7.42	TB7B-in-Isco	TOLLWAY 3218 TOT	0.541		0.093	0.2120		384.04				0.01118	0.719	51.07		82.33	0.0580		5028.5				215.14	
3/31/15	7:27:00 AM	17024	7.87	TB7B-in-Isco	TOLLWAY 3245 TOT	1.487		0.074	0.2036		212.72			0.03	0.04741	3.083	26.25		38.87	0.1331		3865.4		0.109		101.92	
4/13/15	13:02:00 PM	5711	7.72	TB7B-in-Isco	TOLLWAY 3263 TOT	9.192		0.077	0.3578		186.18	0.01		0.10	0.27384	21.586	11.43		65.31	0.4580		1141.9		0.535	0.060	58.43	
4/28/15	12:11:00 PM	8768	7.93	TB7B-in-Isco	TOLLWAY 3302 TOT	0.281		0.060	0.1108		130.11			0.01	0.02465	0.500	19.40		24.33	0.0679		1791.9		0.080		71.05	
5/12/15	13:20:00 PM	5974	7.78	TB7B-in-Isco	TOLLWAY 3335 TOT	1.364		0.062	0.1402		91.59			0.02	0.04682	2.821	14.62		22.58	0.0784		1225.0				55.45	
5/27/15	9:14:00 AM	3670	8.20	TB7B-in-Isco	TOLLWAY 3356 TOT	0.727		0.049	0.0910		79.08			0.01	0.03263	1.313	7.91		20.04	0.0541		682.4		0.112		53.18	
6/10/15	8:05:00 AM	667	8.04	TB7B-in-Isco	TOLLWAY 3393 TOT	1.324			0.0747		30.79			0.03	0.05938	3.245	2.45		8.50	0.0924		104.8		0.148		7.84	
6/24/15	7:56:00 AM	1111	8.42	TB7B-in-Isco	TOLLWAY 3416 TOT	2.308		0.049	0.1018		97.26			0.03	0.07053	6.973	3.40		39.72	0.2307		187.0		0.137		24.90	
7/8/15	9:19:00 AM	3239	7.49	TB7B-in-Isco	TOLLWAY 3444 TOT	0.934		0.104	0.1117		93.55				0.01395	1.957	7.02		28.11	0.2943		539.4				65.86	
7/22/15	8:15:00 AM	3564	7.84	TB7B-in-Isco	TOLLWAY 3470 TOT	missing sample																					
8/19/15	7:24:00 AM	310	8.59	TB7B-in-Isco	TOLLWAY 3514 TOT	1.153		0.027	0.0689		19.39			0.03	0.04334	2.656	1.91		5.65	0.0688		50.2				5.51	
					min	0.281	NA	0.027	0.0501	NA	19.39	0.01	NA	0.01	0.01118	0.500	1.91	NA	5.65	0.0336	NA	50.2	NA	0.080	0.043	5.51	
					max	9.192	NA	0.190	0.3578	NA	384.04	0.01	NA	0.10	0.27384	21.586	51.07	NA	112.24	0.7663	NA	5028.5	NA	0.894	0.060	215.14	
					mean	1.999	NA	0.073	0.1231	NA	116.25	0.01	NA	0.03	0.06667	4.161	11.51	NA	33.85	0.1652	NA	996.4	NA	0.271	0.052	61.18	

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
TB7B-in-Isco Total Metals																									
9/4/14	8:40:00 AM	920	7.19	TB7B-in-Isco			16.015		0.2844	0.20567	0.030		0.4839												
9/16/14	8:40:00 AM	1003	7.68	TB7B-in-Isco			9.179		0.2107	0.13788			0.1843												
10/1/14	8:11:00 AM	NA	NA	TB7B-in-Isco			6.185		0.4011	0.06865			0.2687												
10/14/14	9:35:00 AM	2286	7.58	TB7B-in-Isco			6.937		0.3970	0.07515	0.023		0.1635												
10/28/14	13:25:00 PM	3667	7.73	TB7B-in-Isco			5.710		0.8838	0.02638			0.0928												
11/11/14	13:54:00 PM	NA	NA	TB7B-in-Isco			6.031		0.1074	0.09486			0.3472												
12/2/14	13:57:00 PM	NA	NA	TB7B-in-Isco			2.361		0.3872	0.00944			0.0634												
3/17/15	8:14:00 AM	22059	7.42	TB7B-in-Isco			6.179		3.0123	0.01088			0.0847												
3/31/15	7:27:00 AM	17024	7.87	TB7B-in-Isco			7.605		1.5812	0.60284			0.2263												
4/13/15	13:02:00 PM	5711	7.72	TB7B-in-Isco			27.762		0.9395	0.60049			1.0484												
4/28/15	12:11:00 PM	8768	7.93	TB7B-in-Isco			3.618		1.0963	0.01228			0.0616												
5/12/15	13:20:00 PM	5974	7.78	TB7B-in-Isco			6.030		0.7798	0.05919			0.2301												
5/27/15	9:14:00 AM	3670	8.20	TB7B-in-Isco			3.573		0.6085	0.03223			0.1101												
6/10/15	8:05:00 AM	667	8.04	TB7B-in-Isco			4.609		0.1841	0.06382			0.2190												
6/24/15	7:56:00 AM	1111	8.42	TB7B-in-Isco			6.015		0.2949	0.08335			0.3832												
7/8/15	9:19:00 AM	3239	7.49	TB7B-in-Isco			5.409		0.6255	0.03664			0.0638												
7/22/15	8:15:00 AM	3564	7.84	TB7B-in-Isco																					
8/19/15	7:24:00 AM	310	8.59	TB7B-in-Isco			3.483		0.0922	0.04803			0.2025												
					NA	NA	2.361	NA	0.0922	0.00944	0.023	NA	0.0616												
					NA	NA	27.762	NA	3.0123	0.60284	0.030	NA	1.0484												
					NA	NA	7.453	NA	0.6992	0.12752	0.026	NA	0.2490												

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
TB7B-out-Isco Total Metals																											
9/4/14	9:30:00 AM	296	6.87	TB7B-out-Isco	TOLLWAY 2954 TOT	3.029		0.040	0.0338		16.64			0.01	0.00907	2.110	3.72		5.04	0.0337		35.9		0.097		10.74	
9/16/14	8:18:00 AM	396	7.94	TB7B-out-Isco	TOLLWAY 2966 TOT	0.683		0.039	0.0333		20.81				0.01012	0.735	3.23		5.53	0.0163		48.9		0.114		14.23	
10/14/14	8:50:00 AM	337	7.36	TB7B-out-Isco	TOLLWAY 3019 TOT	0.308		0.033	0.0224		17.33				0.00837	0.329	3.13		4.62	0.0077		45.0		0.111		12.88	
10/28/14	12:25:00 PM	862	8.08	TB7B-out-Isco	TOLLWAY 3046 TOT	0.421		0.049	0.0489		50.31				0.00853	0.361	4.09		13.97	0.0073		119.4				40.54	
12/2/14	13:03:00 PM	1370	7.85	TB7B-out-Isco	TOLLWAY 3099 TOT	0.400		0.027	0.0504		39.13				0.01482	0.640	7.58		9.67	0.0327		230.5		0.205		25.27	
1/13/2015	13:48:00 PM	NA	NA	TB7B-out-Isco	TOLLWAY 3136 TOT	1.052		0.042	0.0484		21.30			0.01	0.02103	1.283	4.25		4.71	0.0441		603.4		0.224		15.92	
3/17/15	9:29:00 AM	2346	7.65	TB7B-out-Isco	TOLLWAY 3220 TOT	0.671		0.051	0.0830		122.08				0.00908	0.731	7.99		39.96	0.0838		338.4		0.099		105.27	
3/31/15	8:10:00 AM	7000	8.20	TB7B-out-Isco	TOLLWAY 3246 TOT	0.332		0.047	0.1145		129.65				0.01197	0.676	11.57		29.66	0.0422		1356.0		0.091		77.10	
4/13/15	12:22:00 PM	1153	7.93	TB7B-out-Isco	TOLLWAY 3268 TOT	2.261		0.034	0.0755		45.04			0.02	0.02937	2.834	4.28		12.39	0.0556		183.4		0.131		25.08	
4/28/15	13:31:00 PM	NA	NA	TB7B-out-Isco	TOLLWAY 3312 TOT	0.139		0.029	0.0202		21.53				0.01033	0.177	2.71		4.52	0.0060		138.0				15.46	
5/12/15	15:04:00 PM	826	8.31	TB7B-out-Isco	TOLLWAY 3343 TOT	1.562		0.037	0.0475		31.86			0.01	0.01922	1.791	3.43		7.99	0.0368		135.0		0.128		19.19	
5/27/15	10:00:00 AM	NA	NA	TB7B-out-Isco	TOLLWAY 3362 TOT	0.460		0.026	0.0255		12.16			0.01	0.01273	0.640	3.05		2.93	0.0118		96.6				7.12	
6/10/15	8:23:00 AM	NA	NA	TB7B-out-Isco	TOLLWAY 3394 TOT	0.289		0.031	0.0183		11.52				0.01418	0.418	2.69		2.77	0.0079		75.1				6.42	
6/24/15	9:02:00 AM	684	8.23	TB7B-out-Isco	TOLLWAY 3417 TOT	0.482		0.047	0.0329		28.03				0.00692	0.462	3.06		7.17	0.0121		102.3				16.67	
7/7/15	16:00:00 PM	780	6.99	TB7B-out-Isco	TOLLWAY 3435 TOT	0.430		0.041	0.0287		21.17				0.00780	0.455	3.82		5.15	0.0127		104.1		0.074		11.82	
7/22/15	8:48:00 AM	312	8.26	TB7B-out-Isco	TOLLWAY 3469 TOT	0.239		0.036	0.0173		11.56			0.01	0.00638	0.249	3.37		2.70	0.0074		47.5		0.106		6.61	
8/19/15	8:57:00 AM	NA	NA	TB7B-out-Isco	TOLLWAY 3521 TOT	0.236		0.024	0.0149		7.47			0.01	0.00934	0.333	3.60		1.85	0.0118		27.7		0.168		4.26	
					min	0.139	NA	0.024	0.0149	NA	7.47	NA	NA	0.01	0.00638	0.177	2.69	NA	1.85	0.0060	NA	27.7	NA	0.074	NA	4.26	
					max	3.029	NA	0.051	0.1145	NA	129.65	NA	NA	0.02	0.02937	2.834	11.57	NA	39.96	0.0838	NA	1356.0	NA	0.224	NA	105.27	
					mean	0.764	NA	0.037	0.0421	NA	35.74	NA	NA	0.01	0.01231	0.837	4.45	NA	9.45	0.0253	NA	216.9	NA	0.129	NA	24.39	

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	Field pH	Sample location	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaC	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
TB7B-out-Isco Total Metals																									
9/4/14	9:30:00 AM	296	6.87	TB7B-out-Isco			8.776		0.0759	0.12561			0.0394												
9/16/14	8:18:00 AM	396	7.94	TB7B-out-Isco			2.718		0.1014	0.02710			0.0412												
10/14/14	8:50:00 AM	337	7.36	TB7B-out-Isco			1.598		0.0784	0.01069			0.0271												
10/28/14	12:25:00 PM	862	8.08	TB7B-out-Isco			2.772		0.2426	0.01456			0.0288												
12/2/14	13:03:00 PM	1370	7.85	TB7B-out-Isco			2.116		0.1761	0.01327			0.0506												
1/13/2015	13:48:00 PM	NA	NA	TB7B-out-Isco			3.294		0.1117	0.04046			0.0666												
3/17/15	9:29:00 AM	2346	7.65	TB7B-out-Isco			3.952		0.5152	0.02870			0.0958												
3/31/15	8:10:00 AM	7000	8.20	TB7B-out-Isco			3.023		0.7457	0.01434			0.0577												
4/13/15	12:22:00 PM	1153	7.93	TB7B-out-Isco			6.972		0.2095	0.10791			0.1152												
4/28/15	13:31:00 PM	NA	NA	TB7B-out-Isco			1.420		0.1237	0.00482			0.0144												
5/12/15	15:04:00 PM	826	8.31	TB7B-out-Isco			6.829		0.1776	0.05583			0.0627												
5/27/15	10:00:00 AM	NA	NA	TB7B-out-Isco			1.970		0.0751	0.01838			0.0288												
6/10/15	8:23:00 AM	NA	NA	TB7B-out-Isco			1.765		0.0665	0.01037			0.0306												
6/24/15	9:02:00 AM	684	8.23	TB7B-out-Isco			2.765		0.1499	0.01682			0.0281												
7/7/15	16:00:00 PM	780	6.99	TB7B-out-Isco			2.115		0.1215	0.01739			0.0228												
7/22/15	8:48:00 AM	312	8.26	TB7B-out-Isco			1.406		0.0679	0.00806			0.0129												
8/19/15	8:57:00 AM	NA	NA	TB7B-out-Isco			1.344		0.0405	0.01099			0.1297												
					NA	NA	1.344	NA	0.0405	0.00482	NA	NA	0.0129												
					NA	NA	8.776	NA	0.7457	0.12561	NA	NA	0.1297												
					NA	NA	3.226	NA	0.1811	0.03090	NA	NA	0.0501												

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
TB9A-Isco Total Metals																											
9/3/14	14:34:00 PM	1025	7.85	TB9A-Isco TOLLWAY 2945 TOT		1.800		0.048	0.0502		25.73				0.00786	1.476	6.47		6.47	0.1046		187.5		0.129		12.82	
9/16/14	10:10:00 AM	2005	7.85	TB9A-Isco TOLLWAY 2968 TOT		0.410		0.054	0.0758		46.05				0.00825	0.623	12.03		10.60	0.1501		377.7		0.139		25.93	
9/30/14	12:52:00 PM	NA	NA	TB9A-Isco TOLLWAY 2994 TOT		0.176		0.061	0.0936		45.43				0.01094	0.548	20.01		9.32	0.2404		645.0		0.115		21.46	
10/14/14	13:01:00 PM	787	7.84	TB9A-Isco TOLLWAY 3022 TOT		0.501		0.034	0.0406		21.12				0.01042	0.657	5.49		4.97	0.1213		138.7		0.111		14.09	
10/28/14	9:00:00 AM	3342	7.88	TB9A-Isco TOLLWAY 3039 TOT		0.353		0.048	0.0988		69.49				0.00740	0.480	16.73		16.44	0.0511		637.9				51.21	
12/2/14	9:48:00 AM	2199	7.84	TB9A-Isco TOLLWAY 3098 TOT		0.424		0.028	0.0658		43.98				0.01280	0.685	13.20		8.96	0.1112		403.8		0.102		23.74	
1/13/2015	10:05:00 AM	5294	8.17	TB9A-Isco TOLLWAY 3138 TOT		0.648		0.039	0.1061		63.13				0.01590	0.952	13.36		11.10	0.1724		1055.4		0.109		37.17	
1/27/2015	15:23:00 PM	10120	7.79	TB9A-Isco TOLLWAY 3159 TOT		0.185		0.048	0.1742		133.54				0.00791	0.352	23.10		28.62	0.7596		2078.8		0.082		70.24	
2/10/15	10:18:00 AM	15910	7.68	TB9A-Isco TOLLWAY 3181 TOT				0.073	0.3431		294.50				0.00465	0.440	45.24		58.48	1.8477		3242.6		0.119		122.30	
3/3/15	13:01:00 PM	15049	7.78	TB9A-Isco TOLLWAY 3198 TOT				0.062	0.2883		340.92					0.129	36.63		83.84	0.6749		3059.9				160.27	
3/4/15	10:59:00 AM	33695	7.70	TB9A-Isco TOLLWAY 3199 TOT		0.296		0.072	0.3824		248.69				0.00822	1.277	36.61		39.49	2.5726		7707.5		0.176		97.45	
3/17/15	12:41:00 PM	9111	7.43	TB9A-Isco TOLLWAY 3222 TOT		2.031		0.040	0.1687		130.88				0.01337	2.731	18.21		30.78	1.5095		1899.6		0.078		51.84	
3/31/15	9:32:00 AM	14821	7.87	TB9A-Isco TOLLWAY 3250 TOT		0.113		0.050	0.2498		252.55				0.00669	0.479	32.31		43.85	0.2305		3232.2		0.096		87.08	
4/15/15	10:26:00 AM	17675	8.82	TB9A-Isco TOLLWAY 3289 TOT		2.845		0.036	0.1358		82.29			0.01	0.02346	2.964	13.55		15.86	0.1286		933.4		0.125		29.40	
4/28/15	14:50:00 PM	9724	8.17	TB9A-Isco TOLLWAY 3305 TOT		0.067		0.047	0.2033		160.77				0.00840	0.215	29.48		24.99	0.0874		1977.7		0.095		55.47	
5/13/15	8:18:00 AM	2969	7.96	TB9A-Isco TOLLWAY 3339 TOT		2.722		0.042	0.0955		59.29				0.01264	2.147	10.15		11.04	0.2813		564.1		0.140		21.71	
5/27/15	12:06:00 PM	6406	7.83	TB9A-Isco TOLLWAY 3354 TOT		1.061		0.053	0.1567		93.58				0.01356	1.656	23.05		14.78	0.4062		1300.8		0.529		26.74	
6/9/15	12:45:00 PM	3757	8.00	TB9A-Isco TOLLWAY 3381 TOT		0.199		0.034	0.0883		61.25				0.00525	0.373	13.32		8.89	0.1198		745.7		0.107		11.26	
6/23/15	14:35:00 PM	2665	8.17	TB9A-Isco TOLLWAY 3415 TOT		0.272		0.052	0.0904		51.58				0.00546	0.980	10.91		6.52	1.1496		505.1		0.215		9.12	
7/8/15	12:26:00 PM	2668	7.35	TB9A-Isco TOLLWAY 3446 TOT		0.494		0.050	0.0819		58.29				0.00570	0.717	10.50		10.25	0.1461		518.3		0.250		16.40	
7/21/15	14:25:00 PM	2598	8.16	TB9A-Isco TOLLWAY 3467 TOT		0.394		0.046	0.0896		47.41				0.00665	1.089	11.41		6.51	0.4918		504.5		0.278		7.40	
8/4/15	11:16:00 AM	NA	NA	TB9A-Isco TOLLWAY 3487 TOT		0.345		0.034	0.1109		65.32				0.00817	1.113	15.77		11.74	1.1489		503.9		0.332		35.26	
					min	0.067	NA	0.028	0.0406	NA	21.12	NA	NA	0.01	0.00465	0.129	5.49	NA	4.97	0.0511	NA	138.7	NA	0.078	NA	7.40	
					max	2.845	NA	0.073	0.3824	NA	340.92	NA	NA	0.01	0.02346	2.964	45.24	NA	83.84	2.5726	NA	7707.5	NA	0.529	NA	160.27	
					mean	0.767	NA	0.048	0.1450	NA	108.90	NA	NA	0.01	0.00970	1.004	18.98	NA	21.07	0.5684	NA	1464.6	NA	0.166	NA	44.93	

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31

TB9A-Isco Total Metals

9/3/14	14:34:00 PM	1025	7.85	TB9A-Isco			6.000		0.1903	0.08602	0.022		0.0439												
9/16/14	10:10:00 AM	2005	7.85	TB9A-Isco			3.636		0.3750	0.01733			0.0278												
9/30/14	12:52:00 PM	NA	NA	TB9A-Isco			2.687		0.4561	0.00578			0.0250												
10/14/14	13:01:00 PM	787	7.84	TB9A-Isco			2.501		0.1543	0.02018			0.0418												
10/28/14	9:00:00 AM	3342	7.88	TB9A-Isco			3.415		0.5609	0.01391			0.0368												
12/2/14	9:48:00 AM	2199	7.84	TB9A-Isco			2.605		0.3062	0.01527			0.0644												
1/13/2015	10:05:00 AM	5294	8.17	TB9A-Isco			2.593		0.5061	0.02753			0.0960												
1/27/2015	15:23:00 PM	10120	7.79	TB9A-Isco			4.013		1.2534	0.00596	0.021		0.1061												
2/10/15	10:18:00 AM	15910	7.68	TB9A-Isco			2.863		2.6983		0.063		0.1017												
3/3/15	13:01:00 PM	15049	7.78	TB9A-Isco			3.520		2.7362		0.035		0.0641												
3/4/15	10:59:00 AM	33695	7.70	TB9A-Isco			3.383		2.5181	0.01209			0.2138												
3/17/15	12:41:00 PM	9111	7.43	TB9A-Isco			6.812		1.1261	0.06365			0.1128												
3/31/15	9:32:00 AM	14821	7.87	TB9A-Isco			1.301		2.1516	0.00375			0.0584												
4/15/15	10:26:00 AM	17675	8.82	TB9A-Isco			7.979		0.7129	0.12360			0.1461												
4/28/15	14:50:00 PM	9724	8.17	TB9A-Isco			0.395		1.5721	0.00253			0.0291												
5/13/15	8:18:00 AM	2969	7.96	TB9A-Isco			8.123		0.5166	0.11520			0.0728												
5/27/15	12:06:00 PM	6406	7.83	TB9A-Isco			4.747		1.0031	0.03909			0.0765												
6/9/15	12:45:00 PM	3757	8.00	TB9A-Isco			2.803		0.6645	0.00701			0.0217												
6/23/15	14:35:00 PM	2665	8.17	TB9A-Isco			3.147		0.4824	0.00938			0.0249												
7/8/15	12:26:00 PM	2668	7.35	TB9A-Isco			3.733		0.4883	0.01781			0.0281												
7/21/15	14:25:00 PM	2598	8.16	TB9A-Isco			3.220		0.4401	0.01583			0.0329												
8/4/15	11:16:00 AM	NA	NA	TB9A-Isco			3.278		0.5596	0.01516			0.0514												
					NA	NA	0.395	NA	0.1543	0.00253	0.021	NA	0.0217												
					NA	NA	8.123	NA	2.7362	0.12360	0.063	NA	0.2138												
					NA	NA	3.762	NA	0.9760	0.03085	0.035	NA	0.0671												

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
TB15B-SW-Isco Total Metals																										
9/3/14	8:48:00 AM	81	7.74	TB15B-SW-Isco	TOLLWAY 2934 TOT	2.505		0.025	0.0251		10.18			0.01	0.00837	2.044	3.46		4.68	0.0349		10.3		0.222		1.46
9/16/14	14:32:00 PM	497	8.51	TB15B-SW-Isco	TOLLWAY 2974 TOT	8.084		0.101	0.0898		38.82			0.01	0.01585	4.952	16.77		9.46	0.0614		60.9		0.650		8.26
10/15/14	9:20:00 AM	124	8.19	TB15B-SW-Isco	TOLLWAY 3028 TOT	3.038			0.0425		12.67			0.01	0.01169	2.494	5.28		4.61	0.0537		19.1		1.066		2.73
3/11/15	9:34:00 AM	5417	6.65	TB15B-SW-Isco	TOLLWAY 3206 TOT	3.514			0.0953		59.01				0.01161	2.550	13.89		11.11	0.0675		1091.0		0.471		17.96
3/31/15	13:00:00 PM	NA	NA	TB15B-SW-Isco	TOLLWAY 3255 TOT	2.254		0.053	0.1679		161.94				0.01153	1.992	25.64		32.16	0.1161		311.6		0.454		20.20
4/14/15	7:50:00 AM	364	8.14	TB15B-SW-Isco	TOLLWAY 3275 TOT	19.648		0.035	0.1767		20.42			0.04	0.04948	14.154	8.65		9.18	0.2150		71.3		0.439		3.81
5/12/15	8:06:00 AM	1965	8.45	TB15B-SW-Isco	TOLLWAY 3325 TOT	13.144		0.028	0.1412		25.56			0.02	0.05037	9.495	7.18		8.28	0.1522		39.0		0.895		3.58
5/28/15	9:02:00 AM	NA	NA	TB15B-SW-Isco	TOLLWAY 3360 TOT	not enough sample																				
6/22/15	14:32:00 PM	190	6.98	TB15B-SW-Isco	TOLLWAY 3400 TOT	6.743		0.032	0.0596		13.98			0.01	0.01589	5.079	5.73		5.16	0.0779		29.9		0.255		2.59
7/7/15	8:32:00 PM	91	8.02	TB15B-SW-Isco	TOLLWAY 3430 TOT	3.920			0.0312		5.77				0.00768	2.770	3.65		2.14	0.0338		12.7		0.152		1.18
7/20/15	12:57:00 PM	163	6.76	TB15B-SW-Isco	TOLLWAY 3453 TOT	36.160		0.072	0.2092	0.00071	18.17			0.04	0.03876	21.832	18.53		9.62	0.1869		28.4		0.723		2.87
8/4/15	7:07:00 AM	NA	NA	TB15B-SW-Isco	TOLLWAY 3478 TOT	4.228		0.035	0.0836		24.32			0.01	0.01861	4.166	30.24		7.94	0.1525		5.7		1.832		2.58
					min	2.254	NA	0.025	0.0251	0.00071	5.77	NA	NA	0.01	0.00768	1.992	3.46	NA	2.14	0.0338	NA	5.7	NA	0.152	NA	1.18
					max	36.160	NA	0.101	0.2092	0.00071	161.94	NA	NA	0.04	0.05037	21.832	30.24	NA	32.16	0.2150	NA	1091.0	NA	1.832	NA	20.20
					mean	9.385	NA	0.048	0.1020	0.00071	35.53	NA	NA	0.02	0.02180	6.503	12.64	NA	9.49	0.1047	NA	152.7	NA	0.651	NA	6.11

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaC	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
				0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
TB15B-SW-Isco Total Metals																								
9/3/14	8:48:00 AM	81	7.74			7.079		0.0226	0.10083			0.0380												
9/16/14	14:32:00 PM	497	8.51			22.808		0.1025	0.29079			0.0956												
10/15/14	9:20:00 AM	124	8.19			8.021		0.0343	0.10662			0.0897												
3/11/15	9:34:00 AM	5417	6.65			10.213		0.2951	0.13114			0.2484												
3/31/15	13:00:00 PM	NA	NA			9.015		0.4279	0.09179			0.3299												
4/14/15	7:50:00 AM	364	8.14			53.167		0.0828	0.94800			0.3055												
5/12/15	8:06:00 AM	1965	8.45			35.133		0.0868	0.57568			0.2649												
5/28/15	9:02:00 AM	NA	NA																					
6/22/15	14:32:00 PM	190	6.98			17.932		0.0431	0.24787			0.1014												
7/7/15	8:32:00 AM	91	8.02			9.548		0.0229	0.14337			0.0392												
7/20/15	12:57:00 PM	163	6.76			92.549		0.0685	1.23171		0.06	0.1731												
8/4/15	7:07:00 AM	NA	NA			10.416		0.0617	0.18182			0.2027												
				NA	NA	7.079	NA	0.0226	0.09179	NA	0.06	0.0380												
				NA	NA	92.549	NA	0.4279	1.23171	NA	0.06	0.3299												
				NA	NA	25.080	NA	0.1135	0.36815	NA	0.06	0.1717												

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
TB15B-GW-Isco Total Metals																											
9/3/14	10:11:00 AM	860	8.25	TB15B-GW-Isco TOLLWAY 2938 TOT		4.294		0.048	0.0436		33.57			0.01	0.01515	3.671	6.87		5.82	0.0724		161.6		0.235		11.57	
9/16/14	15:15:00 PM	909	7.97	TB15B-GW-Isco TOLLWAY 2977 TOT		2.071		0.048	0.0332		34.45				0.01007	1.537	6.68		5.51	0.0265		167.7		0.202		13.90	
9/30/14	8:30:00 AM	NA	NA	TB15B-GW-Isco TOLLWAY 2986 TOT		0.091		0.059	0.0572		69.14				0.00511	0.204	12.38		11.41	0.0084		440.9		0.115		41.93	
10/15/14	10:13:00 AM	901	8.01	TB15B-GW-Isco TOLLWAY 3031 TOT		2.551		0.024	0.0325		31.70				0.01174	2.044	5.89		5.62	0.0477		172.3		0.186		14.43	
10/29/14	9:35:00 AM	1750	8.18	TB15B-GW-Isco TOLLWAY 3056 TOT		0.753		0.048	0.0314		42.34				0.00660	0.599	11.25		6.47	0.0129		345.1		0.153		29.73	
12/3/14	10:25:00 AM	NA	NA	TB15B-GW-Isco TOLLWAY 3095 TOT		0.278		0.036	0.0469		59.86				0.00837	0.285	13.40		12.06	0.0088		496.2		0.194		45.82	
12/16/14	14:55:00 PM	NA	NA	TB15B-GW-Isco TOLLWAY 3117 TOT		0.111		0.023	0.0721		91.13				0.00364	0.118	14.77		11.17	0.0061		760.0		0.119		34.79	
1/14/2015	11:56:00 AM	2159	8.79	TB15B-GW-Isco TOLLWAY 3140 TOT		0.329		0.024	0.0368		57.12				0.00574	0.283	9.02		8.09	0.0058		403.3		0.113		27.30	
1/27/2015	11:46:00 AM	8656	7.95	TB15B-GW-Isco TOLLWAY 3157 TOT		0.153		0.030	0.2201		232.21				0.00507	0.151	16.89		29.68	0.0044		1607.8		0.134		40.65	
2/11/15	9:06:00 AM	15779	8.00	TB15B-GW-Isco TOLLWAY 3182 TOT		0.103			0.4365		442.73					0.092	30.28		40.81	0.0031		3114.9		0.134		59.39	
3/4/15	10:11:00 AM	NA	NA	TB15B-GW-Isco TOLLWAY 3197 TOT		0.625			0.3925		406.06			0.07	0.00672	0.867	27.58		46.15	0.0196	0.024	2869.0	0.05	0.246		59.33	
3/11/15	10:20:00 AM	5533	7.16	TB15B-GW-Isco TOLLWAY 3207 TOT		0.429			0.1313		137.96				0.00400	0.359	8.35		24.35	0.0087		1039.5		0.116		22.94	
3/18/15	10:19:00 AM	13918	8.20	TB15B-GW-Isco TOLLWAY 3235 TOT		0.127			0.2977		258.69				0.00604	0.093	23.33		18.79	0.0039		2910.7		0.087		49.36	
3/31/15	13:45:00 PM	13589	8.00	TB15B-GW-Isco TOLLWAY 3257 TOT		0.158		0.031	0.3032		249.36			0.01	0.00686	0.192	26.22		20.17	0.0135		2947.8		0.140		53.46	
4/14/15	10:59:00 AM	11541	8.18	TB15B-GW-Isco TOLLWAY 3278 TOT		0.146		0.030	0.2498		233.98				0.00235	0.183	27.66		18.74	0.0114	0.024	2420.0		0.128		56.19	
4/29/15	9:45:00 AM	7747	8.27	TB15B-GW-Isco TOLLWAY 3309 TOT		0.306		0.033	0.1439		143.52				0.00907	0.209	20.58		12.40	0.0047	0.023	1590.0		0.092		47.67	
5/12/15	9:27:00 AM	3027	7.97	TB15B-GW-Isco TOLLWAY 3327 TOT		3.925		0.036	0.0712		57.26			0.01	0.01390	2.838	9.85		7.74	0.0480		587.8		0.188		21.86	
5/28/15	9:50:00 AM	5331	7.56	TB15B-GW-Isco TOLLWAY 3363 TOT		0.130		0.037	0.0874		81.56				0.00826	0.075	15.83		11.74	0.0022		1063.5				45.90	
6/9/15	9:45:00 AM	3481	7.99	TB15B-GW-Isco TOLLWAY 3378 TOT		0.545		0.033	0.0613		59.87				0.01033	0.409	11.57		8.83	0.0081		672.2		0.082		29.20	
6/22/15	15:15:00 PM	1655	7.55	TB15B-GW-Isco TOLLWAY 3401 TOT		2.332		0.048	0.0411		39.49				0.01493	1.957	6.53		6.12	0.0469		304.6		0.175		14.86	
7/7/15	11:39:00 AM	1226	7.87	TB15B-GW-Isco TOLLWAY 3432 TOT		2.156		0.046	0.0343		34.05				0.01187	1.676	6.13		5.10	0.0314		231.6		0.160		13.30	
8/4/15	9:40:00 AM	1389	7.87	TB15B-GW-Isco TOLLWAY 3486 TOT		4.164		0.038	0.0575		46.84			0.01	0.01590	3.657	7.70		6.61	0.0767		264.4		0.245		17.54	
8/19/15	11:31:00 AM	2313	7.89	TB15B-GW-Isco TOLLWAY 3518 TOT		1.337		0.057	0.0560		53.37				0.01072	1.189	11.01		8.54	0.0519		428.9		0.183		31.18	
					min	0.091	NA	0.023	0.0314	NA	31.70	NA	NA	0.01	0.00235	0.075	5.89	NA	5.10	0.0022	0.023	161.6	0.05	0.082	NA	11.57	
					max	4.294	NA	0.059	0.4365	NA	442.73	NA	NA	0.07	0.01590	3.671	30.28	NA	46.15	0.0767	0.024	3114.9	0.05	0.246	NA	59.39	
					mean	1.179	NA	0.038	0.1277	NA	125.92	NA	NA	0.02	0.00875	0.986	14.34	NA	14.43	0.0227	0.024	1087.0	0.05	0.156	NA	34.01	

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
TB15B-GW-Isco Total Metals																									
9/3/14	10:11:00 AM	860	8.25	TB15B-GW-Isco			14.547		0.1266	0.13783			0.0286												
9/16/14	15:15:00 PM	909	7.97	TB15B-GW-Isco			9.467		0.1377	0.06206			0.0266												
9/30/14	8:30:00 AM	NA	NA	TB15B-GW-Isco			6.473		0.3209	0.00198			0.0129												
10/15/14	10:13:00 AM	901	8.01	TB15B-GW-Isco			9.865		0.1260	0.07725			0.0198												
10/29/14	9:35:00 AM	1750	8.18	TB15B-GW-Isco			8.252		0.1966	0.01778			0.0176												
12/3/14	10:25:00 AM	NA	NA	TB15B-GW-Isco			6.562		0.3158	0.00823			0.0150												
12/16/14	14:55:00 PM	NA	NA	TB15B-GW-Isco			5.021		0.5656	0.00189			0.0115												
1/14/2015	11:56:00 AM	2159	8.79	TB15B-GW-Isco			4.435		0.3021	0.00870			0.0323												
1/27/2015	11:46:00 AM	8656	7.95	TB15B-GW-Isco			4.075		1.3144	0.00251			0.0571												
2/11/15	9:06:00 AM	15779	8.00	TB15B-GW-Isco			4.233		2.4670	0.00199	0.086		0.0178												
3/4/15	10:11:00 AM	NA	NA	TB15B-GW-Isco			5.330		2.2431	0.01399			0.0125												
3/11/15	10:20:00 AM	5533	7.16	TB15B-GW-Isco			3.446		0.6804	0.01112			0.0142												
3/18/15	10:19:00 AM	13918	8.20	TB15B-GW-Isco			4.151		1.6202	0.00086			0.0099												
3/31/15	13:45:00 PM	13589	8.00	TB15B-GW-Isco			4.996		1.6148	0.00345	0.025		0.0178												
4/14/15	10:59:00 AM	11541	8.18	TB15B-GW-Isco			5.241		1.5030	0.00373	0.022		0.0135												
4/29/15	9:45:00 AM	7747	8.27	TB15B-GW-Isco			5.803		0.9151	0.00714															
5/12/15	9:27:00 AM	3027	7.97	TB15B-GW-Isco			12.667		0.3408	0.11050	0.018		0.0262												
5/28/15	9:50:00 AM	5331	7.56	TB15B-GW-Isco			6.710		0.5333	0.00158															
6/9/15	9:45:00 AM	3481	7.99	TB15B-GW-Isco			6.942		0.3837	0.01484			0.0150												
6/22/15	15:15:00 PM	1655	7.55	TB15B-GW-Isco			10.136		0.1808	0.06749			0.0196												
7/7/15	11:39:00 AM	1226	7.87	TB15B-GW-Isco			9.380		0.1448	0.06017			0.0165												
8/4/15	9:40:00 AM	1389	7.87	TB15B-GW-Isco			14.734		0.1804	0.13943			0.0350												
8/19/15	11:31:00 AM	2313	7.89	TB15B-GW-Isco			9.480		0.2954	0.03816			0.0157												
					NA	NA	3.446	NA	0.1260	0.00086	0.018	NA	0.0099												
					NA	NA	14.734	NA	2.4670	0.13943	0.086	NA	0.0571												
					NA	NA	7.476	NA	0.7178	0.03446	0.038	NA	0.0207												

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
TB19-SW-Isco Total Metals																										
9/3/14	16:19:00 PM	104	8.76	TB19-SW-Isco	TOLLWAY 2946 TOT	1.708		0.024	0.0237		11.98			0.01	0.00832	1.373	5.71		4.45	0.0326		12.4		0.507		1.50
9/16/14	13:10:00 PM	NA	NA	TB19-SW-Isco	TOLLWAY 2973 TOT	0.621		0.029	0.0137		7.37				0.00742	0.586	9.79		1.69	0.0153		14.1		0.634		1.88
10/29/14	11:45:00 AM	NA	NA	TB19-SW-Isco	TOLLWAY 3054 TOT	1.255			0.0180		7.68				0.00542	0.950	3.13		2.05	0.0176		16.7		0.347		1.36
12/3/14	13:07:00 PM	463	8.26	TB19-SW-Isco	TOLLWAY 3097 TOT	0.771		0.025	0.0439		29.82				0.01569	0.899	34.29		5.80	0.0399		51.3		0.650		2.77
12/16/14	11:10:00 AM	NA	NA	TB19-SW-Isco	TOLLWAY 3118 TOT	1.368			0.0432		31.65				0.02000	1.121	35.93		5.22	0.0364		77.7		0.496		5.22
1/13/2015	15:44:00 PM	NA	NA	TB19-SW-Isco	TOLLWAY 3135 TOT	3.104		0.027	0.0433		16.60			0.01	0.01243	2.537	17.34		4.07	0.0615		16.8		0.333		2.00
1/27/2015	8:52:00 AM	NA	NA	TB19-SW-Isco	TOLLWAY 3160 TOT	2.382		0.030	0.0511		23.92			0.01	0.01683	2.059	17.01		5.40	0.0908		220.0		0.975		4.47
3/17/15	14:21:00 PM	NA	NA	TB19-SW-Isco	TOLLWAY 3224 TOT	not enough sample																				
3/31/15	12:19:00 PM	NA	NA	TB19-SW-Isco	TOLLWAY 3254 TOT	5.477		0.031	0.1076		21.67			0.02	0.03733	5.261	12.30		6.33	0.1460		194.2		0.583		5.10
4/15/15	8:50:00 AM	366	8.49	TB19-SW-Isco	TOLLWAY 3286 TOT	8.197		0.027	0.0949		18.59			0.03	0.02774	6.305	5.49		7.84	0.1148		74.3		0.465		3.36
4/28/15	9:52:00 AM	NA	NA	TB19-SW-Isco	TOLLWAY 3311 TOT	14.809		0.045	0.1939		36.62			0.04	0.05208	12.606	12.22		13.16	0.3155		34.0		1.716		4.21
5/12/15	16:28:00 PM	NA	NA	TB19-SW-Isco	TOLLWAY 3337 TOT	2.355			0.0288		4.37			0.01	0.00948	1.564	1.43		1.34	0.0202		31.2		0.255		1.96
6/9/15	15:30:00 PM	NA	NA	TB19-SW-Isco	TOLLWAY 3386 TOT	4.755		0.045	0.0662		21.24			0.02	0.02812	3.982	17.56		5.04	0.1176		35.6		1.474		4.22
6/22/15	12:48:00 PM	152	6.80	TB19-SW-Isco	TOLLWAY 3399 TOT	3.366		0.034	0.0338		8.80			0.01	0.00854	2.043	6.22		2.85	0.0310		21.2		0.253		1.57
7/7/15	14:45:00 PM	NA	NA	TB19-SW-Isco	TOLLWAY 3434 TOT	0.932		0.052	0.0272		19.45				0.01002	0.846	19.73		2.67	0.0322		23.4		1.118		3.22
7/20/15	11:56:00 AM	133	6.54	TB19-SW-Isco	TOLLWAY 3452 TOT	4.456		0.032	0.0761		36.88			0.01	0.01734	3.812	11.75		14.13	0.1626		16.8		0.673		1.92
8/4/15	13:28:00 PM	NA	NA	TB19-SW-Isco	TOLLWAY 3492 TOT	2.162		0.036	0.0491		31.31			0.01	0.02262	2.203	25.69		8.28	0.0839		25.4		1.579		4.92
8/17/15	13:54:00 PM	NA	NA	TB19-SW-Isco	TOLLWAY 3509 TOT	0.601		0.046	0.0272		20.02				0.01512	0.672	25.48		3.95	0.0407		17.1		0.962		3.16
					min	0.601	NA	0.024	0.0137	NA	4.37	NA	NA	0.01	0.00542	0.586	1.43	NA	1.34	0.0153	NA	12.4	NA	0.253	NA	1.36
					max	14.809	NA	0.052	0.1939	NA	36.88	NA	NA	0.04	0.05208	12.606	35.93	NA	14.13	0.3155	NA	220.0	NA	1.716	NA	5.22
					mean	3.431	NA	0.035	0.0554	NA	20.47	NA	NA	0.01	0.01850	2.872	15.36	NA	5.55	0.0799	NA	51.9	NA	0.766	NA	3.11

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31

TB19-SW-Isco Total Metals

9/3/14	16:19:00 PM	104	8.76	TB19-SW-Isco	0.07649			0.0584													
9/16/14	13:10:00 PM	NA	NA	TB19-SW-Isco	0.01939			0.0480													
10/29/14	11:45:00 AM	NA	NA	TB19-SW-Isco	0.04482			0.0411													
12/3/14	13:07:00 PM	463	8.26	TB19-SW-Isco	0.02354			0.1486													
12/16/14	11:10:00 AM	NA	NA	TB19-SW-Isco	0.05564			0.1525													
1/13/2015	15:44:00 PM	NA	NA	TB19-SW-Isco	0.12653			0.1804													
1/27/2015	8:52:00 AM	NA	NA	TB19-SW-Isco	0.09821			0.2391													
3/17/15	14:21:00 PM	NA	NA	TB19-SW-Isco																	
3/31/15	12:19:00 PM	NA	NA	TB19-SW-Isco	0.28247			0.3180													
4/15/15	8:50:00 AM	366	8.49	TB19-SW-Isco	0.32663			0.1624													
4/28/15	9:52:00 AM	NA	NA	TB19-SW-Isco	0.74927			0.5877													
5/12/15	16:28:00 PM	NA	NA	TB19-SW-Isco	0.06543			0.0545													
6/9/15	15:30:00 PM	NA	NA	TB19-SW-Isco	0.20298			0.2477													
6/22/15	12:48:00 PM	152	6.80	TB19-SW-Isco	0.13301			0.0734													
7/7/15	14:45:00 PM	NA	NA	TB19-SW-Isco	0.03036			0.1119													
7/20/15	11:56:00 AM	133	6.54	TB19-SW-Isco	0.16834			0.3693													
8/4/15	13:28:00 PM	NA	NA	TB19-SW-Isco	0.10367			0.2014													
8/17/15	13:54:00 PM	NA	NA	TB19-SW-Isco	0.02526			0.1143													
					0.01939	NA	NA	0.0411													
					0.74927	NA	NA	0.5877													
					0.14894	NA	NA	0.1829													

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
TB19-GW-Isco Total Metals																											
9/3/14	16:15:00 PM	986	8.02	TB19-GW-Isco TOLLWAY 2947 TOT		5.807		0.072	0.0565		42.46			0.01	0.01965	4.179	9.76		9.92	0.0701		169.5		0.204		12.92	
9/16/14	12:30:00 PM	1076	7.93	TB19-GW-Isco TOLLWAY 2971 TOT		3.512		0.061	0.0540		48.65				0.01335	2.364	11.11		10.04	0.0393		192.8		0.138		16.43	
9/30/14	14:46:00 PM	NA	NA	TB19-GW-Isco TOLLWAY 2998 TOT		0.525		0.073	0.0497		58.97				0.00840	0.377	12.21		13.26	0.0076		301.4				31.82	
10/14/14	15:30:00 PM	1049	7.92	TB19-GW-Isco TOLLWAY 3029 TOT		3.901		0.026	0.0462		41.53			0.01	0.01253	2.747	8.45		9.97	0.0434		187.0		0.136		17.13	
10/29/14	12:15:00 PM	572	8.31	TB19-GW-Isco TOLLWAY 3055 TOT		4.629		0.044	0.0410		35.15			0.01	0.01193	3.258	6.75		8.03	0.0502		97.2		0.193		8.35	
12/3/14	12:35:00 PM	2168	8.27	TB19-GW-Isco TOLLWAY 3100 TOT		0.721			0.0551		76.41				0.00730	0.565	12.72		13.30	0.0112		363.4		0.119		25.96	
12/16/14	11:55:00 AM	NA	NA	TB19-GW-Isco TOLLWAY 3119 TOT		0.091		0.033	0.0767		103.92			0.03	0.00751	0.193	16.76		16.55	0.0057		583.1				36.42	
1/13/2015	15:00:00 PM	2485	7.97	TB19-GW-Isco TOLLWAY 3139 TOT		0.323		0.030	0.0567		90.50				0.00578	0.320	12.09		18.06	0.0079		422.1		0.102		26.90	
1/27/2015	9:22:00 AM	9734	7.93	TB19-GW-Isco TOLLWAY 3158 TOT		0.107		0.036	0.3177		398.29				0.00434	0.110	18.75		67.86	0.0072		1704.4		0.083		45.89	
2/10/15	15:21:00 PM	12339	7.84	TB19-GW-Isco TOLLWAY 3183 TOT		0.066		0.028	0.3111		436.30				0.00433	0.079	28.47		53.88	0.0085		2258.7		0.138		49.16	
3/3/15	14:56:00 PM	NA	NA	TB19-GW-Isco TOLLWAY 3196 TOT				0.030	0.2974		424.81			0.05	0.00292	0.223	29.66		62.25	0.0078		2449.7				50.05	
3/17/15	14:41:00 PM	8268	7.58	TB19-GW-Isco TOLLWAY 3227 TOT		1.875		0.026	0.2275		237.01				0.00560	1.032	13.72		40.38	0.0144		1527.7		0.121		28.35	
3/31/15	11:43:00 AM	8779	7.68	TB19-GW-Isco TOLLWAY 3253 TOT		0.840		0.035	0.1887		223.07				0.00590	0.435	20.95		30.94	0.0072		1731.1		0.115		34.04	
4/15/15	8:04:00 AM	5396	8.24	TB19-GW-Isco TOLLWAY 3285 TOT		5.792		0.040	0.1494		158.87			0.01	0.01301	3.708	16.79		27.59	0.0573		973.9		0.254		24.63	
4/28/15	10:29:00 AM	6282	8.33	TB19-GW-Isco TOLLWAY 3301 TOT		0.944		0.048	0.1123		118.83				0.00962	0.567	22.83		22.84	0.0080		1213.8		0.125		36.29	
5/12/15	16:05:00 PM	3290	8.35	TB19-GW-Isco TOLLWAY 3338 TOT		6.164		0.052	0.0808		64.48			0.01	0.01647	3.741	13.68		15.90	0.0442		628.0		0.211		23.66	
5/27/15	14:39:00 PM	3661	8.03	TB19-GW-Isco TOLLWAY 3364 TOT		1.770		0.043	0.0651		63.64				0.01585	1.010	15.30		19.68	0.0152		679.1		0.078		33.10	
6/9/15	14:58:00 PM	3100	8.3	TB19-GW-Isco TOLLWAY 3385 TOT		2.540		0.053	0.0528		51.17			0.01	0.01549	1.615	12.28		12.07	0.0208		595.1		0.115		30.36	
6/22/15	11:52:00 AM	1579	7.97	TB19-GW-Isco TOLLWAY 3398 TOT		6.889		0.065	0.0606		40.92			0.01	0.02127	4.855	9.79		10.52	0.0718		288.7		0.170		15.90	
7/7/15	14:23:00 PM	1974	6.93	TB19-GW-Isco TOLLWAY 3436 TOT		1.505		0.069	0.0488		54.96				0.01157	1.030	11.55		11.74	0.0192		375.2				24.06	
7/20/15	11:35:00 AM	1072	8.16	TB19-GW-Isco TOLLWAY 3468 TOT		5.754		0.067	0.0629		49.89			0.01	0.01865	4.737	9.93		11.17	0.0939		193.7		0.261		12.38	
8/4/15	13:05:00 PM	NA	NA	TB19-GW-Isco TOLLWAY 3491 TOT		6.601		0.059	0.0746		54.60			0.01	0.01845	4.526	11.27		12.54	0.0601		246.4		0.225		17.68	
8/17/15	14:31:00 PM	NA	NA	TB19-GW-Isco TOLLWAY 3511 TOT		0.867		0.061	0.0678		68.41				0.01038	0.612	14.02		15.04	0.0114		480.8		0.086		36.68	
					min	0.066	NA	0.026	0.0410	NA	35.15	NA	NA	0.01	0.00292	0.079	6.75	NA	8.03	0.0057	NA	97.2	NA	0.078	NA	8.35	
					max	6.889	NA	0.073	0.3177	NA	436.30	NA	NA	0.05	0.02127	4.855	29.66	NA	67.86	0.0939	NA	2449.7	NA	0.261	NA	50.05	
					mean	2.783	NA	0.048	0.1110	NA	127.95	NA	NA	0.02	0.01132	1.838	14.73	NA	22.33	0.0297	NA	768.0	NA	0.151	NA	27.75	

APPENDIX A2: Results of Geochemical Analysis of Isco Surface-Water Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
TB19-GW-Isco Total Metals																									
9/3/14	16:15:00 PM	986	8.02	TB19-GW-Isco			18.568		0.1542	0.16119			0.0286												
9/16/14	12:30:00 PM	1076	7.93	TB19-GW-Isco			14.315		0.1909	0.10027			0.0226												
9/30/14	14:46:00 PM	NA	NA	TB19-GW-Isco			8.841		0.2713	0.01223															
10/14/14	15:30:00 PM	1049	7.92	TB19-GW-Isco			14.297		0.1696	0.10907			0.0238												
10/29/14	12:15:00 PM	572	8.31	TB19-GW-Isco			14.704		0.1082	0.12517			0.0223												
12/3/14	12:35:00 PM	2168	8.27	TB19-GW-Isco			6.194		0.4061	0.01860			0.0275												
12/16/14	11:55:00 AM	NA	NA	TB19-GW-Isco			5.740		0.6737	0.00195			0.0118												
1/13/2015	15:00:00 PM	2485	7.97	TB19-GW-Isco			5.292		0.5009	0.00734			0.0140												
1/27/2015	9:22:00 AM	9734	7.93	TB19-GW-Isco			4.763		1.9486	0.00204	0.039		0.0104												
2/10/15	15:21:00 PM	12339	7.84	TB19-GW-Isco			4.732		2.3038	0.00207	0.039		0.0662												
3/3/15	14:56:00 PM	NA	NA	TB19-GW-Isco			4.076		2.2555		0.019		0.0137												
3/17/15	14:41:00 PM	8268	7.58	TB19-GW-Isco			7.808		1.1172	0.04474			0.0156												
3/31/15	11:43:00 AM	8779	7.68	TB19-GW-Isco			6.432		1.2190	0.01812			0.0135												
4/15/15	8:04:00 AM	5396	8.24	TB19-GW-Isco			17.286		0.7543	0.16125			0.0396												
4/28/15	10:29:00 AM	6282	8.33	TB19-GW-Isco			7.829		0.7792	0.02170			0.0152												
5/12/15	16:05:00 PM	3290	8.35	TB19-GW-Isco			18.728		0.3804	0.15951			0.0283												
5/27/15	14:39:00 PM	3661	8.03	TB19-GW-Isco			10.372		0.3836	0.04271	0.018		0.0155												
6/9/15	14:58:00 PM	3100	8.3	TB19-GW-Isco			12.283		0.2809	0.06613			0.0201												
6/22/15	11:52:00 AM	1579	7.97	TB19-GW-Isco			21.052		0.1685	0.19338			0.0306												
7/7/15	14:23:00 PM	1974	6.93	TB19-GW-Isco			10.909		0.2416	0.04110			0.0143												
7/20/15	11:35:00 AM	1072	8.16	TB19-GW-Isco			19.701		0.1722	0.17623			0.0270												
8/4/15	13:05:00 PM	NA	NA	TB19-GW-Isco			22.391		0.2221	0.23300			0.0334												
8/17/15	14:31:00 PM	NA	NA	TB19-GW-Isco			9.410		0.3777	0.02391			0.0099												
					NA	NA	4.076	NA	0.1082	0.00195	0.018	NA	0.0099												
					NA	NA	22.391	NA	2.3038	0.23300	0.039	NA	0.0662												
					NA	NA	11.553	NA	0.6556	0.07826	0.029	NA	0.0229												

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytes and Laboratory Methodologies

SM = "Standard Methods for the Examination of Water and Wastewater": APHA, AWWA, & WEF

US EPA = methods by the US Environmental Protection Agency

Parameter	Analytes	Analytical Methodology
Alkalinity	Alkalinity	Based on SM method 2320B - Titrimetric
Anions	F, Cl, NO ₃ , SO ₄	Based on US EPA Method 300.0 - Ion Chromatography
Metals, dissolved	Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mo, Na, Ni, P, Pb, S, Sb, Se, Si, Sn, Sr, Ti, Tl, V, Zn	Based on US EPA Method 200.7 - Inductively Coupled Plasma (ICP)
Metals, total recoverable	Al, As, B, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, Mo, Na, Ni, P, Pb, S, Sb, Se, Si, Sn, Sr, Ti, Tl, V, Zn	Based on US EPA Method 200.7 - Inductively Coupled Plasma (ICP)
Ammonia/ammonium	NH ₃ -N	Based on US EPA Method 350.1 - Colorimetry
Orthophosphate	oPO ₄ -P	Based on US EPA Method 365.1 - Colorimetry
Non-volatile organic carbon	total NVOC, dissolved NVOC	Based on SM method 5310B - High temperature combustion
Total Dissolved Solids	TDS, 180 C	Based on SM method 2540C - Dried at 180° C
Total Suspended Solids	TSS	Based on SM method 2540D - Dried at 103-105° C
pH	pH	Based on US EPA method 150.1 - Electrometric

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Date collected	Field conductivity	Field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	
					mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
				MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
9/22/09	3605	9.98	TB19r Grab	TOLLWAY 267	0.050		0.056	0.0549		23.8				0.0101	0.0189	91.0		17.1	0.0048	0.061	625	0.029			31.1	
10/6/09	1716	10.42	TB19r Grab	TOLLWAY 270	0.055		0.037	0.0446		23.5				0.00942	0.0181	85.5		7.81	0.0023	0.043	454				21.6	
10/20/09	2249	10.54	TB19r Grab	TOLLWAY 280			0.031	0.0215		14.5			0.0065	0.00792		88.5		7.36		0.032	399				21.5	
11/3/09	1379	10.19	TB19r Grab	TOLLWAY 294	0.042		0.045	0.0176		10.4			0.0073	0.0580	0.0438	63.3		9.85	0.0027		227	0.015	0.064		16.9	
12/1/09	1351	9.66	TB19r Grab	TOLLWAY 314	0.059		0.035	0.019		15.1				0.00537	0.0177	55.2		16.2	0.0019		208				19.0	
12/28/09	8936	9.94	TB19r Grab	TOLLWAY 342	0.041		0.038	0.194		114			0.0080	0.00766	0.0129	73.3		35.1	0.0174		1705	0.033			23.4	
1/26/10	9665	11.95	TB19r Grab	TOLLWAY 380			0.026	0.164		106				0.0248	0.0081	89.7		34.8		0.027	2097	0.027			22.7	
3/3/10	10786	9.43	TB19r Grab	TOLLWAY 424	0.187		0.025	0.261		188				0.0131	0.112	50.7		86.9	0.135		3122	0.045			30.5	
3/16/10	5303	9.28	TB19r Grab	TOLLWAY 434	0.085		0.048	0.0845		52.4				0.0138	0.0555	40.6		46.0	0.0233		1003	0.024			19.9	
3/31/10	8622	8.94	TB19r Grab	TOLLWAY 463			0.063	0.0939		36.2				0.0164		72.1		53.2	0.0268	0.033	1738	0.029			23.8	
4/14/10	6125	9.39	TB19r Grab	TOLLWAY 478	0.059		0.055	0.0684		45.5				0.0179	0.0290	67.8		46.2	0.0589	0.029	1105	0.026	0.306		17.1	
4/27/10	6124	10.83	TB19r Grab	TOLLWAY 500			0.060	0.0562		29.0				0.0192	0.0169	84.2		7.52	0.0045	0.027	1189	0.015			12.7	
5/11/10	653	9.79	TB19r Grab	TOLLWAY 508	0.996		0.042	0.030		34.8				0.00577	0.562	8.11		9.42	0.0083		98.3				4.95	
			TB19r Grab	min	0.041	NA	0.025	0.018	NA	10.376	NA	NA	0.00650	0.00079	0.0081	8.106	NA	7.3640	0.0019	0.027	98.34	0.015	0.064	NA	4.95	
			TB19r Grab	max	0.996	NA	0.063	0.261	NA	187.511	NA	NA	0.00800	0.05804	0.5619	91.000	NA	86.8764	0.1355	0.061	3122.25	0.045	0.306	NA	31.10	
			TB19r Grab	mean	0.175	NA	0.043	0.085	NA	53.242	NA	NA	0.00727	0.01611	0.0813	66.930	NA	29.0357	0.0260	0.036	1074.60	0.027	0.185	NA	20.39	
6/10/08	3200	6.98	SandersSW Grab	TOLLWAY 61	0.186		0.128	0.0863		97.5				0.0157	0.199	1.27		44.5	0.0229		539	0.025			28.4	
8/5/08	5399	8.61	SandersSW Grab	TOLLWAY 95	0.0678		0.125	0.127		69.2				0.0419	0.137	5.85		18.2	0.0690		989		0.114		34.6	
9/17/08	2464	6.97	SandersSW Grab	TOLLWAY 117	0.0954		0.162	0.0897		131					1.55			65.2	0.0859		303	0.041			43.0	
11/12/08	4233	7.32	SandersSW Grab	TOLLWAY 158	0.130		0.040	0.0884		69.6				0.0125	0.0455	4.24		22.9	0.0088		794	0.016			40.2	
12/2/08	5516	7.19	SandersSW Grab	TOLLWAY 160			0.039	0.123		111				0.00658	0.0153	4.70		38.1	0.0157		1060	0.016			49.8	
12/16/08	2560	6.79	SandersSW Grab	TOLLWAY 174	0.045		0.111	0.0831		165				0.00182	0.0271	0.585		86.7	0.0610		301	0.031			44.4	
				*starting with the 12/2/08 sample, MDL for Al = 0.037 mg/L																						
			SandersSW Grab	min	0.045	NA	0.039	0.083	NA	69.200	NA	NA	NA	0.002	0.015	0.585	NA	18.240	0.009	NA	301.000	0.016	0.114	NA	28.400	
			SandersSW Grab	max	0.186	NA	0.162	0.127	NA	165.000	NA	NA	NA	0.042	0.199	5.850	NA	86.690	0.086	NA	1060.000	0.041	0.114	NA	49.800	
			SandersSW Grab	mean	0.105	NA	0.101	0.099	NA	107.217	NA	NA	NA	0.016	0.085	3.033	NA	45.935	0.044	NA	664.333	0.026	0.114	NA	40.067	
3/5/08	8576	8.26	TB20 Grab	TOLLWAY 17	0.0592			0.116		81.8				0.00625	0.0993	10.4		15.0	0.214		1699				29.4	
3/12/08	4154	7.83	TB20 Grab	TOLLWAY 27	0.0461			0.0700		47.8				0.00598	0.1217	3.90		10.4	0.377		784				15.2	
3/26/08	9140	7.75	TB20 Grab	TOLLWAY 30	0.0530		0.042	0.216		132				0.00872	0.0427	7.67	0.024	34.1	0.0625		1784	0.030			42.3	
4/9/08	7467	8.05	TB20 Grab	TOLLWAY 34	0.0456		0.041	0.147		86.5				0.00772	0.0387	7.45	0.019	27.0	0.0727		1477				39.2	

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Date collected	Field conductivity	Field pH	Sample location	Sample ID	Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO ₄ -P	NH ₃ -N	F	Cl	NO ₃ -N	SO ₄	total NVOC	dissolved NVOC
				MDL:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaC	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
					0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
9/22/09	3605	9.98	TB19r Grab	TOLLWAY 267			3.33		0.482					9.98	149	1946	31.2	0.010	0.17	0.25	1023	0.09	84.7	33.9	24.3
10/6/09	1716	10.42	TB19r Grab	TOLLWAY 270			2.25		0.510					10.46	125	1408	27.6	0.003	0.15	0.20	714		60.7	19.9	19.1
10/20/09	2249	10.54	TB19r Grab	TOLLWAY 280			2.24		0.342					10.64	165	1205	66.0	0.008	0.23	0.25	566	0.11	67.8	14.9	14.8
11/3/09	1379	10.19	TB19r Grab	TOLLWAY 294			2.96		0.264				0.0075	10.3	144	749	24.8	0.009	0.16	0.25	322	0.11	51.3	12.4	10.3
12/1/09	1351	9.66	TB19r Grab	TOLLWAY 314			2.13		0.300					9.74	151	761	39.2	0.008	0.08	0.19	310	0.10	52.7	10.1	9.25
12/28/09	8936	9.94	TB19r Grab	TOLLWAY 342			2.44		1.05					9.08	59	4881	180		0.24	0.17	2987	0.35	64.0	13.1	10.5
1/26/10	9665	11.95	TB19r Grab	TOLLWAY 380			2.22		1.26		0.025		0.0123	10.7	139	5798	53.2	0.003	1.07		3459	0.75	62.2	15.5	16.3
3/3/10	10786	9.43	TB19r Grab	TOLLWAY 424			3.04		1.36	0.00370	0.023		0.0082	8.64	114	6118	115	0.008	0.61		3510	0.19	78.8	17.0	13.8
3/16/10	5303	9.28	TB19r Grab	TOLLWAY 434			3.72		0.619	0.00132				9.11	200	2891	8.4	0.006	0.33		1596	0.59	54.1	15.9	16.9
3/31/10	8622	8.94	TB19r Grab	TOLLWAY 463			0.831		0.742					9.12	149	4701	3.2	0.005	0.38		2704		61.9	22.6	22.6
4/14/10	6125	9.39	TB19r Grab	TOLLWAY 478			0.806		0.678					9.32	313	3328	7.6	0.285	0.83		1854		46.5	18.5	24.1
4/27/10	6124	10.83	TB19r Grab	TOLLWAY 500			1.30		0.598					10.6	168	3264	12.0	0.025	0.18		1857		34.5	22.9	22.6
5/11/10	653	9.79	TB19r Grab	TOLLWAY 508			5.31		0.188	0.0287				9.65	152	424	53.6	0.079		0.27	122	0.10	13.2	24.5	13.8
			TB19r Grab	min	NA	NA	0.81	NA	0.19	0.00132	0.023	NA	0.0075	8.64	59	424	3.20	0.00	0.08	0.17	122.02	0.09	13.17	10.10	9.25
			TB19r Grab	max	NA	NA	5.31	NA	1.36	0.02867	0.025	NA	0.0123	10.74	313	6118	180.00	0.28	1.07	0.27	3509.78	0.75	84.66	33.88	24.28
			TB19r Grab	mean	NA	NA	2.50	NA	0.65	0.01123	0.024	NA	0.0094	9.80	156	2883	47.85	0.04	0.37	0.23	1617.16	0.27	56.32	18.55	16.79
6/10/08	3200	6.98	SandersSW Grab*	TOLLWAY 61			6.70		0.562	0.00195			0.0171	7.32	405	1780	4.4	0.02		0.29	758	0.52	83.5	19.8	19.1
8/5/08	5399	8.61	SandersSW Grab	TOLLWAY 95			8.64		0.451	0.00080			0.0148	8.44	188	2910	65.0	0.07	0.13	0.58	1540	0.08	108	40.3	37.5
9/17/08	2464	6.97	SandersSW Grab	TOLLWAY 117			6.38		0.663					7.26	365	1393	22.0	0.03		0.22	532	1.01	110	10.5	9.36
11/12/08	4233	7.32	SandersSW Grab	TOLLWAY 158			4.29		0.395	0.00081				7.70	259	2328	4.4	0.03		0.17	1161	0.10	115	16.0	14.9
12/2/08	5516	7.19	SandersSW Grab	TOLLWAY 160			4.08		0.592					7.76	293	3118	4.0	0.02		0.15	1994	0.23	126	10.6	9.95
12/16/08	2560	6.79	SandersSW Grab	TOLLWAY 174			5.43		0.758	0.00079				7.25	494	1490	23.2			0.18	494	1.38	118	11.3	6.31
			SandersSW Grab	min	NA	NA	4.080	NA	0.395	0.001	NA	NA	0.015	7.247	187.812	1393.000	4.000	0.016	0.125	0.153	493.952	0.083	83.484	10.530	6.308
			SandersSW Grab	max	NA	NA	8.640	NA	0.758	0.002	NA	NA	0.017	8.436	494.155	3118.000	65.000	0.074	0.125	0.576	1994.020	1.384	126.365	40.281	37.548
			SandersSW Grab	mean	NA	NA	5.920	NA	0.570	0.001	NA	NA	0.016	7.621	334.126	2169.833	20.500	0.035	0.125	0.265	1079.910	0.555	110.258	18.108	16.194
3/5/08	8576	8.26	TB20 Grab	TOLLWAY 17			3.11		0.712		0.020		0.0341	8.26	134	4776		0.02	0.12		2693	0.20	76.1	8.27	7.73
3/12/08	4154	7.83	TB20 Grab	TOLLWAY 27			2.41		0.381				0.0435	7.82	96	2225		0.01		0.64	1254	0.09	40.6	9.61	6.13
3/26/08	9140	7.75	TB20 Grab	TOLLWAY 30			2.51		1.22				0.0616	7.92	160	5160		0.01			2932		107	11.3	10.2
4/9/08	7467	8.05	TB20 Grab	TOLLWAY 34			1.90		0.817				0.0339	8.07	145	4086	10				2320		106	13.0	10.5

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
10/17/12	15:58:00 PM	NA	NA	TB7Bin grab	TOLLWAY 1797	0.072		0.025	0.0117		5.85				0.00637	0.042	1.30		0.60	0.0046		15.6		0.086		2.06
10/22/12	13:05:00 PM	528	7.38	TB7Bin grab	TOLLWAY 1809	0.099		0.046	0.0310		16.18				0.01395	0.116	3.32		3.26	0.0070		79.8				13.51
2/20/13	11:06:00 AM	20317	7.06	TB7Bin grab	TOLLWAY 1985			0.093	0.1809		272.13					0.049	72.87		78.78	0.0298		4231.8		0.170		188.63
3/4/13	17:21:00 PM	20827	7.36	TB7Bin grab	TOLLWAY 1996			0.091	0.1411		258.12					0.036	56.45		68.26	0.0215		4498.8		0.131		170.19
3/20/13	12:39:00 PM	18015	7.15	TB7Bin grab	TOLLWAY 2038			0.087	0.1080		226.99					0.026	42.61		59.76	0.0062	0.026	3813.4		0.080		179.36
4/16/13	13:54:00 PM	13422	8.97	TB7Bin grab	TOLLWAY 2083	0.102		0.097	0.0947		100.70			0.0136		0.039	59.11		27.19	0.0045	0.027	2883.3				106.71
6/25/13	14:28:00 PM	4193	7.77	TB7Bin grab	TOLLWAY 2232	0.045		0.104	0.0480		70.40			0.0062	0.01535		14.45		19.11	0.0095		801.8		0.084		63.54
					min	0.045	NA	0.025	0.0117	NA	5.85	NA	NA	0.0062	0.00637	0.026	1.30	NA	0.60	0.0045	0.026	15.6	NA	0.080	NA	2.06
					max	0.102	NA	0.104	0.1809	NA	272.13	NA	NA	0.0136	0.01535	0.116	72.87	NA	78.78	0.0298	0.027	4498.8	NA	0.170	NA	188.63
					mean	0.079	NA	0.078	0.0879	NA	135.77	NA	NA	0.0099	0.01189	0.051	35.73	NA	36.71	0.0119	0.026	2332.1	NA	0.110	NA	103.43
10/17/12	18:00:00 PM	NA	NA	TB7Bout grab	TOLLWAY 1800	0.059		0.039	0.0170		15.76				0.00768	0.094	11.45		3.37	0.0071		60.7		0.253		12.36
					min	0.059	NA	0.039	0.0170	NA	15.76	NA	NA	NA	0.00768	0.094	11.45	NA	3.37	0.0071	NA	60.7	NA	0.253	NA	12.36
					max	0.059	NA	0.039	0.0170	NA	15.76	NA	NA	NA	0.00768	0.094	11.45	NA	3.37	0.0071	NA	60.7	NA	0.253	NA	12.36
					mean	0.059	NA	0.039	0.0170	NA	15.76	NA	NA	NA	0.00768	0.094	11.45	NA	3.37	0.0071	NA	60.7	NA	0.253	NA	12.36
8/28/12	12:50:00 PM	3803	7.83	TB9A grab	TOLLWAY 1738			0.086	0.1413		71.03				0.00647	0.097	40.02		13.75	0.0440		665.8		0.129		17.97
9/10/12	12:36:00 PM	3138	7.99	TB9A grab	TOLLWAY 1745			0.090	0.1021	0.00333	53.26			0.0060	0.00685	0.068	31.88		10.55	0.0188		575.2				13.27
10/17/12	16:40:00 PM	NA	NA	TB9A grab	TOLLWAY 1799			0.041	0.0420		23.38				0.00625	0.043	17.43		4.98	0.0174		287.7		0.082		17.12
10/22/12	15:05:00 PM	2981	7.79	TB9A grab	TOLLWAY 1814			0.070	0.0839		44.07				0.00636	0.047	31.36		9.06	0.0055		524.8		0.083		31.19
11/5/12	16:29:00 PM	5354	7.94	TB9A grab	TOLLWAY 1834			0.047	0.1638		112.14				0.00198		37.55		26.71	0.0055		886.0				51.28
11/19/12	14:47:00 PM	4056	8.30	TB9A grab	TOLLWAY 1851			0.034	0.1085		77.17				0.00288		34.48		16.72			720.9		0.078		41.45
12/4/12	9:03:00 AM	5391	7.30	TB9A grab	TOLLWAY 1866			0.091	0.2201		122.90				0.00346	0.033	39.63		26.69	0.1002		1093.7		0.139		46.16
12/18/12	12:27:00 PM	3689	7.84	TB9A grab	TOLLWAY 1893			0.038	0.0924		78.14				0.00346	0.027	28.32		16.20	0.0055		655.3		0.092		56.52
2/19/13	10:15:00 AM	NA	NA	TB9A grab	TOLLWAY 1979			0.047	0.1689		143.19				0.00187	0.031	33.29		26.02	0.2148		1840.5		0.113		74.23
3/4/13	15:27:00 PM	13776	7.59	TB9A grab	TOLLWAY 1994			0.054	0.2284		253.00				0.00346	0.035	46.15		62.10	0.3795		2683.5		0.163		136.89
3/19/13	16:00:00 PM	12336	8.52	TB9A grab	TOLLWAY 2033			0.043	0.1796		167.91				0.00918		45.07		32.60	0.0471		2509.8		0.106		88.12
4/17/13	9:46:00 AM	4893	8.62	TB9A grab	TOLLWAY 2089			0.050	0.1417		119.29				0.00944	0.093	25.28		25.48	0.2782		1221.0		0.125		78.03
5/29/13	11:53:00 AM	NA	NA	TB9A grab	TOLLWAY 2167			0.101	0.1273		78.25					0.161	30.00		13.06	0.1333	0.028	1116.1		0.115		35.09
					min	NA	NA	0.034	0.0420	0.00333	23.38	NA	NA	0.0060	0.00187	0.027	17.43	NA	4.98	0.0055	0.028	287.7	NA	0.078	NA	13.27
					max	NA	NA	0.101	0.2284	0.00333	253.00	NA	NA	0.0060	0.00944	0.161	46.15	NA	62.10	0.3795	0.028	2683.5	NA	0.163	NA	136.89
					mean	NA	NA	0.061	0.1384	0.00333	103.36	NA	NA	0.0060	0.00547	0.064	33.88	NA	21.84	0.1042	0.028	1136.9	NA	0.111	NA	52.87

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
10/17/12	15:58:00 PM	NA	NA	TB7Bin grab	TOLLWAY 1797			0.618		0.032	0.00090			0.0105	7.30	29	57	64.0	0.043	0.18	0.43	13	0.17	6.29	18.50	4.86	
10/22/12	13:05:00 PM	528	7.38	TB7Bin grab	TOLLWAY 1809			1.414		0.124	0.00198			0.0325	7.28	59	304	16.8	0.033	0.12	0.89	102	0.55	40.38	14.73	11.37	
2/20/13	11:06:00 AM	20317	7.06	TB7Bin grab	TOLLWAY 1985			4.670		3.059				0.0235	7.91	142	12306		0.016	0.18	1.25	7145	1.03	490.88	13.62	13.46	
3/4/13	17:21:00 PM	20827	7.36	TB7Bin grab	TOLLWAY 1996			4.122		2.462				0.0124	7.90	145	12235		0.016	0.07	0.72	7190	1.20	442.92	9.92	9.69	
3/20/13	12:39:00 PM	18015	7.15	TB7Bin grab	TOLLWAY 2038		0.155	4.213		2.132				0.0196	8.10	164	10608		0.016		0.70	6110	1.27	477.27	11.67	11.25	
4/16/13	13:54:00 PM	13422	8.97	TB7Bin grab	TOLLWAY 2083			5.171		1.364					8.72	102	7708		0.022	0.33		4444	1.11	279.78	15.81	15.21	
6/25/13	14:28:00 PM	4193	7.77	TB7Bin grab	TOLLWAY 2232			3.630		0.739		0.019		0.0308	7.85	135	2319	11.2	0.021	0.05	0.52	1192	1.79	167.18	19.75	15.77	
					min	NA	0.155	0.618	NA	0.032	0.00090	0.019	NA	0.0105	7.28	29	57	11.2	0.016	0.05	0.43	13	0.17	6.29	9.92	4.86	
					max	NA	0.155	5.171	NA	3.059	0.00198	0.019	NA	0.0325	8.72	164	12306	64.0	0.043	0.33	1.25	7190	1.79	490.88	19.75	15.77	
					mean	NA	0.155	3.405	NA	1.416	0.00144	0.019	NA	0.0215	7.86	111	6505	30.7	0.024	0.16	0.75	3742	1.02	272.10	14.86	11.66	
10/17/12	18:00:00 PM	NA	NA	TB7Bout grab	TOLLWAY 1800			1.405		0.066	0.00187				7.17	52	224	19.2	0.199	0.03	0.49	67	0.22	35.56	17.63	12.87	
					min	NA	NA	1.405	NA	0.066	0.00187	NA	NA	NA	7.17	52	224	19.2	0.199	0.03	0.49	67	0.22	35.56	17.63	12.87	
					max	NA	NA	1.405	NA	0.066	0.00187	NA	NA	NA	7.17	52	224	19.2	0.199	0.03	0.49	67	0.22	35.56	17.63	12.87	
					mean	NA	NA	1.405	NA	0.066	0.00187	NA	NA	NA	7.17	52	224	19.2	0.199	0.03	0.49	67	0.22	35.56	17.63	12.87	
8/28/12	12:50:00 PM	3803	7.83	TB9A grab	TOLLWAY 1738			1.296		0.723				0.0274	8.13	226	2001		0.062	0.05	0.34	1053		48.04	23.74	22.39	
9/10/12	12:36:00 PM	3138	7.99	TB9A grab	TOLLWAY 1745			0.878		0.554	0.00357			0.0161	8.24	210	1663		0.050		0.33	847		36.42	16.64	16.46	
10/17/12	16:40:00 PM	NA	NA	TB9A grab	TOLLWAY 1799			0.663		0.246					7.29	78	835	7.6	0.037		0.27	429	0.12	49.66	15.83	12.95	
10/22/12	15:05:00 PM	2981	7.79	TB9A grab	TOLLWAY 1814			1.507		0.491					8.15	140	1579		0.015		0.50	786		87.63	16.75	16.83	
11/5/12	16:29:00 PM	5354	7.94	TB9A grab	TOLLWAY 1834			0.154		0.929				0.0103	8.37	264	2716		0.005		0.19	1362		138.78	20.06	19.68	
11/19/12	14:47:00 PM	4056	8.30	TB9A grab	TOLLWAY 1851			0.145		0.682					8.71	204	2252		0.009		0.28	1125		122.75	18.59	15.82	
12/4/12	9:03:00 AM	5391	7.30	TB9A grab	TOLLWAY 1866			0.243		1.161				0.0711	7.85	291	3080		0.006		0.16	1586		108.65	21.59	18.33	
12/18/12	12:27:00 PM	3689	7.84	TB9A grab	TOLLWAY 1893			0.597		0.693				0.0143	8.27	153	1998		0.008		0.28	998	0.09	147.73	12.89	12.76	
2/19/13	10:15:00 AM	NA	NA	TB9A grab	TOLLWAY 1979			1.674		1.523				0.0509	8.05	101	4979		0.010	0.47	0.49	2890	0.52	194.69	13.09	11.62	
3/4/13	15:27:00 PM	13776	7.59	TB9A grab	TOLLWAY 1994			1.511		2.346				0.0265	8.44	88	7972		0.008	0.37		4546	0.61	370.21	9.22	8.98	
3/19/13	16:00:00 PM	12336	8.52	TB9A grab	TOLLWAY 2033		0.223	0.110		1.771				0.0131	8.77	54	6991	6.4	0.006		0.41	4113	0.21	226.17	12.58	11.30	
4/17/13	9:46:00 AM	4893	8.62	TB9A grab	TOLLWAY 2089			0.230		1.210				0.0244	8.28	104	3553	8.8	0.014	0.14	0.26	1950	0.09	202.66	17.65	15.66	
5/29/13	11:53:00 AM	NA	NA	TB9A grab	TOLLWAY 2167			0.360		0.920				0.0106	8.15	188	3045		0.026	0.05	0.24	1646		92.26	19.94	16.50	
					min	NA	0.223	0.110	NA	0.246	0.00357	NA	NA	0.0103	7.29	54	835	6.4	0.005	0.05	0.16	429	0.09	36.42	9.22	8.98	
					max	NA	0.223	1.674	NA	2.346	0.00357	NA	NA	0.0711	8.77	291	7972	8.8	0.062	0.47	0.50	4546	0.61	370.21	23.74	22.39	
					mean	NA	0.223	0.721	NA	1.019	0.00357	NA	NA	0.0265	8.21	162	3282	7.6	0.020	0.22	0.31	1795	0.27	140.43	16.81	15.33	

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
10/17/12	16:20:00 PM	NA	NA	TB9Ac2N grab	TOLLWAY 1798	0.074921			0.0111		5.33				0.00410	0.041	1.00		0.42	0.0043		11.4		0.090		1.01
1/11/13	9:00:00 AM	601	8.96	TB9Ac2N grab	TOLLWAY 1921	0.133064			0.0148		7.17				0.00320	0.059	1.24		0.44	0.0067		109.6		0.120		4.82
2/6/13	12:32:00 PM	17994	10.29	TB9Ac2N grab	TOLLWAY 1962	0.038086		0.071	0.3100		238.20			0.0117	0.00313		86.87		24.13		0.02631	4570.7		0.154		90.54
2/19/13	11:21:00 AM	2161	9.44	TB9Ac2N grab	TOLLWAY 1980			0.064	0.3314		234.48			0.0163	0.00512		86.47		16.69		0.02331	4233.5		0.117		79.65
3/4/13	16:08:00 PM	19242	10.82	TB9Ac2N grab	TOLLWAY 1995			0.056	0.3351		217.12			0.0137			87.78		10.12		0.03159	3978.8		0.136		67.78
3/19/13	16:55:00 PM	18730	10.89	TB9Ac2N grab	TOLLWAY 2035			0.056	0.2997		178.10			0.0115	0.01815		71.12		7.06		0.02889	3989.8				70.51
4/17/13	10:47:00 AM	1681	10.22	TB9Ac2N grab	TOLLWAY 2091	0.109986		0.025	0.0481		30.86			0.0061	0.01250	0.050	11.19		1.43	0.0061		392.8		0.124		11.11
4/29/13	16:01:00 PM	13244	11.55	TB9Ac2N grab	TOLLWAY 2104			0.094	0.2004		118.82			0.0150	0.01770		67.03		3.77		0.03743	2801.5				57.05
6/26/13	11:03:00 AM	4770	9.75	TB9Ac2N grab	TOLLWAY 2240	0.282593		0.131	0.0515		23.36			0.0146	0.00936	0.148	31.13		5.02		0.02787	992.8		0.120		53.79
					min	0.038	NA	0.025	0.0111	NA	5.33	NA	NA	0.0061	0.00313	0.041	1.00	NA	0.42	0.0043	0.023	11.4	NA	0.090	NA	1.01
					max	0.283	NA	0.131	0.3351	NA	238.20	NA	NA	0.0163	0.01815	0.148	87.78	NA	24.13	0.0067	0.037	4570.7	NA	0.154	NA	90.54
					mean	0.128	NA	0.071	0.1780	NA	117.05	NA	NA	0.0127	0.00916	0.074	49.31	NA	7.67	0.0057	0.029	2342.3	NA	0.123	NA	48.47
1/11/13	8:30:00 AM	8767	9.41	TB15Bc3N grab	TOLLWAY 1920	0.123		0.045	0.1847		125.81				0.00348	0.064	47.12		4.85	0.026	0.036	1739.6		0.159		48.37
1/30/13	8:30:00 AM	6283	NA	TB15Bc3N grab	TOLLWAY 1943			0.024	0.0653		124.05				0.00628		29.96		1.93		0.024	1109.5				30.26
2/19/13	13:10:00 PM	15848	10.53	TB15Bc3N grab	TOLLWAY 1981	0.786		0.039	0.2994		251.05			0.0082	0.02085	0.324	63.92		1.12	0.004	0.035	3269.2		0.101	0.056	54.81
					min	0.123	NA	0.024	0.0653	NA	124.05	NA	NA	0.0082	0.00348	0.064	29.96	NA	1.12	0.004	0.024	1109.5	NA	0.101	0.056	30.26
					max	0.786	NA	0.045	0.2994	NA	251.05	NA	NA	0.0082	0.02085	0.324	63.92	NA	4.85	0.026	0.036	3269.2	NA	0.159	0.056	54.81
					mean	0.454	NA	0.036	0.1831	NA	166.97	NA	NA	0.0082	0.01020	0.194	47.00	NA	2.64	0.015	0.032	2039.4	NA	0.130	0.056	44.48

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L	
					MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
10/17/12	16:20:00 PM	NA	NA	TB9Ac2N grab	TOLLWAY 1798			0.573		0.027	0.00067			0.0117	7.33	24	42	60.5	0.037	0.14	0.25	10	0.12	2.90	11.62	3.32	
1/11/13	9:00:00 AM	601	8.96	TB9Ac2N grab	TOLLWAY 1921			0.479		0.055	0.00117				7.49	33	300	449.1	0.040	0.16	0.24	157	0.18	13.14	34.68	2.99	
2/6/13	12:32:00 PM	17994	10.29	TB9Ac2N grab	TOLLWAY 1962			5.715		3.395		0.02083		0.0103	10.02	44	11504	9.2	0.015	0.59	0.94	6793	1.67	218.30	11.74	11.34	
2/19/13	11:21:00 AM	2161	9.44	TB9Ac2N grab	TOLLWAY 1980			6.178		3.514				0.0102	10.60	63	11309	8.0	0.019	0.54	0.89	6804	1.38	188.43	13.08	12.47	
3/4/13	16:08:00 PM	19242	10.82	TB9Ac2N grab	TOLLWAY 1995			4.193		3.090					10.92	94	10948	14.8	0.012	1.23		6611	1.29	169.12	15.45	14.23	
3/19/13	16:55:00 PM	18730	10.89	TB9Ac2N grab	TOLLWAY 2035		0.20652	5.365		2.634				0.0099	10.71	97	10730	8.4	0.010	0.72		6501	1.18	177.50	12.69	12.09	
4/17/13	10:47:00 AM	1681	10.22	TB9Ac2N grab	TOLLWAY 2091			1.158		0.402	0.00074			0.0107	9.85	50	1059	19.2	0.028	0.61	0.15	598	0.48	29.25	14.22	7.44	
4/29/13	16:01:00 PM	13244	11.55	TB9Ac2N grab	TOLLWAY 2104			5.773		1.928				0.0106	11.20	144	7435	31.6	0.024	1.61		4391	0.94	139.81	14.99	14.43	
6/26/13	11:03:00 AM	4770	9.75	TB9Ac2N grab	TOLLWAY 2240			12.472		0.411	0.00535				9.45	189	2544	46.0	0.064	0.57	0.31	1366	1.22	138.77	21.90	19.83	
					min	NA	0.207	0.479	NA	0.027	0.00067	0.021	NA	0.0099	7.33	24	42	8.0	0.010	0.14	0.15	10	0.12	2.90	11.62	2.99	
					max	NA	0.207	12.472	NA	3.514	0.00535	0.021	NA	0.0117	11.20	189	11504	449.1	0.064	1.61	0.94	6804	1.67	218.30	34.68	19.83	
					mean	NA	0.207	4.656	NA	1.717	0.00198	0.021	NA	0.0106	9.73	82	6208	71.9	0.028	0.69	0.46	3692	0.94	119.69	16.71	10.91	
1/11/13	8:30:00 AM	8767	9.41	TB15Bc3N grab	TOLLWAY 1920			5.445		1.3054				0.0119	9.75	92	4916	40.2	0.041	1.22		2830	0.52	114.94	24.39	22.93	
1/30/13	8:30:00 AM	6283	NA	TB15Bc3N grab	TOLLWAY 1943			4.483		0.7220					11.04	134	3349	236.3	0.009	0.30	0.49	1884	0.39	80.25	37.05	26.05	
2/19/13	13:10:00 PM	15848	10.53	TB15Bc3N grab	TOLLWAY 1981			6.127		2.2201	0.00692			0.0129	11.20	262	9399	1054.0	0.020	1.09		5588	0.39	129.81	81.99	29.68	
					min	NA	NA	4.483	NA	0.7220	0.00692	NA	NA	0.0119	9.75	92	3349	40.2	0.009	0.30	0.49	1884	0.39	80.25	24.39	22.93	
					max	NA	NA	6.127	NA	2.2201	0.00692	NA	NA	0.0129	11.20	262	9399	1054.0	0.041	1.22	0.49	5588	0.52	129.81	81.99	29.68	
					mean	NA	NA	5.352	NA	1.4158	0.00692	NA	NA	0.0124	10.66	163	5888	443.5	0.024	0.87	0.49	3434	0.43	108.33	47.81	26.22	

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Date collected	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
5/14/14	8:03:00 AM	7889	11.73	TB15Bc1N grab	TOLLWAY 2734	0.749		0.080	0.0812		85.52				0.0166	0.050	32.69		0.12		0.043	1571.6			0.047	50.99
7/8/14	8:05:00 AM	2564	10.96	TB15Bc1N grab	TOLLWAY 2825	0.506		0.044	0.0495		39.05				0.0058	0.038	16.41		0.25			428.0	0.087			12.73
8/5/14	7:48:00 AM	3697	11.19	TB15Bc1N grab	TOLLWAY 2877	0.538		0.097	0.0307		30.36				0.0038	0.040	20.41		0.25		0.046	714.2				60.52
					min	0.506	NA	0.044	0.0307	NA	30.36	NA	NA	NA	0.0038	0.038	16.41	NA	0.12	NA	0.043	428.0	NA	0.087	0.047	12.73
					max	0.749	NA	0.097	0.0812	NA	85.52	NA	NA	NA	0.0166	0.050	32.69	NA	0.25	NA	0.046	1571.6	NA	0.087	0.047	60.52
					mean	0.598	NA	0.074	0.0538	NA	51.64	NA	NA	NA	0.0088	0.043	23.17	NA	0.21	NA	0.045	904.6	NA	0.087	0.047	41.41
9/3/13	15:37:00 PM	2407	7.62	TB19gw grab	TOLLWAY 2347	0.172		0.074	0.0662		62.62				0.0091	0.111	20.38		18.34	0.0109		438.3		0.142		42.65
9/17/13	15:22:00 PM	1918	7.62	TB19gw grab	TOLLWAY 2367	0.658		0.060	0.0519		55.26				0.0131	0.501	16.95		14.97	0.0127	0.022	336.4		0.124		36.02
9/30/13	11:41:00 AM	2003	7.49	TB19gw grab	TOLLWAY 2380	0.156		0.049	0.0523		51.57				0.0086	0.126	16.78		13.55	0.0051		339.2		0.184		31.10
10/15/13	15:15:00 PM	1799	7.94	TB19gw grab	TOLLWAY 2408	0.359		0.076	0.0512		66.45				0.0071	0.140	16.12		17.19	0.0056		302.0		0.134		42.42
10/29/13	11:57:00 AM	2016	7.60	TB19gw grab	TOLLWAY 2430	0.098		0.065	0.0524		68.01				0.0049	0.050	18.78		17.88	0.0035	0.024	332.5		0.116		55.50
11/13/13	8:52:00 AM	1546	7.78	TB19gw grab	TOLLWAY 2456	0.193		0.047	0.0388		45.64				0.0070	0.149	13.66		11.57	0.0030		252.5		0.091		27.50
12/4/13	8:55:00 AM	1988	8.42	TB19gw grab	TOLLWAY 2486	0.142		0.028	0.0420		52.60				0.0035	0.068	15.24		12.86	0.0021		338.1		0.197		28.93
1/14/14	13:45:00 PM	11259	7.51	TB19gw grab	TOLLWAY 2520			0.038	0.3360		298.33				0.030	0.030	20.14		49.47	0.0073		2051.9		0.179		46.25
2/19/14	14:02:00 PM	14715	7.10	TB19gw grab	TOLLWAY 2559				0.5397		415.31				0.0065	0.055	25.85		89.50	0.0237	0.023	2788.7		0.184		85.37
3/4/14	12:23:00 PM	1181	6.44	TB19gw grab	TOLLWAY 2575			0.042	0.4147		353.81					0.056	22.85		81.88	0.0077		2143.8				68.01
3/19/14	12:24:00 PM	7753	8.79	TB19gw grab	TOLLWAY 2624	0.926		0.039	0.1392		137.44				0.0139	0.568	20.26		15.87	0.0071		1521.7		0.154		22.04
4/1/14	12:38:00 PM	9178	7.44	TB19gw grab	TOLLWAY 2644	0.067		0.041	0.2090		195.47				0.0652	0.038	31.49		37.29	0.0027		1780.4				44.20
4/16/14	12:44:00 PM	5761	8.51	TB19gw grab	TOLLWAY 2682	0.270		0.056	0.1047		113.88			0.0059	0.0149	0.169	18.92		27.72	0.0028		1091.5		0.099		37.60
4/30/14	8:11:00 AM	3224	8.92	TB19gw grab	TOLLWAY 2703	1.719		0.059	0.0657		67.03				0.0184	1.045	14.83		19.46	0.0098		607.3		0.096		26.59
5/12/14	12:11:00 PM	4758	8.15	TB19gw grab	TOLLWAY 2712	0.553		0.063	0.0780		70.75				0.0181	0.329	22.83		18.99	0.0039	0.026	935.0		0.184		36.17
5/29/14	7:56:00 AM	4491	8.27	TB19gw grab	TOLLWAY 2755	0.552		0.077	0.0671		61.94				0.0161	0.330	25.14		17.07	0.0046		863.1		0.140		36.74
6/9/14	12:06:00 PM	4609	8.41	TB19gw grab	TOLLWAY 2758	0.410		0.058	0.0586		49.14				0.0163	0.228	26.09		11.32	0.0039	0.026	820.8		0.114		37.37
6/24/14	13:55:00 PM	NA	NA	TB19gw grab	TOLLWAY 2809	1.043		0.060	0.0364		37.13				0.0198	0.817	15.16		9.45	0.0117		416.8		0.161		23.12
7/9/14	7:22:00 AM	2027	7.43	TB19gw grab	TOLLWAY 2840	1.211		0.077	0.0479		44.33				0.0140	0.874	14.92		12.22	0.0130		361.0		0.105		23.44
7/23/14	8:01:00 AM	2886	7.38	TB19gw grab	TOLLWAY 2868	0.350		0.059	0.0660		72.55				0.0078	0.215	18.53		17.01	0.0066		514.7		0.075		42.99
8/6/14	12:18:00 PM	1510	7.99	TB19gw grab	TOLLWAY 2901	3.073		0.070	0.0408		34.81			0.0085	0.0186	2.135	11.48		8.26	0.0272		273.3		0.109		22.82
8/20/14	12:45:00 PM	2087	7.35	TB19gw grab	TOLLWAY 2924	0.254		0.063	0.0536		58.60				0.0065	0.219	14.23		13.06	0.0074		354.8				28.65
					min	0.067	NA	0.028	0.0364	NA	34.81	NA	NA	0.0059	0.0035	0.030	11.48	NA	8.26	0.0021	0.022	252.5	NA	0.075	NA	22.04
					max	3.073	NA	0.077	0.5397	NA	415.31	NA	NA	0.0085	0.0652	2.135	31.49	NA	89.50	0.0272	0.026	2788.7	NA	0.197	NA	85.37
					mean	0.642	NA	0.057	0.1187	NA	109.67	NA	NA	0.0072	0.0145	0.390	19.12	NA	24.31	0.0083	0.024	857.5	NA	0.136	NA	38.43

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	TI mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L	
Sample location	MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097	4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31	
TB15Bc1N grab	TOLLWAY 2734			13.020		0.627				11.49	248	4170	74.0	0.028	0.74	0.34	2275	0.23	123.26	31.53	24.37	
TB15Bc1N grab	TOLLWAY 2825			5.733		0.338	0.00058			11.01	131	1253	79.2	0.030	0.48	0.21	647	0.16	34.71	10.77	9.09	
TB15Bc1N grab	TOLLWAY 2877			17.375		0.260				11.23	195	1955	898.0	0.063	0.18	0.41	888	0.18	161.37	19.59	16.69	
	min	NA	NA	5.733	NA	0.260	0.00058	NA	NA	NA	11.01	131	1253	74.0	0.028	0.18	0.21	647	0.16	34.71	10.77	9.09
	max	NA	NA	17.375	NA	0.627	0.00058	NA	NA	NA	11.49	248	4170	898.0	0.063	0.74	0.41	2275	0.23	161.37	31.53	24.37
	mean	NA	NA	12.043	NA	0.408	0.00058	NA	NA	NA	11.24	191	2459	350.4	0.040	0.47	0.32	1270	0.19	106.45	20.63	16.72
TB19gw grab	TOLLWAY 2347			7.397		0.407	0.00173	0.022		7.87	231	1363		0.067		0.30	560	2.12	111.31	17.22	16.83	
TB19gw grab	TOLLWAY 2367			8.239		0.324	0.01766			7.88	191	1083		0.091		0.35	427	1.69	95.96	22.05	18.73	
TB19gw grab	TOLLWAY 2380			6.843		0.325	0.00395			7.76	217	1135		0.083		0.26	459	1.83	87.79	16.75	15.64	
TB19gw grab	TOLLWAY 2408			7.434		0.358	0.00397			8.06	245	1030		0.056		0.29	368	1.99	115.21	13.52	12.56	
TB19gw grab	TOLLWAY 2430			6.753		0.409	0.00121			8.13	255	1138	17.6	0.041		0.24	409	1.60	153.84	12.92	12.57	
TB19gw grab	TOLLWAY 2456			6.665		0.306	0.00487			8.10	199	855		0.076		0.26	318	2.30	74.85	14.50	14.01	
TB19gw grab	TOLLWAY 2486			6.187		0.338	0.00208			8.40	154	1100		0.055		0.21	491	1.82	81.48	10.40	10.09	
TB19gw grab	TOLLWAY 2520	0.201		3.789		1.414				7.67	137	6429		0.040	0.08		3766	3.37	122.81	8.78	8.42	
TB19gw grab	TOLLWAY 2559	0.233		4.311		2.584		0.043		7.45	166	8619	14.8	0.033			5056	2.97	208.64	10.72	7.71	
TB19gw grab	TOLLWAY 2575	0.219		4.386		1.718				7.54	192	7009		0.040			3944	3.38	182.59	5.99	6.27	
TB19gw grab	TOLLWAY 2624			6.058		0.766	0.01916			8.61	125	4363		0.167	0.46		2511	1.60	55.24	18.45	15.54	
TB19gw grab	TOLLWAY 2644			5.116		1.155				7.89	182	5311		0.057	0.15		2945	3.22	116.67	9.20	9.02	
TB19gw grab	TOLLWAY 2682			5.897		0.567	0.00473			8.50	214	3230		0.063	0.08	0.16	1783	3.02	95.55	13.33	12.85	
TB19gw grab	TOLLWAY 2703			9.302		0.309	0.03832		0.0112	8.96	245	1806		0.109	0.04	0.32	873	3.65	70.13	23.70	18.94	
TB19gw grab	TOLLWAY 2712			7.977		0.441	0.01145			8.40	249	2663		0.090	0.10	0.26	1384	2.70	94.33	16.60	15.56	
TB19gw grab	TOLLWAY 2755			9.092		0.383	0.01075			8.35	251	2471		0.092	0.12	0.27	1234	2.27	97.71	19.35	18.66	
TB19gw grab	TOLLWAY 2758			8.672		0.335	0.00626		0.0100	8.64	220	2563		0.093	0.07	0.31	1323	2.01	111.21	21.14	20.53	
TB19gw grab	TOLLWAY 2809			9.368		0.195	0.02503			8.58	264	1263		0.165		0.36	515	1.21	61.30	26.75	23.71	
TB19gw grab	TOLLWAY 2840			9.946		0.222	0.03326			7.75	306	1144		0.143	0.03	0.26	431	1.36	64.18	16.24	14.61	
TB19gw grab	TOLLWAY 2868			8.608		0.358	0.00799			7.90	314	1605		0.092		0.28	666	1.77	116.42	12.17	11.36	
TB19gw grab	TOLLWAY 2901			12.916		0.166	0.07109			8.16	206	903	4.4	0.187	0.04	0.38	304	1.60	64.30	22.61	19.82	
TB19gw grab	TOLLWAY 2924			7.558		0.297	0.00719			7.57	279	1149		0.100		0.23	437	1.48	78.14	16.75	15.49	
	min	NA	0.201	3.789	NA	0.166	0.00121	0.022	NA	0.0100	7.45	125	855	4.4	0.033	0.03	0.16	304	1.21	55.24	5.99	6.27
	max	NA	0.233	12.916	NA	2.584	0.07109	0.043	NA	0.0112	8.96	314	8619	17.6	0.187	0.46	0.38	5056	3.65	208.64	26.75	23.71
	mean	NA	0.218	7.387	NA	0.608	0.01504	0.033	NA	0.0106	8.10	220	2647	12.3	0.088	0.12	0.28	1373	2.23	102.71	15.87	14.50

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217

TB7B-in-grab Dissolved Metals

10/14/14	9:55:00 AM	414	8.00	TB7B-in-grab	TOLLWAY 3018	0.122			0.0254		14.36				0.00731	0.099	2.10		3.00	0.0047		78.6					9.83
11/11/14	9:35:00 AM	240	7.13	TB7B-in-grab	TOLLWAY 3059	0.059			0.0161		6.15			0.01	0.01586	0.061	1.96		0.79	0.0094		20.2					3.43
2/10/15	13:59:00 PM	22563	7.83	TB7B-in-grab	TOLLWAY 3169			0.099	0.1906		365.15				0.00361		46.65		80.59	0.0232		4864.0		0.087			206.15
3/3/15	10:05:00 AM	65303	7.67	TB7B-in-grab	TOLLWAY 3192			0.123	0.2693		148.49			0.01		0.062	22.83		8.17	0.2116		13640.5		0.262			83.94
3/10/15	12:33:00 PM	13371	7.27	TB7B-in-grab	TOLLWAY 3203			0.066	0.1079		225.62				0.00284	0.053	26.41		52.07	0.0379		2608.4					144.76
8/19/15	7:36:00 AM	6174	8.16	TB7B-in-grab	TOLLWAY 3513	0.088		0.154	0.0708		88.88				0.00848	0.059	18.14		21.52	0.0078		1273.4					106.44
					min	0.059	NA	0.066	0.0161	NA	6.15	NA	NA	0.01	0.00284	0.053	1.96	NA	0.79	0.0047	NA	20.2	NA	0.087	NA	NA	3.43
					max	0.122	NA	0.154	0.2693	NA	365.15	NA	NA	0.01	0.01586	0.099	46.65	NA	80.59	0.2116	NA	13640.5	NA	0.262	NA	206.15	
					mean	0.090	NA	0.110	0.1134	NA	141.44	NA	NA	0.01	0.00762	0.067	19.68	NA	27.69	0.0491	NA	3747.5	NA	0.174	NA	92.42	

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	Field pH	Sample location	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31

TB7B-in-grab Dissolved Metals

10/14/14	9:55:00 AM	414	8.00	TB7B-in-grab			1.168		0.0929	0.00238			0.0176	7.49	43	257	9.6	0.021	0.20	0.22	100	0.21	27.07	6.08	3.06
11/11/14	9:35:00 AM	240	7.13	TB7B-in-grab			0.354		0.0357	0.00111			0.0257	7.58	28	82	230.0	0.088	0.99	1.03	22	0.57	10.24	35.59	10.86
2/10/15	13:59:00 PM	22563	7.83	TB7B-in-grab			3.830		3.0287		0.047		0.0415	7.89	143	13556	7.2	0.019	0.13		8158	1.20	532.81	10.13	8.91
3/3/15	10:05:00 AM	65303	7.67	TB7B-in-grab			0.829		1.7720				0.1756	7.77	67	34341	165.3	0.026	2.15	0.82	21940	1.07	213.43	56.84	28.00
3/10/15	12:33:00 PM	13371	7.27	TB7B-in-grab			2.575		1.8153	0.00100	0.025		0.0458	7.59	128	7696	20.8	0.017	0.06		4449	0.42	392.36	16.55	13.01
8/19/15	7:36:00 AM	6174	8.16	TB7B-in-grab			7.807		0.8439	0.00229			0.0139	8.28	236	3451		0.029		0.39	1776	1.20	275.65	12.50	11.64
					NA	NA	0.354	NA	0.0357	0.00100	0.025	NA	0.0139	7.49	28	82	7.2	0.017	0.06	0.22	22	0.21	10.24	6.08	3.06
					NA	NA	7.807	NA	3.0287	0.00238	0.047	NA	0.1756	8.28	236	34341	230.0	0.088	2.15	1.03	21940	1.20	532.81	56.84	28.00
					NA	NA	2.760	NA	1.2647	0.00170	0.036	NA	0.0534	7.76	108	9897	86.6	0.033	0.70	0.62	6074	0.78	241.93	22.95	12.58

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
TB7B-out-grab Dissolved Metals																											
10/14/14	8:49:00 AM	892	7.47	TB7B-out-grab	TOLLWAY 3016	0.208		0.068	0.0604		59.14				0.00724	0.173	8.07		16.52	0.0102		115.4		0.119		55.55	
3/10/15	12:05:00 PM	2219	7.03	TB7B-out-grab	TOLLWAY 3202	0.057		0.061	0.0685		136.95				0.00390	0.064	6.93		47.78	0.0393		291.1				130.49	
4/13/15	12:32:00 PM	2295	7.64	TB7B-out-grab	TOLLWAY 3260	0.051		0.064	0.0501		53.08				0.00870	0.060	6.19		10.62	0.0042		383.5		0.096		34.59	
					min	0.051	NA	0.061	0.0501	NA	53.08	NA	NA	NA	0.00390	0.060	6.19	NA	10.62	0.0042	NA	115.4	NA	0.096	NA	34.59	
					max	0.208	NA	0.068	0.0685	NA	136.95	NA	NA	NA	0.00870	0.173	8.07	NA	47.78	0.0393	NA	383.5	NA	0.119	NA	130.49	
					mean	0.105	NA	0.064	0.0597	NA	83.06	NA	NA	NA	0.00661	0.099	7.06	NA	24.97	0.0179	NA	263.3	NA	0.108	NA	73.55	

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31

TB7B-out-grab Dissolved Metals

10/14/14	8:49:00 AM	892	7.47	TB7B-out-	0.00769	0.017		0.0180	7.40	78	590	11.2	0.131	0.05	0.18	159	0.05	155.04	15.93	12.61
3/10/15	12:05:00 PM	2219	7.03	TB7B-out-	0.00206	0.026		0.0194	7.47	123	1364		0.063	0.08	0.14	465	0.27	361.62	8.19	7.54
4/13/15	12:32:00 PM	2295	7.64	TB7B-out-	0.00076			0.0117	7.27	70	1249	4.0	0.024		0.41	619		98.24	12.96	10.79
					0.00076	0.017	NA	0.0117	7.27	70	590	4.0	0.024	0.05	0.14	159	0.05	98.24	8.19	7.54
					0.00769	0.026	NA	0.0194	7.47	123	1364	11.2	0.131	0.08	0.41	619	0.27	361.62	15.93	12.61
					0.00350	0.022	NA	0.0164	7.38	91	1068	7.6	0.073	0.07	0.24	414	0.16	204.97	12.36	10.31

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
TB9A-grab Dissolved Metals																											
10/14/14	12:56:00 PM	1775	7.81	TB9A-grab	TOLLWAY 3021	0.064		0.051	0.0631		46.10				0.00806	0.127	8.64		10.68	0.0229		298.4					36.05
11/11/14	13:07:00 PM	2112	8.09	TB9A-grab	TOLLWAY 3062			0.035	0.0431		29.93				0.00930	0.103	19.19		6.46	0.0240		401.2		0.073			23.78
12/17/14	14:22:00 PM	6257	8.44	TB9A-grab	TOLLWAY 3115			0.033	0.1165		96.10					0.043	26.92		17.71	0.0296		1214.8					57.71
1/27/2015	14:24:00 PM	16932	7.49	TB9A-grab	TOLLWAY 3156			0.057	0.3346		290.60					0.195	41.71		41.65	2.0352		3697.1					100.37
2/10/15	10:49:00 AM	15905	7.44	TB9A-grab	TOLLWAY 3167			0.061	0.3165		326.55				0.00413	0.098	36.73		72.33	0.7381		3182.4		0.099			157.31
3/17/15	12:35:00 PM	16182	7.88	TB9A-grab	TOLLWAY 3221			0.051	0.3526		286.83				0.00510	0.024	44.07		45.34	0.1224		3399.1					91.62
3/31/15	9:45:00 AM	18439	8.02	TB9A-grab	TOLLWAY 3249			0.062	0.3573		296.68					0.160	9.18		43.30	0.0605		3932.8					94.47
5/27/15	12:10:00 PM	2712	8.82	TB9A-grab	TOLLWAY 3353			0.027	0.0387		45.05				0.00354	0.093	14.78		5.36	0.0226		512.3		0.109			5.01
6/23/15	15:29:00 PM	4264	7.86	TB9A-grab	TOLLWAY 3414	0.040		0.053	0.0839		54.92				0.00209	0.144	12.80		9.12	0.0640		803.2		0.094			13.93
7/8/15	12:51:00 PM	3401	7.09	TB9A-grab	TOLLWAY 3445			0.054	0.0857		56.70					0.057	18.28		7.96	0.0908		648.6					11.32
7/21/15	14:31:00 PM	4116	8.19	TB9A-grab	TOLLWAY 3466			0.048	0.1153		69.80								11.72	0.1849		792.8		0.143			1.51
					min	0.040	NA	0.027	0.0387	NA	29.93	NA	NA	NA	0.00209	0.024	8.64	NA	5.36	0.0226	NA	298.4	NA	0.073	NA	NA	1.51
					max	0.064	NA	0.062	0.3573	NA	326.55	NA	NA	NA	0.00930	0.195	50.84	NA	72.33	2.0352	NA	3932.8	NA	0.143	NA	NA	157.31
					mean	0.052	NA	0.048	0.1734	NA	145.39	NA	NA	NA	0.00537	0.104	25.74	NA	24.69	0.3086	NA	1716.6	NA	0.104	NA	NA	53.92

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31

TB9A-grab Dissolved Metals

10/14/14	12:56:00 PM	1775	7.81	TB9A-grab	0.00314			0.0237	7.78	99	948	4.0	0.026		0.27	430		94.74	10.99	9.29
11/11/14	13:07:00 PM	2112	8.09	TB9A-grab	0.00062			0.0120	7.66	65	1134	3.6	0.068	0.04	0.56	587	0.44	64.23	16.46	13.76
12/17/14	14:22:00 PM	6257	8.44	TB9A-grab					8.21	149	3445		0.008		0.36	1976		141.56	10.23	10.01
1/27/2015	14:24:00 PM	16932	7.49	TB9A-grab				0.1073	7.44	137	9999		0.008	0.45		5870	0.20	246.82	11.09	11.18
2/10/15	10:49:00 AM	15905	7.44	TB9A-grab		0.076		0.0518	7.60	140	9394		0.024	0.75		5587	0.26	397.43	8.53	8.52
3/17/15	12:35:00 PM	16182	7.88	TB9A-grab				0.0115	8.09	84	9517					5695		238.95	11.23	10.47
3/31/15	9:45:00 AM	18439	8.02	TB9A-grab				0.0161	7.98	76	10820		0.010			6413		249.41	11.30	11.04
5/27/15	12:10:00 PM	2712	8.82	TB9A-grab	0.00085				8.62	131	1399	28.4	0.064		0.29	753		12.60	13.80	9.65
6/23/15	15:29:00 PM	4264	7.86	TB9A-grab					7.68	160	2281		0.076		0.27	1267		38.30	11.69	11.35
7/8/15	12:51:00 PM	3401	7.09	TB9A-grab					7.55	158	1802		0.059		0.28	982		30.63	9.69	9.35
7/21/15	14:31:00 PM	4116	8.19	TB9A-grab		0.020			8.17	225	2164		0.076		0.28	1212		2.02	12.74	12.30
					0.00062	0.020	NA	0.0115	7.44	65	948	3.6	0.008	0.04	0.27	430	0.20	2.02	8.53	8.52
					0.00314	0.076	NA	0.1073	8.62	225	10820	28.4	0.076	0.75	0.56	6413	0.44	397.43	16.46	13.76
					0.00154	0.048	NA	0.0371	7.89	129	4809	12.0	0.042	0.42	0.33	2798	0.30	137.88	11.61	10.63

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S
					MDL:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
						0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
9/3/14	10:23:00 AM	2327	7.40	TB15B-GW-grab TOLLWAY 2936		0.064		0.072	0.0571		66.66				0.00638	0.072	12.54		12.03	0.0114		416.2		0.132		35.55
9/16/14	15:16:00 PM	2702	7.52	TB15B-GW-grab TOLLWAY 2976		0.078		0.066	0.0582		65.47				0.00681	0.078	14.30		10.77	0.0134	0.023	495.1		0.160		46.09
9/30/14	8:26:00 AM	3341	7.85	TB15B-GW-grab TOLLWAY 2984				0.064	0.0729		93.44				0.00466	0.033	14.93		16.92	0.0168		580.9		0.104		57.60
10/15/14	10:09:00 AM	1140	8.60	TB15B-GW-grab TOLLWAY 3030		0.994		0.032	0.0220		29.61				0.00808	0.734	6.93		4.92	0.0095		212.6		0.168		18.01
12/3/14	10:49:00 AM	3961	8.14	TB15B-GW-grab TOLLWAY 3093				0.030	0.0761		92.74				0.00364		17.23		12.34	0.0096		727.3		0.115		43.76
12/16/14	15:11:00 PM	3541	8.19	TB15B-GW-grab TOLLWAY 3113				0.030	0.0581		71.99				0.00220	0.025	13.82		9.51	0.0063		655.4		0.119		33.93
1/27/15	11:39:00 AM	11832	8.28	TB15B-GW-grab TOLLWAY 3154					0.2979		300.17				0.00246		27.29		18.93	0.0015		2394.3				49.94
2/11/15	9:17:00 AM	14760	7.84	TB15B-GW-grab TOLLWAY 3173					0.4114		407.06						26.54		46.91	0.0023		2834.3		0.112		60.76
3/4/15	10:20:00 AM	28711	7.20	TB15B-GW-grab TOLLWAY 3194					0.7122		494.79						34.19		57.24	0.0062		5026.8		0.106		76.18
3/18/15	10:20:00 AM	13254	8.23	TB15B-GW-grab TOLLWAY 3234		0.043		0.031	0.2704		252.82				0.00619		27.03		16.71		0.023	2623.8				52.98
3/31/15	13:56:00 PM	12386	8.31	TB15B-GW-grab TOLLWAY 3256				0.036	0.2395		241.20				0.00542		28.05		17.88	0.0016	0.025	2663.8		0.097		60.90
4/14/15	10:41:00 AM	8302	9.04	TB15B-GW-grab TOLLWAY 3276		0.077		0.032	0.1465		153.87				0.00326	0.027	21.60		11.53		0.026	1725.2		0.103		45.88
4/29/15	9:29:00 AM	9221	8.00	TB15B-GW-grab TOLLWAY 3307				0.039	0.1788		167.79				0.00629		24.88		16.67	0.0022	0.024	1838.4				61.16
5/12/15	11:08:00 AM	4309	7.79	TB15B-GW-grab TOLLWAY 3326		0.104		0.047	0.0717		75.15				0.00865	0.070	13.08		11.17	0.0021		833.1		0.113		38.48
5/28/15	9:54:00 AM	5071	7.11	TB15B-GW-grab TOLLWAY 3361		0.126		0.036	0.0826		76.07				0.01034	0.055	15.75		10.09	0.0021	0.023	936.2				39.84
6/9/15	10:24:00 AM	2664	7.74	TB15B-GW-grab TOLLWAY 3377		0.577		0.031	0.0427		47.64				0.01313	0.433	9.46		6.60	0.0094		510.5		0.114		24.06
6/22/15	16:17:00 PM	2944	7.48	TB15B-GW-grab TOLLWAY 3402		0.111		0.061	0.0529		56.93				0.00868	0.089	11.35		8.28	0.0047		555.4		0.082		31.26
7/7/15	11:42:00 AM	1551	7.47	TB15B-GW-grab TOLLWAY 3431		0.571		0.049	0.0322		39.74				0.01237	0.476	6.87		5.91	0.0110		293.5		0.143		16.85
7/20/15	14:11:00 PM	2591	7.11	TB15B-GW-grab TOLLWAY 3454		0.149		0.063	0.0477		54.18				0.00895	0.124	11.35		8.19	0.0074		493.9		0.160		30.98
8/4/15	9:24:00 AM	2363	7.59	TB15B-GW-grab TOLLWAY 3485		0.313		0.051	0.0448		50.22				0.00928	0.268	10.98		8.87	0.0106		444.2		0.113		30.32
8/19/15	11:19:00 AM	2077	7.67	TB15B-GW-grab TOLLWAY 3517		0.394		0.059	0.0412		45.98				0.00924	0.325	8.97		6.48	0.0094		355.7		0.100		28.11
				min		0.043	NA	0.030	0.0220	NA	29.61	NA	NA	NA	0.00220	0.025	6.87	NA	4.92	0.0015	0.023	212.6	NA	0.082	NA	16.85
				max		0.994	NA	0.072	0.7122	NA	494.79	NA	NA	NA	0.01313	0.734	34.19	NA	57.24	0.0168	0.026	5026.8	NA	0.168	NA	76.18
				mean		0.277	NA	0.046	0.1437	NA	137.31	NA	NA	NA	0.00716	0.201	17.01	NA	15.14	0.0072	0.024	1267.5	NA	0.120	NA	42.03

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Ti mg/L	TI mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
9/3/14	10:23:00 AM	2327	7.40	TB15B-GW-grab	0.00182				7.78	251	1286		0.160		0.23	524	1.12	93.77	8.76	8.62
9/16/14	15:16:00 PM	2702	7.52	TB15B-GW-grab	0.00193				7.84	200	1501		0.162		0.34	676	1.01	122.67	9.85	10.20
9/30/14	8:26:00 AM	3341	7.85	TB15B-GW-grab	0.00059	0.021			8.06	244	1864		0.157		0.24	854	1.31	153.48	9.13	9.23
10/15/14	10:09:00 AM	1140	8.60	TB15B-GW-grab	0.02474				8.44	117	645		0.194		0.25	260	0.48	48.11	10.37	10.34
12/3/14	10:49:00 AM	3961	8.14	TB15B-GW-grab					8.03	134	2160		0.115		0.12	1146	1.08	119.53	8.65	8.63
12/16/14	15:11:00 PM	3541	8.19	TB15B-GW-grab					8.13	135	1906		0.117		0.29	1011	1.10	86.92	7.97	7.80
1/27/15	11:39:00 AM	11832	8.28	TB15B-GW-grab		0.034			8.22	112	6742		0.057	0.11		3982	1.48	123.58	8.54	8.73
2/11/15	9:17:00 AM	14760	7.84	TB15B-GW-grab		0.049			7.96	131	8511		0.061	0.05		5218	1.21	152.96	7.67	7.37
3/4/15	10:20:00 AM	28711	7.20	TB15B-GW-grab					7.78	130	14365		0.065	0.19		9168	1.66	193.10	9.11	8.74
3/18/15	10:20:00 AM	13254	8.23	TB15B-GW-grab		0.018			8.51	116	7693		0.049	0.08		4664	1.59	139.39	10.04	9.80
3/31/15	13:56:00 PM	12386	8.31	TB15B-GW-grab					8.49	112	7034		0.067	0.05		4197	1.76	156.62	9.71	9.75
4/14/15	10:41:00 AM	8302	9.04	TB15B-GW-grab					8.77	130	4694		0.084	0.06	0.19	2670	1.14	119.64	9.91	10.30
4/29/15	9:29:00 AM	9221	8.00	TB15B-GW-grab					7.79	145	5211		0.063		0.16	3183	1.64	158.45	8.95	8.83
5/12/15	11:08:00 AM	4309	7.79	TB15B-GW-grab	0.00193				8.03	200	2353		0.134		0.21	1307	0.68	100.68	10.88	10.68
5/28/15	9:54:00 AM	5071	7.11	TB15B-GW-grab	0.00121				7.64	167	2723		0.091		0.22	1528	0.98	108.21	9.82	9.70
6/9/15	10:24:00 AM	2664	7.74	TB15B-GW-grab	0.01691				7.97	196	1445	7.2	0.140		0.28	691	0.38	65.49	12.05	11.88
6/22/15	16:17:00 PM	2944	7.48	TB15B-GW-grab	0.00274	0.021			7.71	251	1596		0.167		0.23	732	0.90	82.52	9.54	9.88
7/7/15	11:42:00 AM	1551	7.47	TB15B-GW-grab	0.01794				7.71	203	850		0.166		0.31	337	0.45	45.54	11.80	10.64
7/20/15	14:11:00 PM	2591	7.11	TB15B-GW-grab	0.00452				7.77	185	1392		0.175		0.26	656	0.88	85.33	9.77	9.49
8/4/15	9:24:00 AM	2363	7.59	TB15B-GW-grab	0.01057			0.0123	7.87	191	1283		0.163		0.30	575	0.97	80.03	9.20	9.57
8/19/15	11:19:00 AM	2077	7.67	TB15B-GW-grab	0.01072				7.74	153	1104		0.147		0.33	497	0.70	78.23	10.66	10.07
					0.00059	0.018	NA	0.0123	7.64	112	645	7.2	0.049	0.05	0.12	260	0.38	45.54	7.67	7.37
					0.02474	0.049	NA	0.0123	8.77	251	14365	7.2	0.194	0.19	0.34	9168	1.76	193.10	12.05	11.88
					0.00797	0.028	NA	0.0123	8.01	167	3636	7.2	0.121	0.09	0.25	2089	1.07	110.20	9.64	9.53

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217

TB19-SW-grab Dissolved Metals

10/14/14	14:59:00 PM	116	7.72	TB19-SW-grab	TOLLWAY 3025	0.408			0.0080		4.84				0.00269	0.297	2.54		1.25	0.0034		15.4		0.208		1.28
					min	0.408	NA	NA	0.0080	NA	4.84	NA	NA	NA	0.00269	0.297	2.54	NA	1.25	0.0034	NA	15.4	NA	0.208	NA	1.28
					max	0.408	NA	NA	0.0080	NA	4.84	NA	NA	NA	0.00269	0.297	2.54	NA	1.25	0.0034	NA	15.4	NA	0.208	NA	1.28
					mean	0.408	NA	NA	0.0080	NA	4.84	NA	NA	NA	0.00269	0.297	2.54	NA	1.25	0.0034	NA	15.4	NA	0.208	NA	1.28

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31

TB19-SW-grab Dissolved Metals

10/14/14	14:59:00 P	116	7.72	TB19-SW-grab			2.396		0.0178	0.01310				7.13	37	76	14.4	0.240	0.05	0.14	9	0.09	3.26	8.34	5.85
					NA	NA	2.396	NA	0.0178	0.01310	NA	NA	NA	7.13	37	76	14.4	0.240	0.05	0.14	9	0.09	3.26	8.34	5.85
					NA	NA	2.396	NA	0.0178	0.01310	NA	NA	NA	7.13	37	76	14.4	0.240	0.05	0.14	9	0.09	3.26	8.34	5.85
					NA	NA	2.396	NA	0.0178	0.01310	NA	NA	NA	7.13	37	76	14.4	0.240	0.05	0.14	9	0.09	3.26	8.34	5.85

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
9/3/14	16:03:00 PM	2034	7.56	TB19-GW-grab TOLLWAY 2944		0.260		0.077	0.0547		66.31				0.00941	0.180	15.37		15.35	0.0048		348.5		0.074		34.78
9/16/14	12:35:00 PM	1731	7.58	TB19-GW-grab TOLLWAY 2970		0.362		0.067	0.0468		56.61				0.00942	0.241	13.42		11.83	0.0054		301.0		0.086		29.90
9/30/14	15:04:00 PM	2157	7.75	TB19-GW-grab TOLLWAY 2997		0.138		0.063	0.0570		68.40				0.00721	0.073	14.26		16.74	0.0032		364.0				45.53
10/14/14	15:24:00 PM	762	7.77	TB19-GW-grab TOLLWAY 3026		0.937			0.0256		37.06				0.00805	0.669	5.17		7.87	0.0079		116.1	0.137			8.53
12/3/14	12:41:00 PM	2712	7.73	TB19-GW-grab TOLLWAY 3094		0.043		0.032	0.0666		95.09				0.00511	0.045	14.25		17.39	0.0027		450.8				36.80
12/16/14	10:54:00 AM	3232	7.71	TB19-GW-grab TOLLWAY 3111				0.033	0.0722		102.13				0.00242		15.56		16.91	0.0019		548.0				37.96
1/13/15	15:11:00 PM	3050	7.58	TB19-GW-grab TOLLWAY 3128				0.035	0.0760		129.11				0.00367		10.66		27.28	0.0033		469.4				43.27
1/27/15	9:33:00 AM	12232	7.52	TB19-GW-grab TOLLWAY 3152				0.026	0.3130		438.99				0.00183		27.63		41.85	0.0052		2334.1				44.52
2/10/15	15:24:00 PM	13553	7.48	TB19-GW-grab TOLLWAY 3171				0.031	0.3636		454.44				0.00486		26.48		67.87	0.0075		2447.1		0.103		53.16
3/3/15	15:00:00 PM	10894	7.22	TB19-GW-grab TOLLWAY 3193				0.035	0.2724		362.68				0.00219		22.47		78.88	0.0079		1432.8		0.079		69.96
3/17/15	14:40:00 PM	7338	7.61	TB19-GW-grab TOLLWAY 3225		0.075		0.047	0.1682		206.71				0.00471	0.033	20.66		33.53	0.0024		1376.6				29.95
3/31/15	11:52:00 AM	8601	7.54	TB19-GW-grab TOLLWAY 3251				0.044	0.1903		229.74				0.00529		25.48		38.63	0.0030		1665.2		0.079		39.73
4/15/15	8:19:00 AM	6079	8.27	TB19-GW-grab TOLLWAY 3284		0.204		0.069	0.1201		144.10				0.00708	0.083	24.22		31.57	0.0025		1137.6		0.116		34.51
4/28/15	10:18:00 AM	7225	8.09	TB19-GW-grab TOLLWAY 3300		0.087		0.047	0.1174		124.68				0.00718	0.036	24.90		22.21	0.0021		1355.0		0.122		42.23
5/12/15	16:16:00 PM	2975	8.71	TB19-GW-grab TOLLWAY 3336		0.627		0.061	0.0483		58.23				0.01008	0.371	13.15		19.58	0.0056		560.7		0.101		27.11
5/27/15	14:40:00 PM	3170	8.32	TB19-GW-grab TOLLWAY 3358		1.742		0.039	0.0432		43.15			0.006	0.01533	1.086	13.73		11.12	0.0128		629.1		0.117		27.15
6/9/15	15:19:00 PM	2517	8.06	TB19-GW-grab TOLLWAY 3384		2.134		0.058	0.0423		41.58			0.007	0.01745	1.378	11.02		10.17	0.0169		492.5		0.146		24.94
6/22/15	12:11:00 PM	2099	7.98	TB19-GW-grab TOLLWAY 3396		0.549		0.077	0.0404		50.71				0.01089	0.345	12.56		13.61	0.0067		374.3				27.09
7/7/15	14:21:00 PM	1750	6.84	TB19-GW-grab TOLLWAY 3433		0.813		0.059	0.0391		44.20				0.01279	0.564	10.14		8.81	0.0117		322.0				18.91
7/20/15	11:43:00 AM	1368	7.25	TB19-GW-grab TOLLWAY 3450		0.357		0.066	0.0342		47.06				0.01262	0.258	10.67		9.56	0.0059		258.6		0.108		21.44
8/4/15	13:18:00 PM	1986	7.04	TB19-GW-grab TOLLWAY 3489		0.402		0.053	0.0519		58.44				0.01107	0.299	12.86		13.28	0.0077		366.1		0.099		25.89
8/17/15	14:36:00 PM	2806	7.37	TB19-GW-grab TOLLWAY 3510		0.170		0.071	0.0596		64.21				0.01124	0.129	15.03		14.51	0.0055		507.6		0.094		43.91
				min		0.043	NA	0.026	0.0256	NA	37.06	NA	NA	0.006	0.00183	0.033	5.17	NA	7.87	0.0019	NA	116.1	NA	0.074	NA	8.53
				max		2.134	NA	0.077	0.3636	NA	454.44	NA	NA	0.007	0.01745	1.378	27.63	NA	78.88	0.0169	NA	2447.1	NA	0.146	NA	69.96
				mean		0.556	NA	0.052	0.1047	NA	132.89	NA	NA	0.007	0.00818	0.362	16.35	NA	24.03	0.0060	NA	811.7	NA	0.104	NA	34.88

APPENDIX A3: Results of Geochemical Analysis of Biweekly Surface-Water Grab Samples

Analytical Results

Date	Time collected	Field conductivity (us/cm)	Field pH	Sample location	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
9/3/14	16:03:00 PM	2034	7.56	TB19-GW-grab	0.00637				7.70	287	1161		0.102		0.26	413	2.01	92.98	13.12	12.91
9/16/14	12:35:00 PM	1731	7.58	TB19-GW-grab	0.00835				7.96	247	981		0.098		0.27	355	1.86	83.05	11.96	12.00
9/30/14	15:04:00 PM	2157	7.75	TB19-GW-grab	0.00190				7.95	279	1230		0.077		0.26	449	2.12	124.77	12.85	12.65
10/14/14	15:24:00 PM	762	7.77	TB19-GW-grab	0.02536				7.87	177	435	21.2	0.172		0.23	111	0.80	23.70	11.17	9.50
12/3/14	12:41:00 PM	2712	7.73	TB19-GW-grab	0.00086				7.74	162	1491		0.069		0.20	714	1.75	101.51	9.16	8.98
12/16/14	10:54:00 AM	3232	7.71	TB19-GW-grab		0.028			7.72	137	1769		0.058		0.20	892	1.49	97.57	8.01	8.11
1/13/15	15:11:00 PM	3050	7.58	TB19-GW-grab					7.75	176	1697		0.052		0.17	816	2.59	114.56	6.59	6.68
1/27/15	9:33:00 AM	12232	7.52	TB19-GW-grab		0.038			7.54	127	7020		0.037	0.10		4149	2.00	109.10	7.95	7.97
2/10/15	15:24:00 PM	13553	7.48	TB19-GW-grab		0.049			7.75	161	7912		0.044	0.07		4545	2.00	134.61	7.47	7.83
3/3/15	15:00:00 PM	10894	7.22	TB19-GW-grab		0.018			7.64	191	4947		0.046			2763	3.41	185.21	6.46	6.81
3/17/15	14:40:00 PM	7338	7.61	TB19-GW-grab					7.93	173	4187		0.064	0.05		2354	3.14	77.11	9.28	9.45
3/31/15	11:52:00 AM	8601	7.54	TB19-GW-grab					7.94	192	5110		0.061	0.05	0.12	2737	3.55	106.95	9.35	9.18
4/15/15	8:19:00 AM	6079	8.27	TB19-GW-grab	0.00239				8.09	224	3368		0.084	0.09	0.22	1848	3.71	89.91	11.69	11.86
4/28/15	10:18:00 AM	7225	8.09	TB19-GW-grab	0.00056	0.025			8.08	188	4010		0.054	0.04	0.17	2212	1.77	111.89	10.44	10.34
5/12/15	16:16:00 PM	2975	8.71	TB19-GW-grab	0.01510	0.017			8.67	280	1628		0.115		0.23	757	1.24	72.38	14.91	14.65
5/27/15	14:40:00 PM	3170	8.32	TB19-GW-grab	0.04157				8.29	242	1750		0.117	0.05	0.26	869	0.97	74.04	16.03	14.55
6/9/15	15:19:00 PM	2517	8.06	TB19-GW-grab	0.05550			0.0101	8.03	284	1400		0.138		0.27	594	1.17	67.09	18.69	17.80
6/22/15	12:11:00 PM	2099	7.98	TB19-GW-grab	0.01278				8.36	302	1179		0.119		0.25	434	1.61	74.55	12.73	12.18
7/7/15	14:21:00 PM	1750	6.84	TB19-GW-grab	0.02278				7.66	255	982		0.133		0.24	365	1.20	53.47	14.87	14.00
7/20/15	11:43:00 AM	1368	7.25	TB19-GW-grab	0.00936				7.94	248	796		0.117		0.29	245	1.04	58.27	13.60	12.71
8/4/15	13:18:00 PM	1986	7.04	TB19-GW-grab	0.01317			0.0121	7.69	257	1089		0.103		0.20	421	2.06	70.58	12.13	11.70
8/17/15	14:36:00 PM	2806	7.37	TB19-GW-grab	0.00421				7.71	243	1523		0.096		0.25	668	1.91	116.31	14.87	13.99
					0.00056	0.017	NA	0.0101	7.54	127	435	21.2	0.037	0.04	0.12	111	0.80	23.70	6.46	6.68
					0.05550	0.049	NA	0.0121	8.67	302	7912	21.2	0.172	0.10	0.29	4545	3.71	185.21	18.69	17.80
					0.01468	0.029	NA	0.0111	7.91	220	2530	21.2	0.089	0.07	0.23	1305	1.97	92.71	11.52	11.18

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Date	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L		
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097		
TB9Ac2N Grab Total Metals																																					
10/17/12	16:20:00 PM	NA	NA	TB9Ac2N grab	TOLLWAY 1798 TOT	1.007			0.0580		11.16			0.0124	0.02847	1.745	1.19		2.94	0.0390		11.0		0.117		1.14					2.197			0.0393	0.03484		0.1202
1/11/13	9:00:00 AM	8/23/01	8.96	TB9Ac2N grab	TOLLWAY 1921 TOT	4.035		0.027	0.1980		72.97			0.0394	0.11499	7.779	2.28		22.66	0.2140		117.2		0.248		19.20				9.012		0.3070	0.18106		0.6643		
2/6/13	12:32:00 PM	4/6/49	10.29	TB9Ac2N grab	TOLLWAY 1962 TOT	0.053		0.070	0.3091		231.88			0.0114	0.00361	0.059	86.79		23.45	0.0055	0.025	4314.4		0.133		87.98				5.741		3.3849		0.0141			
2/19/13	11:21:00 AM	11/30/05	9.44	TB9Ac2N grab	TOLLWAY 1980 TOT	0.076		0.078	0.3288		230.07			0.0147	0.00558	0.053	86.76		16.44	0.0019	0.030	4005.2				76.96				6.145		3.4463		0.0130			
3/4/13	16:08:00 PM	9/5/52	10.82	TB9Ac2N grab	TOLLWAY 1995 TOT	0.051		0.057	0.3431		222.66			0.0136		0.040	89.48		11.00	0.0020	0.031	4020.7		0.082		68.90				4.368		3.1917		0.0112			
3/19/13	16:55:00 PM	4/12/51	10.89	TB9Ac2N grab	TOLLWAY 2035 TOT			0.055	0.2967		182.90			0.0146	0.01880	0.056	72.36		8.23		0.031	4038.3		0.084		71.46		0.192		5.474		2.6435		0.0129			
4/17/13	10:47:00 AM	8/7/04	10.22	TB9Ac2N grab	TOLLWAY 2091 TOT	1.083			0.1039		29.33			0.0119	0.03035	1.687	10.21		2.26		0.0316	348.7		0.151		10.10				3.592	0.05030	0.020		0.0926			
4/29/13	16:01:00 PM	4/4/36	11.55	TB9Ac2N grab	TOLLWAY 2104 TOT	0.088		0.096	0.2006		120.07			0.0153	0.01853	68.39	5.04		5.04		0.040	2846.6				57.44		0.141		5.958	1.9369			0.0114			
6/26/13	11:03:00 AM	1/21/13	9.75	TB9Ac2N grab	TOLLWAY 2240 TOT	3.615		0.138	0.0685		28.50			0.0199	0.01206	1.643	31.71		6.11		0.0162	976.1		0.127		53.30				0.4369	0.11248			0.0243			
					min	0.051	NA	0.027	0.0580	NA	11.16	NA	NA	0.0114	0.00361	0.040	1.19	NA	2.26	0.0019	0.025	11.0	NA	0.082	NA	1.14	NA	0.141	2.197	NA	0.0393	0.03484	0.020	NA	0.0112		
					max	4.035	NA	0.138	0.3431	NA	231.88	NA	NA	0.0394	0.11499	7.779	89.48	NA	23.45	0.2140	0.040	4314.4	NA	0.248	NA	87.98	NA	0.192	20.492	NA	3.4463	0.18106	0.020	NA	0.6643		
					mean	1.251	NA	0.074	0.2119	NA	125.51	NA	NA	0.0170	0.02905	1.633	49.91	NA	10.90	0.0443	0.031	2297.6	NA	0.135	NA	49.61	NA	0.166	6.998	NA	1.7510	0.09467	0.020	NA	0.1071		
TB15Bc3N Grab Total Metals																																					
1/11/13	8:30:00 AM	8767	9.41	TB15Bc3N grab	TOLLWAY 1920 TOT	1.516		0.046	0.2081		129.30			0.0088	0.01756	1.528	46.14		5.66	0.0668	0.035	1675.8		0.262		47.237				8.629		1.3012	0.08977		0.0587		
1/30/13	8:30:00 AM	6283	NA	TB15Bc3N grab	TOLLWAY 1943 TOT	2.006		0.031	0.1216		156.41			0.0323	0.05097	3.894	30.61		12.65	0.0943	0.028	1125.6		0.150		37.738				8.869		0.8335	0.10140		0.2041		
2/19/13	13:10:00 PM	15848	10.53	TB15Bc3N grab	TOLLWAY 1981 TOT	27.260		0.070	0.6851	0.00055	447.54			0.0652	0.17010	24.026	58.32		25.11	0.5505	0.035	3330.9		1.001	0.102	58.160				48.167		3.1340	0.80204		0.051	0.6675	
					min	1.516	NA	0.031	0.1216	0.00055	129.30	NA	NA	0.0088	0.01756	1.528	30.61	NA	5.66	0.0668	0.028	1125.6	NA	0.150	0.102	37.738	NA	NA	8.629	NA	0.8335	0.08977	NA	0.051	0.0587		
					max	27.260	NA	0.070	0.6851	0.00055	447.54	NA	NA	0.0652	0.17010	24.026	58.32	NA	25.11	0.5505	0.035	3330.9	NA	1.001	0.102	58.160	NA	NA	48.167	NA	3.1340	0.80204	NA	0.051	0.6675		
					mean	10.261	NA	0.049	0.3383	0.00055	244.42	NA	NA	0.0354	0.07954	9.816	45.03	NA	14.47	0.2372	0.033	2044.1	NA	0.471	0.102	47.711	NA	NA	21.888	NA	1.7562	0.33107	NA	0.051	0.3101		

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Date	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097	
TB7Bin Grab Total Metals																																				
01/15/14	9:59:00 AM	31105	7.81	TB7Bin grab	TOLLWAY 2527 TOT			0.099	0.3514		430.85				0.039	54.13			83.16	0.0355		6718.9			221.28		0.214	4.911		3.784					0.0491	
02/20/14	11:40:00 AM	1981	8.68	TB7Bin grab	TOLLWAY 2570 TOT	5.606		0.040	0.3261		78.11			0.0550	0.2120	18.774	3.72		25.32	0.3040		392.3		0.396	0.043	22.74		16.337		0.449	0.33233				0.8101	
03/19/14	8:34:00 AM	7272	8.02	TB7Bin grab	TOLLWAY 2616 TOT	2.589		0.069	0.1944		84.47			0.0238	0.0763	4.922	12.07		13.63	0.0962		1566.3	0.046	0.079	50.84		8.566		0.688	0.13626	0.018			0.3146		
04/16/14	8:44:00 AM	21285	7.92	TB7Bin grab	TOLLWAY 2675 TOT			0.128	0.1194		246.46			0.0110	0.0243	0.041	43.66		47.95	0.0198	0.029	4831.9			177.87		5.236		1.894					0.0268		
04/29/14	14:45:00 PM	9962	8.47	TB7Bin grab	TOLLWAY 2701 TOT	0.320		0.094	0.0716		130.60			0.0076	0.0240	0.380	22.44		33.30	0.0106		2152.2			107.91		0.148		5.326		1.045	0.00946			0.0317	
05/13/14	10:00:00 AM	13521	8.82	TB7Bin grab	TOLLWAY 2722 TOT	0.440		0.173	0.0625		147.78			0.0124	0.0183	0.209	35.86		43.55	0.0055	0.023	2899.7		0.227	156.82		9.583		1.132	0.01744				0.0151		
06/10/14	8:47:00 AM	14810	7.85	TB7Bin grab	TOLLWAY 2781 TOT	0.095		0.168	0.1101		194.66				0.0230	0.189	45.43		44.91	0.0216	0.030	3196.3		0.164	0.042	175.07		6.627		2.037	0.00211			0.0347		
06/24/14	9:39:00 AM	9830	7.53	TB7Bin grab	TOLLWAY 2804 TOT	0.286		0.158	0.0816		134.63			0.0062	0.0307	0.408	33.43		33.11	0.0188	0.027	1980.0		0.165	0.067	127.48		6.846		1.227	0.01217			0.0650		
07/09/14	9:57:00 AM	9608	8.14	TB7Bin grab	TOLLWAY 2845 TOT	0.748		0.190	0.0652		116.61				0.0051	0.374	33.52		29.60	0.0087	0.026	1998.5			127.17		10.135		1.113	0.03286				0.0201		
08/06/14	8:35:00 AM	9876	8.06	TB7Bin grab	TOLLWAY 2895 TOT	0.541		0.211	0.1004		139.13					0.297	35.00		35.83	0.0158	0.028	2054.9			160.84		9.055		1.381	0.02322	0.018			0.0197		
					min	0.095	NA	0.040	0.0625	NA	78.11	NA	NA	0.0062	0.0051	0.039	3.72	NA	13.63	0.0055	0.023	392.3	0.046	0.079	0.042	22.74	NA	0.148	4.911	NA	0.449	0.00211	0.018	NA	0.0151	
					max	5.606	NA	0.211	0.3514	NA	430.85	NA	NA	0.0550	0.2120	18.774	54.13	NA	83.16	0.3040	0.030	6718.9	0.046	0.396	0.067	221.28	NA	0.231	16.337	NA	3.784	0.33233	0.018	NA	0.8101	
					mean	1.328	NA	0.133	0.1483	NA	170.33	NA	NA	0.0193	0.0517	2.563	31.93	NA	39.04	0.0536	0.027	2779.1	0.046	0.206	0.051	132.80	NA	0.187	8.262	NA	1.475	0.07073	0.018	NA	0.1387	
TB7Bout Grab Total Metals																																				
02/20/14	12:06:00 PM	6973	7.74	TB7Bout grab	TOLLWAY 2571 TOT	0.272		0.044	0.1001		123.26				0.0109	0.510	7.80		26.06	0.0598		1423.8		0.073	80.94				2.034		0.860	0.01195			0.0595	
03/19/14	10:11:00 AM	5139	7.61	TB7Bout grab	TOLLWAY 2621 TOT	7.781		0.079	0.1503		83.74			0.0189	0.0394	6.795	11.59		19.34	0.1304		1014.2		0.355	68.31		21.869		0.470	0.30218				0.1393		
04/29/14	14:09:00 PM	1527	7.52	TB7Bout grab	TOLLWAY 2699 TOT	3.090		0.047	0.0727		41.22			0.0078	0.0212	2.476	5.59		10.31	0.0397		260.9		0.109	32.94		9.246		0.259	0.13331				0.0688		
05/13/14	8:25:00 AM	2564	7.43	TB7Bout grab	TOLLWAY 2719 TOT	0.606		0.103	0.0942		107.21				0.0103	0.499	6.18		29.37	0.0150		397.3		0.139	88.43		4.876		0.576	0.02156				0.0274		
					min	0.272	NA	0.044	0.0727	NA	41.22	NA	NA	0.0078	0.0103	0.499	5.59	NA	10.31	0.0150	NA	260.9	NA	0.073	NA	32.94	NA	NA	2.034	NA	0.259	0.01195	NA	NA	0.0274	
					max	7.781	NA	0.103	0.1503	NA	123.26	NA	NA	0.0189	0.0394	6.795	11.59	NA	29.37	0.1304	NA	1423.8	NA	0.355	NA	88.43	NA	21.869	NA	0.860	0.30218	NA	NA	NA	0.1393	
					mean	2.937	NA	0.068	0.1043	NA	88.86	NA	NA	0.0134	0.0204	2.570	7.79	NA	21.27	0.0612	NA	774.1	NA	0.169	NA	67.65	NA	NA	9.506	NA	0.541	0.11725	NA	NA	0.0738	

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Date	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097	
TB9A Grab Total Metals																																				
9/17/13	14:15:00 PM	3941	8.14	TB9A grab	TOLLWAY 2366 TOT	0.114		0.054	0.1123		84.96				0.0074	0.118	33.56		13.90	0.0275		695.4		0.204		41.17			2.211		0.696	0.00407				0.0226
10/15/13	13:20:00 PM	4928	7.77	TB9A grab	TOLLWAY 2406 TOT	0.094		0.052	0.1310		90.02				0.0022	0.195	35.58		16.81	0.1100		908.3		0.276		29.18			3.307		0.796	0.00556				0.0271
11/12/13	11:26:00 AM	3515	7.50	TB9A grab	TOLLWAY 2448 TOT	0.154		0.046	0.0823		54.44				0.0055	0.164	26.05		10.82	0.0401		646.0		0.144		43.67			4.018		0.551	0.00756				0.0248
12/3/13	16:00:00 PM	4410	7.76	TB9A grab	TOLLWAY 2484 TOT	0.044		0.032	0.0954		63.18					0.095	24.87		12.92	0.1476		853.8		0.204		35.86			2.531		0.564	0.00179				0.0381
1/14/14	15:19:00 PM	13694	7.41	TB9A grab	TOLLWAY 2521 TOT			0.057	0.2891		290.98					0.117	21.78		65.81	0.6513		2733.1		0.158		134.13		0.169	3.348		2.357					0.0841
2/19/14	11:05:00 AM	24146	7.17	TB9A grab	TOLLWAY 2557 TOT			0.073	0.4850		381.92				0.0073	0.278	35.33		78.37	1.2322		5284.4		0.201		167.49		0.135	3.673		3.432			0.034		0.2314
3/18/14	8:59:00 AM	19262	7.89	TB9A grab	TOLLWAY 2601 TOT	0.143		0.051	0.3072		285.31				0.0147	0.134	55.65		33.24	0.2026		4133.1		0.075		94.11		0.135	3.276		2.688	0.00078		0.042		0.0437
4/1/14	10:47:00 AM	20616	8.01	TB9A grab	TOLLWAY 2643 TOT	0.350		0.067	0.3954		284.91				0.1363	0.640	69.39		38.65	0.0886		4474.0			103.07		0.209	1.456		3.013	0.01930		0.052			0.0665
4/15/14	14:22:00 PM	9685	8.98	TB9A grab	TOLLWAY 2668 TOT	0.114		0.053	0.1415		136.40				0.0180	0.204	34.08		25.63	0.0619		1907.5			77.97		0.136	0.757		1.240	0.00116					0.0219
4/29/14	13:03:00 PM	782	8.67	TB9A grab	TOLLWAY 2697 TOT	2.043		0.026	0.0557		20.97			0.0110	0.0237	2.354	3.29		5.90	0.0494		137.0			10.74			6.349		0.147	0.10040					0.1403
5/13/14	13:52:00 PM	4824	7.86	TB9A grab	TOLLWAY 2730 TOT	0.283		0.084	0.1300		111.86				0.0115	0.423	13.41		29.19	0.1111		889.0		0.208		67.49		0.134	1.697		0.831	0.01246				0.0227
5/28/14	9:51:00 AM	7991	7.58	TB9A grab	TOLLWAY 2746 TOT	0.094		0.087	0.1524		92.65				0.0186	0.455	36.93		17.10	0.2331		1541.3		0.210		27.51			0.927		1.129	0.00282		0.027		0.0265
6/10/14	12:50:00 PM	9758	7.91	TB9A grab	TOLLWAY 2786 TOT	0.074		0.075	0.1381		104.50				0.0126	0.344	49.93		16.32	0.2085		2051.8		0.165		5.10			1.373		1.295	0.00185				0.0188
6/24/14	10:45:00 AM	NA	NA	TB9A grab	TOLLWAY 2806 TOT	0.042		0.085	0.1048		70.55				0.0026	0.300	33.26		12.27	0.1328		1161.1		0.184		24.61			3.834		0.809	0.00149				0.0137
7/8/14	13:40:00 PM	2191	7.77	TB9A grab	TOLLWAY 2837 TOT	0.141		0.061	0.0594		46.47				0.0035	0.330	9.53		10.08	0.0463		370.2		0.092		20.71			2.171		0.425	0.00550				0.0132
8/5/14	13:26:00 PM	3411	7.61	TB9A grab	TOLLWAY 2888 TOT			0.077	0.1195		86.91				0.0029	0.154	14.53		20.52	0.0677		593.3		0.084		62.41			2.267		0.677	0.00061				0.0142
8/20/14	9:27:00 AM	8351	7.56	TB9A grab	TOLLWAY 2921 TOT			0.075	0.1620		85.76					0.151	55.53		18.36	0.0559		1614.7		0.075		15.42			0.981		0.934					
					min	0.042	NA	0.026	0.0557	NA	20.97	NA	NA	0.0110	0.0022	0.095	3.29	NA	5.90	0.0275	NA	137.0	NA	0.075	NA	5.10	NA	0.134	0.757	NA	0.147	0.00061	0.027	NA		0.0132
					max	2.043	NA	0.087	0.4850	NA	381.92	NA	NA	0.0110	0.1363	2.354	69.39	NA	78.37	1.2322	NA	5284.4	NA	0.276	NA	167.49	NA	0.209	6.349	NA	3.432	0.10040	0.052	NA		0.2314
					mean	0.284	NA	0.062	0.1742	NA	134.81	NA	NA	0.0110	0.0191	0.380	32.51	NA	25.05	0.2039	NA	1764.4	NA	0.158	NA	56.51	NA	0.153	2.598	NA	1.270	0.01181	0.039	NA		0.0506

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Date	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L			
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			
TB9Ac2N Grab Total Metals																																						
9/17/13	13:45:00 PM	7342	9.76	TB9Ac2N grab	TOLLWAY 2365 TOT	0.099		0.117	0.1049		31.93			0.0092	0.0076	0.054	68.24				0.045	1546.8			86.47				14.116		0.888	0.00119						
10/1/13	16:02:00 PM	6375	10.83	TB9Ac2N grab	TOLLWAY 2390 TOT	0.052		0.093	0.0830		23.18			0.0089	0.0047	0.030	53.32				0.045	1319.8			75.19				11.785		0.753							
10/15/13	12:35:00 PM	367	8.91	TB9Ac2N grab	TOLLWAY 2405 TOT	0.972		0.039	0.0807		17.46			0.0108	0.0365	1.583	4.03			3.35	0.0339		59.1	0.162		8.25			3.460		0.221	0.04249				0.1447		
11/12/13	10:42:00 AM	5189	10.11	TB9Ac2N grab	TOLLWAY 2447 TOT	0.150		0.106	0.0674		33.11			0.0097	0.0088	0.053	48.59			9.31	0.036		984.1			73.56			11.820		0.763	0.00305						
12/3/13	15:21:00 PM	3307	8.15	TB9Ac2N grab	TOLLWAY 2483 TOT	7.642		0.072	0.2974		39.28			0.0255	0.1054	8.114	9.94			8.75	0.1677		632.5	0.389		21.50			21.891		0.298	0.41443				0.4957		
12/18/13	10:22:00 AM	11857	9.18	TB9Ac2N grab	TOLLWAY 2502 TOT	0.067		0.086	0.2418		146.49					0.030	70.52			24.29	0.0036	0.035	2467.6	0.144		79.70			9.811		2.465							
1/14/14	16:09:00 PM	31344	9.45	TB9Ac2N grab	TOLLWAY 2524 TOT	0.050		0.072	0.6185		397.80			0.0116		0.040	67.19			32.77	0.0135		6777.0	0.087		139.03		0.273	5.989		4.882					0.0163		
2/19/14	10:16:00 AM	22955	8.07	TB9Ac2N grab	TOLLWAY 2556 TOT	1.713		0.091	0.2433		200.99			0.0167	0.0654	4.292	18.64			13.48	0.1534		4975.8	0.185	0.064	115.03			7.590		2.313	0.10962	0.042			0.2636		
3/18/14	9:57:00 AM	29316	11.56	TB9Ac2N grab	TOLLWAY 2602 TOT	0.162			0.4641		364.04			0.0215	0.0578	0.074	112.04			16.00	0.0031	0.048	6528.6			92.85		0.192	4.933		4.453					0.0165		
4/1/14	10:10:00 AM	24944	11.42	TB9Ac2N grab	TOLLWAY 2642 TOT			0.063	0.3916		288.40			0.0144	0.2060	0.248	109.04			14.71	0.0174	0.048	5866.8			81.72		0.164	5.425		3.799	0.00158				0.0433		
4/15/14	13:27:00 PM	21220	11.80	TB9Ac2N grab	TOLLWAY 2667 TOT	0.203		0.063	0.3205		214.72			0.0197	0.0696	0.040	98.26			5.48	0.0041	0.042	4583.9			71.00		0.187	6.129		2.739		0.035			0.0160		
4/29/14	12:06:00 PM	5817	10.71	TB9Ac2N grab	TOLLWAY 2695 TOT	1.179		0.034	0.1295		61.62			0.0132	0.0382	1.507	25.36			3.54	0.0269		1296.6	0.096		22.00			5.237		0.751	0.04645				0.0775		
5/13/14	15:00:00 PM	14648	11.14	TB9Ac2N grab	TOLLWAY 2732 TOT	1.904		0.105	0.1682		128.27			0.0220	0.0332	0.797	54.84			15.36	0.0098	0.035	3056.9	0.198		88.00			13.356		1.599	0.04978				0.0221		
5/28/14	11:15:00 AM	12387	11.33	TB9Ac2N grab	TOLLWAY 2748 TOT	0.121		0.073	0.1879		103.09			0.0157	0.0414	0.038	72.68			3.82			2459.6	0.129		51.81			8.094		1.411					0.0141		
6/10/14	13:42:00 PM	14758	11.47	TB9Ac2N grab	TOLLWAY 2788 TOT	0.093		0.087	0.2144		106.51			0.0142	0.0480	0.042	95.49			4.32	0.0047	0.053	3185.9	0.083		69.85			9.500		1.666							
6/24/14	11:40:00 AM	NA	NA	TB9Ac2N grab	TOLLWAY 2807 TOT	0.038		0.110	0.1400		54.58			0.0122	0.0207		82.77			7.11	0.050		2407.8			77.61			12.201		1.192							
7/8/14	14:29:00 PM	8191	10.71	TB9Ac2N grab	TOLLWAY 2839 TOT	0.827		0.124	0.0982		37.30			0.0093	0.0123	0.262	61.19			3.48	0.0027	0.036	1708.8			55.03			16.060		0.719	0.02531						
7/22/14	11:04:00 AM	9980	10.35	TB9Ac2N grab	TOLLWAY 2865 TOT	0.052		0.089	0.1302		34.45			0.0071	0.0093	0.038	74.98			5.34	0.0019	0.042	2114.1			68.75			13.080		1.004					0.0115		
8/5/14	14:25:00 PM	7959	10.04	TB9Ac2N grab	TOLLWAY 2890 TOT	1.029		0.135	0.1029		45.17			0.0149	0.0057	0.339	57.03			7.73	0.0040	0.033	1659.4			74.60			18.483		0.768	0.02941					0.0106	
					min	0.038	NA	0.034	0.0674	NA	17.46	NA	NA	0.0071	0.0047	0.030	4.03	NA		3.35	0.0019	0.033	59.1	NA	0.083	0.064	8.25	NA	0.164	3.460	NA	0.221	0.00119	0.035	NA	0.0106		
					max	7.642	NA	0.135	0.6185	NA	397.80	NA	NA	0.0255	0.2060	8.114	112.04	NA		32.77	0.1677	0.053	6777.0	NA	0.389	0.064	139.03	NA	0.273	21.891	NA	4.882	0.41443	0.042	NA	0.4957		
					mean	0.909	NA	0.087	0.2150	NA	122.55	NA	NA	0.0142	0.0453	1.033	62.32	NA		10.28	0.0319	0.042	2822.7	NA	0.164	0.064	71.16	NA	0.204	10.471	NA	1.720	0.07233	0.038	NA	0.0943		

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Date	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	
MDL:						0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097	
TB15Bgw Grab Total Metals																																				
09/04/13	9:26:00 AM	2246	7.87	TB15Bgw grab	TOLLWAY 2353 TOT	0.307		0.070	0.0654		69.88				0.0072	0.302	12.67		11.80	0.0252		420.5		0.185		29.49			6.919		0.400	0.00625	0.022			
09/16/13	13:45:00 PM	1966	7.15	TB15Bgw grab	TOLLWAY 2362 TOT	1.784		0.050	0.0561		55.44			0.0060	0.0091	1.383	11.36		7.86	0.0301		352.6		0.200		29.88			8.906		0.323	0.04539			0.0110	
10/01/13	9:35:00 AM	2447	8.12	TB15Bgw grab	TOLLWAY 2386 TOT	0.523		0.045	0.0621		62.88				0.0056	0.429	13.16		8.94	0.0223	0.042	434.1		0.221		30.35			6.650		0.359	0.01256				
10/16/13	10:30:00 AM	2275	8.02	TB15Bgw grab	TOLLWAY 2418 TOT	0.284		0.054	0.0624		62.38				0.0039	0.288	13.73		10.70	0.0170		406.8		0.212		36.38			6.498		0.394	0.00718				
10/29/13	10:03:00 AM	3370	7.60	TB15Bgw grab	TOLLWAY 2428 TOT	0.096		0.049	0.0827		85.91				0.0064	0.167	16.78		15.25	0.0304	0.023	599.2		0.205		50.95			5.495		0.523	0.00205				
11/12/13	14:55:00 PM	2235	7.50	TB15Bgw grab	TOLLWAY 2449 TOT	0.399		0.034	0.0465		50.78				0.0064	0.349	12.70		7.61	0.0108		396.7		0.203		31.23			6.178		0.330	0.01118				
12/03/13	11:33:00 AM	3174	7.87	TB15Bgw grab	TOLLWAY 2480 TOT	0.068		0.026	0.0650		78.71				0.0017	0.071	14.96		12.88	0.0058		577.4		0.260		39.08			5.103		0.420	0.00130				
12/17/13	13:20:00 PM	8591	7.63	TB15Bgw grab	TOLLWAY 2500 TOT			0.028	0.2230		199.30					0.042	32.01		21.84	0.0198		1627.3		0.228		52.05			4.945		1.436					
01/13/14	15:00:00 PM	6944	7.71	TB15Bgw grab	TOLLWAY 2514 TOT	1.031		0.031	0.1444		147.11					0.634	8.96		24.74	0.0074		1313.0		0.351		40.54			4.898		0.730	0.01906			0.0133	
02/19/14	16:44:00 PM	16021	7.44	TB15Bgw grab	TOLLWAY 2562 TOT	0.049		0.024	0.4123		288.57					0.042	15.17		44.48			3397.5		0.272		69.34		0.177	3.000		1.833					
03/04/14	14:56:00 PM	11860	7.24	TB15Bgw grab	TOLLWAY 2577 TOT			0.033	0.3045		251.26					17.20	40.30		40.30	0.0073		2378.6		0.143		103.66		0.157	3.736		1.473					
03/18/14	12:30:00 PM	14717	9.10	TB15Bgw grab	TOLLWAY 2610 TOT	0.306		0.046	0.2357		211.37				0.0167	0.165	31.97		13.04	0.0038	0.024	3216.2		0.111		79.68		0.137	4.705		1.295	0.00449			0.0104	
04/01/14	14:47:00 PM	12465	8.62	TB15Bgw grab	TOLLWAY 2645 TOT	0.076		0.046	0.2146		184.65				0.0843	0.027	35.51		17.76		0.034	2670.3		0.075		76.66			5.293		1.268					
04/15/14	11:40:00 AM	7482	8.87	TB15Bgw grab	TOLLWAY 2665 TOT	0.485		0.041	0.1031		110.03			0.0070	0.0168	0.282	21.97		13.63	0.0032	0.023	1519.0				50.43		0.144	5.948		0.617	0.00969	0.021		0.0097	
04/30/14	10:29:00 AM	4197	8.36	TB15Bgw grab	TOLLWAY 2708 TOT	1.478		0.041	0.0647		69.33				0.0174	1.564	12.55		11.76	0.0235		830.0		0.311		38.06			7.476		0.340	0.03033			0.0152	
05/14/14	11:32:00 AM	4118	8.43	TB15Bgw grab	TOLLWAY 2742 TOT	1.591		0.062	0.0673		65.58				0.0161	1.157	15.14		10.49	0.0159	0.030	789.4		0.197		51.16			8.662		0.365	0.03940			0.0109	
05/28/14	14:53:00 PM	4977	7.46	TB15Bgw grab	TOLLWAY 2751 TOT	0.933		0.075	0.0730		58.42			0.0064	0.0259	0.798	20.47		9.20	0.0151		978.3		0.332		45.03			9.464		0.365	0.02427			0.0113	
06/25/14	9:00:00 AM	NA	NA	TB15Bgw grab	TOLLWAY 2810 TOT	4.027		0.063	0.0462		39.54			0.0076	0.0175	3.064	10.48		7.55	0.0489		305.8		0.287		22.58			14.065		0.184	0.10225			0.0168	
07/08/14	11:04:00 AM	1528	7.36	TB15Bgw grab	TOLLWAY 2835 TOT	1.431		0.061	0.0391		42.62				0.0129	1.097	8.70		6.86	0.0224		267.2		0.164		17.22			8.687		0.186	0.04384			0.0134	
08/05/14	8:27:00 AM	1230	7.95	TB15Bgw grab	TOLLWAY 2878 TOT	5.773		0.043	0.0478		32.95			0.0119	0.0154	4.390	8.28		6.01	0.0696		214.3		0.234		17.33			16.846		0.148	0.14945			0.0282	
08/19/14	12:46:00 PM	3857	7.67	TB15Bgw grab	TOLLWAY 2915 TOT	0.136		0.075	0.0822		78.36				0.0046	0.124	19.30		12.27	0.0133	0.024	701.1		0.179		48.39			7.910		0.432	0.00397				
					min	0.049	NA	0.024	0.0391	NA	32.95	NA	NA	0.0060	0.0017	0.027	8.28	NA	6.01	0.0032	0.023	214.3	NA	0.075	NA	17.22	NA	0.137	3.000	NA	0.148	0.00130	0.021	NA	0.0097	
					max	5.773	NA	0.075	0.4123	NA	288.57	NA	NA	0.0119	0.0843	4.390	35.51	NA	44.48	0.0696	0.042	3397.5	NA	0.351	NA	103.66	NA	0.177	16.846	NA	1.833	0.14945	0.022	NA	0.0282	
					mean	1.094	NA	0.048	0.1190	NA	106.91	NA	NA	0.0078	0.0163	0.819	16.81	NA	15.00	0.0206	0.028	1114.1	NA	0.219	NA	45.69	NA	0.154	7.209	NA	0.639	0.03016	0.021	NA	0.0140	

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Date	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L		
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097		
TB15Bc1N Grab Total Metals																																					
5/14/14	8:03:00 AM	7889	11.73	TB15Bc1N grab	TOLLWAY 2734 TOT	2.714		0.090	0.1209		92.98			0.0119	0.0459	3.428	35.05		3.41	0.0558	0.060	1602.0		0.224		52.41			19.100		0.646	0.10208				0.1544	
7/8/14	8:05:00 AM	2564	10.96	TB15Bc1N grab	TOLLWAY 2825 TOT	1.581		0.046	0.0949		84.21			0.0290	0.0373	4.112	17.08		15.85	0.1336		441.0		0.134		13.35			8.749		0.417	0.04178				0.1985	
8/5/14	7:48:00 AM	3697	11.19	TB15Bc1N grab	TOLLWAY 2877 TOT	1.278		0.097	0.0679		79.23			0.0124	0.0479	2.471	20.15		16.47	0.1730		704.3				62.43			19.296		0.318	0.02435				0.3458	
					min	1.278	NA	0.046	0.0679	NA	79.23	NA	NA	0.0119	0.0373	2.471	17.08	NA	3.41	0.0558	0.047	441.0	NA	0.134	NA	13.35	NA	NA	8.749	NA	0.318	0.02435	NA	NA	NA	0.1544	
					max	2.714	NA	0.097	0.1209	NA	92.98	NA	NA	0.0290	0.0479	4.112	35.05	NA	16.47	0.1730	0.060	1602.0	NA	0.224	NA	62.43	NA	NA	19.296	NA	0.646	0.10208	NA	NA	NA	0.3458	
					mean	1.858	NA	0.078	0.0946	NA	85.47	NA	NA	0.0178	0.0437	3.337	24.10	NA	11.91	0.1208	0.054	915.7	NA	0.179	NA	42.73	NA	NA	15.715	NA	0.461	0.05607	NA	NA	NA	0.2329	
TB19sw Grab Total Metals																																					
2/19/14	15:04:00 PM	8030	7.79	TB19sw grab	TOLLWAY 2561 TOT	0.771		0.026	0.0984		63.40					0.856	23.11		9.67	0.0623		1715.3		0.658		31.15			3.949		0.482	0.03104				0.0949	
					min	0.771	NA	0.026	0.0984	NA	63.40	NA	NA	NA	NA	0.856	23.11	NA	9.67	0.0623	NA	1715.3	NA	0.658	NA	31.15	NA	NA	3.949	NA	0.482	0.03104	NA	NA	NA	0.0949	
					max	0.771	NA	0.026	0.0984	NA	63.40	NA	NA	NA	NA	0.856	23.11	NA	9.67	0.0623	NA	1715.3	NA	0.658	NA	31.15	NA	NA	3.949	NA	0.482	0.03104	NA	NA	NA	0.0949	
					mean	0.771	NA	0.026	0.0984	NA	63.40	NA	NA	NA	NA	0.856	23.11	NA	9.67	0.0623	NA	1715.3	NA	0.658	NA	31.15	NA	NA	3.949	NA	0.482	0.03104	NA	NA	NA	0.0949	

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Date	Time collected (CST)	Field conductivity (uS/cm)	Field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Ti mg/L	V mg/L	Zn mg/L
					MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097
TB19gw Grab Total Metals																																			
09/03/13	15:37:00 PM	2407	7.62	TB19gw grab	TOLLWAY 2347 TOT	0.589		0.075	0.0691		64.56				0.0104	0.534	21.03		19.01	0.0185	0.023	444.4		0.147		43.02				8.477	0.414	0.01220			
09/17/13	15:22:00 PM	1918	7.62	TB19gw grab	TOLLWAY 2367 TOT	2.513		0.059	0.0582		51.47				0.0155	1.793	17.41		14.37	0.0335		327.1		0.145		34.15				11.941	0.317	0.06233			
09/30/13	11:41:00 AM	2003	7.49	TB19gw grab	TOLLWAY 2380 TOT	1.010		0.042	0.0532		52.39				0.0086	0.762	14.69		12.61	0.0150		297.1		0.136		27.88				7.914	0.308	0.03018			
10/15/13	15:15:00 PM	1799	7.94	TB19gw grab	TOLLWAY 2408 TOT	0.677		0.074	0.0521		66.09				0.0075	0.486	15.64		16.81	0.0100		293.8		0.137		41.59				8.286	0.352	0.01500			
10/29/13	11:57:00 AM	2016	7.60	TB19gw grab	TOLLWAY 2430 TOT	0.641		0.065	0.0666		85.25				0.0068	0.578	18.84		18.96	0.0476	0.024	328.7		0.148		55.19				7.787	0.459	0.01382			
11/13/13	8:52:00 AM	1546	7.78	TB19gw grab	TOLLWAY 2456 TOT	0.599		0.047	0.0409		46.27				0.0070	0.454	14.03		12.05	0.0079		254.8		0.075		27.21				7.592	0.309	0.01429			
12/04/13	8:55:00 AM	1988	8.42	TB19gw grab	TOLLWAY 2486 TOT	0.242		0.032	0.0413		49.96				0.0029	0.147	14.79		12.17	0.0034		328.2		0.150		27.86				6.233	0.328	0.00465			
01/14/14	13:45:00 PM	11259	7.51	TB19gw grab	TOLLWAY 2520 TOT	0.074		0.038	0.3449		297.60					0.065	20.59		49.25	0.0078		2096.9		0.159		47.23		0.254	4.013	1.456					
02/19/14	14:02:00 PM	14715	7.10	TB19gw grab	TOLLWAY 2559 TOT	0.104			0.5355		411.10				0.0061	0.115	29.60		89.10	0.0223		2771.4		0.257		85.30		0.232	4.538	2.639	0.00182				0.0104
03/04/14	12:23:00 PM	1181	6.44	TB19gw grab	TOLLWAY 2575 TOT	0.046		0.041	0.4197		354.01					0.065	23.32		82.65	0.0082		2202.5		0.081		69.33		0.176	4.470	1.741		0.021			
03/19/14	12:24:00 PM	7753	8.79	TB19gw grab	TOLLWAY 2624 TOT	6.258		0.049	0.1631		139.89		0.0095	0.0193	3.896	22.14		16.90	0.0474		1532.6		0.259		22.36				17.701	0.785	0.15003				
04/01/14	12:38:00 PM	9178	7.44	TB19gw grab	TOLLWAY 2644 TOT	0.089		0.041	0.2120		193.42				0.0648	0.057	32.23		35.51	0.0022		1790.7		0.094		44.36				5.242	1.168	0.00073			
04/16/14	12:44:00 PM	5761	8.51	TB19gw grab	TOLLWAY 2682 TOT	0.800		0.055	0.1073		109.96				0.0158	0.457	19.39		27.69	0.0063		1105.2		0.094		37.61				6.959	0.578	0.01513			
04/30/14	8:11:00 AM	3224	8.92	TB19gw grab	TOLLWAY 2703 TOT	4.731		0.060	0.0776		66.33			0.0082	0.0215	3.336	14.97		18.96	0.0371		587.9		0.155		25.64				15.372	0.305	0.10612			
05/12/14	12:11:00 PM	4758	8.15	TB19gw grab	TOLLWAY 2712 TOT	1.344		0.063	0.0803		72.13				0.0185	0.828	22.81		19.41	0.0100	0.023	930.5		0.117		36.31				9.642	0.440	0.02910			
05/29/14	7:56:00 AM	4491	8.27	TB19gw grab	TOLLWAY 2755 TOT	1.396		0.077	0.0710		63.71				0.0179	0.898	25.29		17.45	0.0115		868.3		0.187		37.64				11.031	0.380	0.02915			
06/09/14	12:06:00 PM	4609	8.41	TB19gw grab	TOLLWAY 2758 TOT	1.727		0.063	0.0691		53.57			0.0115	0.0191	1.185	28.82		12.96	0.0210	0.029	896.4		0.224		41.02				12.297	0.366	0.03372			
06/24/14	13:55:00 PM	NA	NA	TB19gw grab	TOLLWAY 2809 TOT	10.371		0.075	0.0710		38.05			0.0145	0.0287	7.405	17.15		11.25	0.0996	0.023	407.9		0.330		22.63				27.379	0.202	0.23271			
07/09/14	7:22:00 AM	2027	7.43	TB19gw grab	TOLLWAY 2840 TOT	3.034		0.081	0.0567		45.02				0.0159	2.122	15.66		12.93	0.0343		366.8		0.121		24.08				14.016	0.227	0.07863			
07/23/14	8:01:00 AM	2886	7.38	TB19gw grab	TOLLWAY 2868 TOT	1.044		0.057	0.0691		71.90				0.0081	0.656	18.82		16.96	0.0148		517.7			42.45				10.023	0.360	0.02407				
08/06/14	12:18:00 PM	1510	7.99	TB19gw grab	TOLLWAY 2901 TOT	10.453		0.078	0.0700		37.35			0.0146	0.0288	8.375	13.19		9.90	0.1183		276.4		0.246		23.15				26.882	0.176	0.20412			
08/20/14	12:45:00 PM	2087	7.35	TB19gw grab	TOLLWAY 2924 TOT	0.865		0.062	0.0557		59.81				0.0075	0.636	14.28		12.82	0.0137		351.2			27.61				8.761	0.293	0.02332				
					min	0.046	NA	0.032	0.0409	NA	37.35	NA	NA	0.0082	0.0029	0.057	13.19	NA	9.90	0.0022	0.023	254.8	NA	0.075	NA	22.36	NA	0.176	4.013	NA	0.176	0.00073	0.021	NA	0.0104
					max	10.453	NA	0.081	0.5355	NA	411.10	NA	NA	0.0146	0.0648	8.375	32.23	NA	89.10	0.1183	0.029	2771.4	NA	0.330	NA	85.30	NA	0.254	27.379	NA	2.639	0.23271	0.021	NA	0.0425
					mean	2.209	NA	0.059	0.1266	NA	110.45	NA	NA	0.0117	0.0165	1.656	19.76	NA	24.53	0.0268	0.024	862.6	NA	0.167	NA	38.35	NA	0.221	10.753	NA	0.618	0.05406	0.021	NA	0.0224

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L		
					MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217		
TB7B-in-grab Total Metals																												
10/14/14	9:55:00 AM	414	8.00	TB7B-in-grab	TOLLWAY 3018 TOT	0.465			0.0540		14.87				0.02037	0.920	2.08		3.34	0.0158					71.6		9.40	
11/11/14	9:35:00 AM	240	7.13	TB7B-in-grab	TOLLWAY 3059 TOT	3.784		0.038	0.1994		32.71			0.03	0.20086	8.198	4.47		8.64	0.1485					36.3	0.324	6.97	
2/10/15	13:59:00 PM	22563	7.83	TB7B-in-grab	TOLLWAY 3169 TOT	0.230		0.096	0.1918		368.13				0.00590	0.425	45.75		79.43	0.0288					4629.0	0.101	200.47	
3/3/15	10:05:00 AM	65303	7.67	TB7B-in-grab	TOLLWAY 3192 TOT	4.488		0.132	0.4460		172.07			0.05	0.13099	8.906	25.60		16.04	0.3594					14208.4	0.214	88.09	
3/10/15	12:33:00 PM	13371	7.27	TB7B-in-grab	TOLLWAY 3203 TOT	0.771		0.070	0.1272		234.33				0.01973	1.239	28.76		55.60	0.0550					2715.9		151.01	
8/19/15	7:36:00 AM	6174	8.16	TB7B-in-grab	TOLLWAY 3513 TOT	1.107		0.151	0.0719		85.53				0.01072	0.604	18.41		20.34	0.0156					1231.2		102.76	
					min	0.230	NA	0.038	0.0540	NA	14.87	NA	NA	0.03	0.00590	0.425	2.08	NA	3.34	0.0156	NA	36.3	NA	0.101	NA	6.97		
					max	4.488	NA	0.151	0.4460	NA	368.13	NA	NA	0.05	0.20086	8.906	45.75	NA	79.43	0.3594	NA	14208.4	NA	0.324	NA	200.47		
					mean	1.807	NA	0.097	0.1817	NA	151.27	NA	NA	0.04	0.06476	3.382	20.85	NA	30.57	0.1039	NA	3815.4	NA	0.213	NA	93.12		
TB7B-out-grab Total Metals																												
10/14/14	8:49:00 AM	892	7.47	TB7B-out-grab	TOLLWAY 3016 TOT	1.295		0.059	0.0637		55.32				0.00919	0.879	8.45		15.95	0.0180					112.2	0.189	49.98	
3/10/15	12:05:00 PM	2219	7.03	TB7B-out-grab	TOLLWAY 3202 TOT	0.205		0.059	0.0698		136.28				0.00404	0.168	7.04		47.56	0.0400					294.4	0.092	128.87	
4/13/15	12:32:00 PM	2295	7.64	TB7B-out-grab	TOLLWAY 3260 TOT	0.277		0.065	0.0615		56.45			0.01	0.01154	0.490	6.63		11.50	0.0088					400.7	0.085	35.67	
					min	0.205	NA	0.059	0.0615	NA	55.32	NA	NA	0.01	0.00404	0.168	6.63	NA	11.50	0.0088	NA	112.2	NA	0.085	NA	35.67		
					max	1.295	NA	0.065	0.0698	NA	136.28	NA	NA	0.01	0.01154	0.879	8.45	NA	47.56	0.0400	NA	400.7	NA	0.189	NA	128.87		
					mean	0.593	NA	0.061	0.0650	NA	82.68	NA	NA	0.01	0.00826	0.512	7.38	NA	25.01	0.0222	NA	269.1	NA	0.122	NA	71.50		
TB9A-grab Total Metals																												
10/14/14	12:56:00 PM	1775	7.81	TB9A-grab	TOLLWAY 3021 TOT	0.344		0.051	0.0693		47.46				0.01059	0.450	9.18		10.95	0.0310					309.0	0.076	36.68	
11/11/14	13:07:00 PM	2112	8.09	TB9A-grab	TOLLWAY 3062 TOT	0.226		0.044	0.0568		30.35				0.01479	0.467	19.95		6.59	0.0318					406.5	0.116	23.79	
12/17/14	14:22:00 PM	6257	8.44	TB9A-grab	TOLLWAY 3115 TOT			0.040	0.1198		99.94				0.087	27.84			18.48	0.0330					1244.0		59.25	
1/27/2015	14:24:00 PM	16932	7.49	TB9A-grab	TOLLWAY 3156 TOT			0.057	0.3383		286.54					0.262	45.25		41.84	2.0289					3663.1		99.98	
2/10/15	10:49:00 AM	15905	7.44	TB9A-grab	TOLLWAY 3167 TOT			0.060	0.3243		328.21					0.142	37.50		73.12	0.7466					3152.1	0.118	158.97	
3/17/15	12:35:00 PM	16182	7.88	TB9A-grab	TOLLWAY 3221 TOT			0.052	0.3576		296.43				0.00426	0.179	44.12		46.78	0.1281					3488.3		94.73	
3/31/15	9:45:00 AM	18439	8.02	TB9A-grab	TOLLWAY 3249 TOT			0.064	0.3546		295.41					0.053	49.51		43.11	0.0617					4007.0		96.00	
5/27/15	12:10:00 PM	2712	8.82	TB9A-grab	TOLLWAY 3353 TOT	0.165		0.027	0.0460		53.85				0.00679	0.428	9.60		5.54	0.0762					516.9	0.257	5.16	
6/23/15	15:29:00 PM	4264	7.86	TB9A-grab	TOLLWAY 3414 TOT	0.077		0.055	0.0891		58.42				0.00255	0.185	15.84		9.58	0.0692					844.9	0.093	14.64	
7/8/15	12:51:00 PM	3401	7.09	TB9A-grab	TOLLWAY 3445 TOT			0.054	0.0865		56.42					0.201	12.85		7.90	0.0990					649.6		11.49	
7/21/15	14:31:00 PM	4116	8.19	TB9A-grab	TOLLWAY 3466 TOT			0.047	0.1178		71.71					0.235	18.23		12.55	0.2193					789.0	0.131	1.53	
					min	0.077	NA	0.027	0.0460	NA	30.35	NA	NA	NA	0.00255	0.053	9.18	NA	5.54	0.0310	NA	309.0	NA	0.076	NA	1.53		
					max	0.344	NA	0.064	0.3576	NA	328.21	NA	NA	NA	0.01479	0.467	49.51	NA	73.12	2.0289	NA	4007.0	NA	0.257	NA	158.97		
					mean	0.203	NA	0.050	0.1782	NA	147.70	NA	NA	NA	0.00780	0.244	26.35	NA	25.13	0.3204	NA	1733.7	NA	0.132	NA	54.75		

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples

Analytical Results

Date	Time collected (cst)	Field conductivity (us/cm)	Sample location	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity DS, 180 mg/L as CaCO ₃	TSS mg/L	PO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total N mg/L	total P mg/L	
				0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
TB7B-in-grab Total Metals																								
10/14/14	9:55:00 AM	414	TB7B-in-grab			2.058		0.0924	0.02561			0.0670												
11/11/14	9:35:00 AM	240	TB7B-in-grab			9.642		0.0953	0.18296			0.4851												
2/10/15	13:59:00 PM	2563	TB7B-in-grab			4.499		2.9548	0.01460	0.034		0.0740												
3/3/15	10:05:00 AM	5303	TB7B-in-grab			14.867		1.8618	0.31161			0.7627												
3/10/15	12:33:00 PM	13371	TB7B-in-grab			4.844		1.9425	0.04414	0.019		0.1302												
8/19/15	7:36:00 AM	6174	TB7B-in-grab			9.856		0.8081	0.03988			0.0266												
				NA	NA	2.058	NA	0.0924	0.01460	0.019	NA	0.0266												
				NA	NA	14.867	NA	2.9548	0.31161	0.034	NA	0.7627												
				NA	NA	7.628	NA	1.2925	0.10313	0.026	NA	0.2576												
TB7B-out-grab Total Metals																								
10/14/14	8:49:00 AM	892	TB7B-out-gra	0.04671			0.0342																	
3/10/15	12:05:00 PM	2219	TB7B-out-gra	0.00786			0.0278																	
4/13/15	12:32:00 PM	2295	TB7B-out-gra	0.00995			0.0318																	
				0.00786	NA	NA	0.0278																	
				0.04671	NA	NA	0.0342																	
				0.02150	NA	NA	0.0312																	
TB9A-grab Total Metals																								
10/14/14	12:56:00 PM	1775	TB9A-grab	0.01567			0.0285																	
11/11/14	13:07:00 PM	2112	TB9A-grab	0.00963			0.0321																	
12/17/14	14:22:00 PM	257	TB9A-grab	0.00058	0.023		0.0144																	
1/27/2015	14:24:00 PM	16932	TB9A-grab				0.1167																	
2/10/15	10:49:00 AM	15905	TB9A-grab		0.074		0.0649																	
3/17/15	12:35:00 PM	16182	TB9A-grab				0.0210																	
3/31/15	9:45:00 AM	18439	TB9A-grab		0.039		0.0243																	
5/27/15	12:10:00 PM	2712	TB9A-grab	0.00587			0.0179																	
6/23/15	15:29:00 PM	4264	TB9A-grab	0.00172			0.0127																	
7/8/15	12:51:00 PM	3401	TB9A-grab	0.00063																				
7/21/15	14:31:00 PM	4116	TB9A-grab																					
				0.00058	0.023	NA	0.0127																	
				0.01567	0.074	NA	0.1167																	
				0.00568	0.045	NA	0.0369																	

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Date	Time collected	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S				
						mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
MDL:						0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217				
TB15B-SW-grab Total Metals																														
no samples						Tb15B sw																								
TB15B-GW-grab Total Metals																														
9/3/14	10:23:00 AM	2327	7.40	TB15B-GW-grab	TOLLWAY 2936 TOT	0.199		0.073	0.0596		68.00				0.00777	0.189	13.00		12.10	0.0145		426.5		0.162		36.10				
9/16/14	15:16:00 PM	2702	7.52	TB15B-GW-grab	TOLLWAY 2976 TOT	0.204		0.067	0.0603		67.12				0.00708	0.182	14.74		11.00	0.0155	0.022	506.4		0.173		47.49				
9/30/14	8:26:00 AM	3341	7.85	TB15B-GW-grab	TOLLWAY 2984 TOT	0.092		0.066	0.0764		96.24				0.00420	0.087	15.53		17.55	0.0185		598.6		0.107		59.64				
10/15/14	10:09:00 AM	1140	8.60	TB15B-GW-grab	TOLLWAY 3030 TOT	2.256		0.030	0.0287		30.96				0.01051	1.725	7.60		5.23	0.0279		219.2		0.216		18.52				
12/3/14	10:49:00 AM	3961	8.14	TB15B-GW-grab	TOLLWAY 3093 TOT			0.029	0.0767		95.59				0.00342		16.24		12.73	0.0099		726.5		0.093		45.08				
12/16/14	15:11:00 PM	3541	8.19	TB15B-GW-grab	TOLLWAY 3113 TOT	0.067		0.030	0.0597		73.95				0.00357	0.058	13.94		9.28	0.0092		663.7		0.083		34.21				
1/27/2015	11:39:00 AM	11832	8.28	TB15B-GW-grab	TOLLWAY 3154 TOT				0.2964		298.97				0.00255		25.67		19.72			2455.6				49.96				
2/11/15	9:17:00 AM	14760	7.84	TB15B-GW-grab	TOLLWAY 3173 TOT				0.4104		417.23						26.49		46.64	0.0022		2914.4		0.154		60.65				
3/4/15	10:20:00 AM	28711	7.20	TB15B-GW-grab	TOLLWAY 3194 TOT				0.7214		520.71						33.99		58.98	0.0065		5063.0		0.122		77.69				
3/18/15	10:20:00 AM	13254	8.23	TB15B-GW-grab	TOLLWAY 3234 TOT	0.047		0.032	0.2924		264.81				0.00723		28.63		17.35		0.029	2798.2				56.31				
3/31/15	13:56:00 PM	12386	8.31	TB15B-GW-grab	TOLLWAY 3256 TOT	0.055		0.037	0.2446		247.32				0.00543		28.46		18.09	0.0016	0.026	2709.4				62.17				
4/14/15	10:41:00 AM	8302	9.04	TB15B-GW-grab	TOLLWAY 3276 TOT	0.108		0.031	0.1460		154.01				0.00313	0.065	21.62		10.81	0.0021	0.025	1751.9		0.139		45.76				
4/29/15	9:29:00 AM	9221	8.00	TB15B-GW-grab	TOLLWAY 3307 TOT			0.039	0.1842		171.05				0.00622		25.54		16.76	0.0022	0.028	1911.9		0.083		63.38				
5/12/15	11:08:00 AM	4309	7.79	TB15B-GW-grab	TOLLWAY 3326 TOT	0.172		0.052	0.0712		75.04				0.00859	0.119	13.20		11.21	0.0032		837.0		0.093		38.28				
5/28/15	9:54:00 AM	5071	7.11	TB15B-GW-grab	TOLLWAY 3361 TOT	0.190		0.037	0.0868		77.89				0.00877	0.103	17.28		10.18	0.0028		987.1				40.80				
6/9/15	10:24:00 AM	2664	7.74	TB15B-GW-grab	TOLLWAY 3377 TOT	1.082		0.031	0.0453		47.86				0.01443	0.802	9.80		6.71	0.0163		515.6		0.122		23.73				
6/22/15	16:17:00 PM	2944	7.48	TB15B-GW-grab	TOLLWAY 3402 TOT	0.192		0.061	0.0536		58.06				0.00979	0.157	11.53		8.38	0.0062		559.4		0.082		31.75				
7/7/15	11:42:00 AM	1551	7.47	TB15B-GW-grab	TOLLWAY 3431 TOT	1.120		0.056	0.0350		39.48				0.01317	0.941	6.81		6.01	0.0212		290.4		0.150		16.86				
7/20/15	14:11:00 PM	2591	7.11	TB15B-GW-grab	TOLLWAY 3454 TOT	0.373		0.065	0.0506		55.97				0.00992	0.295	11.96		8.53	0.0112		513.5		0.134		32.05				
8/4/15	9:24:00 AM	2363	7.59	TB15B-GW-grab	TOLLWAY 3485 TOT	0.640		0.052	0.0468		51.12				0.01006	0.535	11.23		8.99	0.0163		446.8		0.109		30.14				
8/19/15	11:19:00 AM	2077	7.67	TB15B-GW-grab	TOLLWAY 3517 TOT	0.930		0.060	0.0453		47.21			0.01	0.01056	0.751	9.41		6.91	0.0175		367.7		0.129		28.79				
					min	0.047	NA	0.029	0.0287	NA	30.96	NA	NA	0.01	0.00255	0.058	6.81	NA	5.23	0.0016	0.022	219.2	NA	0.082	NA	16.86				
					max	2.256	NA	0.073	0.7214	NA	520.71	NA	NA	0.01	0.01443	1.725	33.99	NA	58.98	0.0279	0.029	5063.0	NA	0.216	NA	77.69				
					mean	0.483	NA	0.047	0.1472	NA	140.88	NA	NA	0.01	0.00770	0.429	17.27	NA	15.39	0.0108	0.026	1298.2	NA	0.127	NA	42.83				

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Date	Time collected (cst)	Field conductivit (us/cm)	field pH	Sample location	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCQ	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
					0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31

TB15B-GW-grab Total Metals

9/3/14	10:23:00 AM	2327	7.40	TB15B-GW-g	0.00580			0.0112																	
9/16/14	15:16:00 PM	2702	7.52	TB15B-GW-g	0.00556			0.0114																	
9/30/14	8:26:00 AM	3341	7.85	TB15B-GW-g	0.00206	0.021		0.0117																	
10/15/14	10:09:00 AM	1140	8.60	TB15B-GW-g	0.06076			0.0178																	
12/3/14	10:49:00 AM	3961	8.14	TB15B-GW-grab				0.0106																	
12/16/14	15:11:00 PM	3541	8.19	TB15B-GW-g	0.00111			0.0101																	
1/27/2015	11:39:00 AM	1832	8.28	TB15B-GW-grab		0.021		0.0147																	
2/11/15	9:17:00 AM	14760	7.84	TB15B-GW-grab		0.060		0.0108																	
3/4/15	10:20:00 AM	28711	7.20	TB15B-GW-grab				0.0144																	
3/18/15	10:20:00 AM	13254	8.23	TB15B-GW-grab		0.019																			
3/31/15	13:56:00 PM	12386	8.31	TB15B-GW-grab		0.018		0.0109																	
4/14/15	10:41:00 AM	302	9.04	TB15B-GW-g	0.00120	0.019																			
4/29/15	9:29:00 AM	9221	8.00	TB15B-GW-grab																					
5/12/15	11:08:00 AM	4309	7.79	TB15B-GW-g	0.00373	0.019																			
5/28/15	9:54:00 AM	5071	7.11	TB15B-GW-g	0.00305																				
6/9/15	10:24:00 AM	2664	7.74	TB15B-GW-g	0.03082			0.0116																	
6/22/15	16:17:00 PM	2944	7.48	TB15B-GW-g	0.00476	0.019																			
7/7/15	11:42:00 AM	1551	7.47	TB15B-GW-g	0.03271			0.0150																	
7/20/15	14:11:00 PM	2591	7.11	TB15B-GW-g	0.01079																				
8/4/15	9:24:00 AM	2363	7.59	TB15B-GW-g	0.02049			0.0130																	
8/19/15	11:19:00 AM	2077	7.67	TB15B-GW-g	0.02565			0.0111																	
					0.00111	0.018	NA	0.0101																	
					0.06076	0.060	NA	0.0178																	
					0.01489	0.025	NA	0.0124																	

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Analytical Results

Date collected	Time collected (cst)	Field conductivity (us/cm)	field pH	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L		
MDL:						0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217		
TB19-SW-grab Total Metals																												
10/14/14	14:59:00 PM	116	7.72	TB19-SW-grab	TOLLWAY 3025 TOT	1.046			0.0193		6.34			0.01	0.00579	0.800	2.96		1.87	0.0118		17.5		0.279		1.47		
min						1.046	NA	NA	0.0193	NA	6.34	NA	NA	0.01	0.00579	0.800	2.96	NA	1.87	0.0118	NA	17.5	NA	0.279	NA	1.47		
max						1.046	NA	NA	0.0193	NA	6.34	NA	NA	0.01	0.00579	0.800	2.96	NA	1.87	0.0118	NA	17.5	NA	0.279	NA	1.47		
mean						1.046	NA	NA	0.0193	NA	6.34	NA	NA	0.01	0.00579	0.800	2.96	NA	1.87	0.0118	NA	17.5	NA	0.279	NA	1.47		
TB19-GW-grab Total Metals																												
9/3/14	16:03:00 PM	2034	7.56	TB19-GW-grab	TOLLWAY 2944 TOT	0.901		0.081	0.0605		67.10				0.01123	0.565	16.75		15.61	0.0096		369.4		0.085		35.71		
9/16/14	12:35:00 PM	1731	7.58	TB19-GW-grab	TOLLWAY 2970 TOT	0.908		0.070	0.0508		59.60				0.01009	0.587	14.14		12.49	0.0100		312.3		0.092		30.99		
9/30/14	15:04:00 PM	2157	7.75	TB19-GW-grab	TOLLWAY 2997 TOT	0.409		0.076	0.0606		69.62				0.00891	0.306	14.93		17.45	0.0070		377.2				46.62		
10/14/14	15:24:00 PM	762	7.77	TB19-GW-grab	TOLLWAY 3026 TOT	4.442			0.0455		40.42			0.01	0.01212	3.633	6.16		9.71	0.0754		120.3		0.216		9.20		
12/3/14	12:41:00 PM	2712	7.73	TB19-GW-grab	TOLLWAY 3094 TOT	0.095		0.032	0.0684		96.17				0.00604	0.084	14.42		18.10	0.0031		460.4		0.100		37.45		
12/16/14	10:54:00 AM	3232	7.71	TB19-GW-grab	TOLLWAY 3111 TOT	0.037		0.032	0.0741		105.67				0.00267	0.042	15.79		18.65	0.0023		559.5				38.99		
1/13/2015	15:11:00 PM	3050	7.58	TB19-GW-grab	TOLLWAY 3128 TOT			0.036	0.0772		135.58				0.00506	0.030	10.46		31.66	0.0035		471.3		0.083		44.28		
1/27/2015	9:33:00 AM	12232	7.52	TB19-GW-grab	TOLLWAY 3152 TOT			0.027	0.3223		432.37				0.00319		27.89		42.75	0.0057		2399.8		0.073		45.00		
2/10/15	15:24:00 PM	13553	7.48	TB19-GW-grab	TOLLWAY 3171 TOT			0.032	0.3745		474.45				0.00410		27.23		69.00	0.0075		2513.1		0.145		54.43		
3/3/15	15:00:00 PM	10894	7.22	TB19-GW-grab	TOLLWAY 3193 TOT			0.036	0.2735		362.53				0.00313		22.44		80.77	0.0078		1434.0				71.78		
3/17/15	14:40:00 PM	7338	7.61	TB19-GW-grab	TOLLWAY 3225 TOT	0.355		0.044	0.1684		206.51				0.00506	0.197	21.38		34.50	0.0038		1373.7		0.087		29.99		
3/31/15	11:52:00 AM	8601	7.54	TB19-GW-grab	TOLLWAY 3251 TOT	0.052		0.043	0.1926		233.12				0.00532	0.039	25.83		37.36	0.0040		1699.0		0.079		40.60		
4/15/15	8:19:00 AM	6079	8.27	TB19-GW-grab	TOLLWAY 3284 TOT	0.378		0.066	0.1226		144.99				0.00764	0.226	24.90		32.07	0.0044		1169.1		0.140		34.59		
4/28/15	10:18:00 AM	7225	8.09	TB19-GW-grab	TOLLWAY 3300 TOT	0.150		0.048	0.1220		129.78				0.00708	0.078	25.42		22.96	0.0024		1399.8		0.109		43.76		
5/12/15	16:16:00 PM	2975	8.71	TB19-GW-grab	TOLLWAY 3336 TOT	1.125		0.062	0.0503		60.55				0.01076	0.670	13.03		18.70	0.0094		559.6		0.079		27.47		
5/27/15	14:40:00 PM	3170	8.32	TB19-GW-grab	TOLLWAY 3358 TOT	2.937		0.041	0.0486		44.25			0.01	0.01720	1.862	13.90		11.45	0.0231		639.9		0.151		27.50		
6/9/15	15:19:00 PM	2517	8.06	TB19-GW-grab	TOLLWAY 3384 TOT	3.450		0.059	0.0483		42.02			0.01	0.01961	2.217	11.38		10.70	0.0295		495.5		0.168		24.90		
6/22/15	12:11:00 PM	2099	7.98	TB19-GW-grab	TOLLWAY 3396 TOT	0.939		0.077	0.0427		51.82				0.01241	0.624	12.81		14.24	0.0139		377.4				27.31		
7/7/15	14:21:00 PM	1750	6.84	TB19-GW-grab	TOLLWAY 3433 TOT	2.134		0.061	0.0459		45.66				0.01497	1.482	10.82		9.54	0.0272		329.9		0.098		19.44		
7/20/15	11:43:00 AM	1368	7.25	TB19-GW-grab	TOLLWAY 3450 TOT	2.299		0.068	0.0419		47.42				0.01501	1.520	11.07		9.80	0.0240		255.1		0.133		21.30		
8/4/15	13:18:00 PM	1986	7.04	TB19-GW-grab	TOLLWAY 3489 TOT	1.258		0.059	0.0615		62.94				0.01378	0.875	14.39		14.54	0.0163		404.0		0.092		28.60		
8/17/15	14:36:00 PM	2806	7.37	TB19-GW-grab	TOLLWAY 3510 TOT	0.597		0.071	0.0619		64.82				0.01203	0.433	15.22		13.90	0.0119		509.8		0.133		43.82		
min						0.037	NA	0.027	0.0419	NA	40.42	NA	NA	0.01	0.00267	0.030	6.16	NA	9.54	0.0023	NA	120.3	NA	0.073	NA	9.20		
max						4.442	NA	0.081	0.3745	NA	474.45	NA	NA	0.01	0.01961	3.633	27.89	NA	80.77	0.0754	NA	2513.1	NA	0.216	NA	71.78		
mean						1.248	NA	0.053	0.1097	NA	135.33	NA	NA	0.01	0.00943	0.814	16.83	NA	24.82	0.0137	NA	828.6	NA	0.115	NA	35.62		

Appendix A4. Results of Geochemical Analysis of Total Recoverable Metals for Biweekly Surface-Water Grab Samples (con't.)

Analytical Results

Date	Time collected (cst)	Field conductivity (us/cm)	Sample location	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO	TDS, 180 C mg/L	TSS mg/L	oPO4-P mg/L	NH3 -N mg/L	F mg/L	Cl mg/L	NO3 -N mg/L	SO4 mg/L	total NVOC mg/L	dissolved NVOC mg/L
				0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31

TB19-SW-grab Total Metals

10/14/14	14:59:00 PM	16	7.72	TB19-SW-grab		4.190		0.0223	0.03918			0.0232												
					NA	NA	4.190	NA	0.0223	0.03918	NA	NA	0.0232											
					NA	NA	4.190	NA	0.0223	0.03918	NA	NA	0.0232											
					NA	NA	4.190	NA	0.0223	0.03918	NA	NA	0.0232											

TB19-GW-grab Total Metals

9/3/14	16:03:00 PM	M2034	7.56	TB19-GW-grab	0.01955		0.0137																	
9/16/14	12:35:00 PM	M1731	7.58	TB19-GW-grab	0.02141		0.0134																	
9/30/14	15:04:00 PM	M2157	7.75	TB19-GW-grab	0.00869		0.0112																	
10/14/14	15:24:00 PM	M762	7.77	TB19-GW-grab	0.15545		0.0249																	
12/3/14	12:41:00 PM	M2712	7.73	TB19-GW-grab	0.00189	0.019	0.0113																	
12/16/14	10:54:00 AM	B232	7.71	TB19-GW-grab																				
1/13/2015	15:11:00 PM	B050	7.58	TB19-GW-grab			0.0138																	
1/27/2015	09:33:00 AM	12232	7.52	TB19-GW-grab		0.036	0.0163																	
2/10/15	15:24:00 PM	M3553	7.48	TB19-GW-grab		0.059	0.0150																	
3/3/15	15:00:00 PM	M10894	7.22	TB19-GW-grab		0.027	0.0134																	
3/17/15	14:40:00 PM	M7338	7.61	TB19-GW-grab	0.00790		0.0109																	
3/31/15	11:52:00 AM	B601	7.54	TB19-GW-grab		0.019	0.0135																	
4/15/15	8:19:00 AM	6079	8.27	TB19-GW-grab	0.00720		0.0110																	
4/28/15	10:18:00 AM	M7225	8.09	TB19-GW-grab	0.00170	0.025	0.0102																	
5/12/15	16:16:00 PM	M2975	8.71	TB19-GW-grab	0.02680	0.024	0.0116																	
5/27/15	14:40:00 PM	B170	8.32	TB19-GW-grab	0.07125		0.0197																	
6/9/15	15:19:00 PM	M2517	8.06	TB19-GW-grab	0.08669		0.0200																	
6/22/15	12:11:00 PM	M2099	7.98	TB19-GW-grab	0.02247		0.0121																	
7/7/15	14:21:00 PM	M1750	6.84	TB19-GW-grab	0.05717		0.0159																	
7/20/15	11:43:00 AM	M1368	7.25	TB19-GW-grab	0.05789		0.0154																	
8/4/15	13:18:00 PM	M1986	7.04	TB19-GW-grab	0.03647		0.0187																	
8/17/15	14:36:00 PM	M2806	7.37	TB19-GW-grab	0.01482		0.0105																	
					0.00170	0.019	NA	0.0102																
					0.15545	0.059	NA	0.0249																
					0.03733	0.030	NA	0.0144																

APPENDIX B: Masses and Mean Concentrations at all Sites

Post-Construction Isco Total Metals Samples

	TB7Bin		TB7Bout		TB9A		TB15Bsw		TB15Bgw		TB19sw		TB19gw	
<i>Date Range</i>	7/3/12-8/15/15		7/3/12-8/15/15		7/3/12-8/15/15		7/3/12-8/15/15		7/3/12-8/15/15		7/3/12-8/15/15		7/3/12-8/15/15	
Discharge Volume (ft3)	554196	15693168	289072	8185652	3823315	108264811	145600	4122955	1981773	56117866	157288	4453924	1353385	38323803
Total Precip on Roadway (ft3)	546700		546700		3623000		2473500		1729500	2127373	1544500		1497500	1510673
Paved Watershed Area Drained (ft2)	55757		55757		368953		176418		176418		127530		127530	
Discharge yield (disch./area)	9.939487419		5.184497014		10.36260716		0.82531261		11.23339455		1.233341175		10.6122873	
Total precipitation during period (in.)	117.72		117.72		117.72		104.24		117.72		117.72		114.48	
Standardized yield (discharge/ volume of ppt on roadway area)	1.013199533		0.53		1.06		0.0950	0.860065899	1.15	1.07322704	0.13	0.978098414	1.11	1.009668496
Analyte	TB7Bin Isco TM	TB7Bin Isco TM	TB7Bout Isco TM	TB7Bout Isco TM	TB9A Isco TM	TB9A Isco TM	TB15Bsw Isco TM	TB15Bsw Isco TM	TB15Bgw Isco TM	TB15Bgw Isco TM	TB19sw Isco TM	TB19sw Isco TM	TB19gw Isco TM	TB19gw Isco TM
	Total mass (kg)	Std. conc. (mg/L)	Total mass (kg)	Std. conc. (mg/L)	Total mass (kg)	Std. conc. (mg/L)	Total mass (kg)	Std. conc. (mg/L)	Total mass (kg)	Std. conc. (mg/L)	Total mass (kg)	Std. conc. (mg/L)	Total mass (kg)	Std. conc. (mg/L)
Al	37.519	2.391	20.522	2.507	210.081	1.940	37.830	9.175	144.310	2.572	23.303	5.232	209.100	5.456
As	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
B	1.004	0.064	0.338	0.041	5.027	0.046	0.095	0.023	2.246	0.040	0.173	0.039	2.267	0.059
Ba	2.363	0.151	0.479	0.059	10.556	0.098	0.305	0.074	5.870	0.105	0.293	0.066	5.591	0.146
Be	0.000	0.000	0.000	0.000	0.001	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Ca	1706.000	108.710	426.614	52.117	7312.800	67.545	64.500	15.644	5144.000	91.664	176.321	39.588	4784.000	124.831
Cd	0.005	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Co	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Cr	0.378	0.024	0.047	0.006	0.500	0.005	0.053	0.013	0.316	0.006	0.056	0.013	0.333	0.009
Cu	1.098	0.070	0.122	0.015	1.421	0.013	0.079	0.019	0.633	0.011	0.094	0.021	0.590	0.015
Fe	84.385	5.377	19.537	2.387	198.370	1.832	25.100	6.088	120.170	2.141	17.253	3.874	160.820	4.196
K	208.500	13.286	39.268	4.797	1419.900	13.115	23.820	5.777	807.300	14.386	45.239	10.157	725.900	18.941
Li	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Mg	469.900	29.943	127.651	15.594	1597.800	14.758	19.760	4.793	679.600	12.110	62.555	14.045	963.200	25.133
Mn	2.656	0.169	1.165	0.142	22.923	0.212	0.350	0.085	2.630	0.047	0.394	0.089	2.947	0.077
Mo	0.009	0.001	0.001	0.000	0.000	0.000	0.000	0.000	0.230	0.004	0.000	0.000	0.010	0.000
Na	21190.000	1350.269	2024.890	247.371	75658.000	698.824	649.700	157.581	47907.000	853.685	666.602	149.666	32605.000	850.777
Ni	0.013	0.001	0.000	0.000	0.012	0.000	0.000	0.000	0.103	0.002	0.000	0.000	0.000	0.000
P	3.178	0.203	1.314	0.160	19.431	0.179	1.311	0.318	14.864	0.265	2.465	0.553	11.871	0.310
Pb	0.082	0.005	0.043	0.005	0.075	0.001	0.012	0.003	0.097	0.002	0.000	0.000	0.008	0.000
S	941.000	59.962	220.061		3510.200	32.422	20.200	4.899	1802.000	32.111	36.551	8.206	1064.000	27.763
Sb	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Se	0.327	0.021	0.111	0.014	1.339	0.012	0.000	0.000	0.538	0.010	0.000	0.000	0.274	0.007
Si	125.020	7.967	55.929	6.833	614.440	5.675	86.200	20.907	546.500	9.738	60.738	13.637	594.900	15.523
Sn	0.000	0.000	0.000	0.000	0.359	0.003	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Sr	11.290	0.719	1.806	0.221	62.124	0.574	0.314	0.076	29.312	0.522	0.554	0.124	24.920	0.650
Ti	1.933	0.123	0.686	0.084	7.109	0.066	1.123	0.272	3.550	0.063	0.773	0.174	4.690	0.122
Tl	0.040	0.003	0.000	0.000	0.210	0.002	0.000	0.000	0.233	0.004	0.000	0.000	0.135	0.004
V	0.000	0.000	0.000	0.000	0.000	0.000	0.005	0.001	0.000	0.000	0.000	0.000	0.000	0.000
Zn	4.567	0.291	0.502	0.061	7.918	0.073	0.494	0.120	1.048	0.019	0.708	0.159	1.525	0.040

APPENDIX C: Percent Reductions in Analytes Compared to Input

Post-Construction Isco Total Metals Samples
Percent reductions compared to TB7Bin Isco

	TB7Bout Isco TM	TB7Bout Isco TM	TB9A Isco TM	TB15Bsw Isco TM	TB15Bgw Isco TM	TB15Btot (dry+wet)	TB19sw Isco TM	TB19gw Isco TM	TB19TOT (dry+wet)	wet bioswales (tot mass/tot q)	dry bioswales (tot mass/tot q)	total all bioswales
	Total mass (% reduction)	Mean Conc (% reduction)	Mean Conc (% reduction)	Mean Conc (% reduction)	Mean Conc (% reduction)	Mean Conc (% reduction)	Mean Conc (% reduction)	Mean Conc (% reduction)	Mean Conc (% reduction)	Mean Conc (% reduction)	Mean Conc (% reduction)	Mean Conc (% reduction)
Al	45.30	-4.87	18.84	-283.78	-7.56	-26.47	-118.84	-128.22	-127.24	17.17	-68.31	-22.95
As												
B	66.31	35.41	27.42	63.95	37.44	39.26	39.46	7.54	10.86	27.98	27.47	27.74
Ba	79.71	61.09	35.24	50.80	30.53	31.91	56.38	3.10	8.65	37.06	22.25	30.11
Be												
Ca	74.99	52.06	37.87	85.61	15.68	20.47	63.58	-14.83	-6.67	38.86	9.20	24.94
Cd	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Co												
Cr	87.69	76.40	80.80	47.10	76.63	74.61	47.56	63.96	62.25	80.49	69.48	75.32
Cu	88.89	78.70	81.24	72.54	83.86	83.09	69.67	78.01	77.14	81.06	80.62	80.85
Fe	76.85	55.61	65.93	-13.22	60.18	55.15	27.96	21.96	22.58	65.20	41.63	54.14
K	81.17	63.89	1.29	56.52	-8.28	-3.84	23.55	-42.56	-35.68	5.69	-17.06	-4.99
Li												
Mg	72.83	47.92	50.71	83.99	59.56	61.23	53.09	16.06	19.92	50.52	44.07	47.49
Mn	56.13	15.90	-25.10	49.86	72.31	70.77	47.69	54.56	53.85	-22.22	63.75	18.13
Mo	87.76	76.54	100.00	100.00	-578.76	-532.31	100.00	57.71	62.12	98.35	-285.48	-81.82
Na	90.44	81.68	48.25	88.33	36.78	40.31	88.92	36.99	42.40	50.60	41.17	46.17
Ni	100.00	100.00	86.74	100.00	-124.13	-108.79	100.00	100.00	100.00	87.67	-22.09	36.15
P	58.67	20.76	11.37	-57.02	-30.80	-32.59	-173.26	-52.96	-65.48	12.03	-46.25	-15.32
Pb	47.61	-0.43	86.62	45.66	66.76	65.32	100.00	95.82	96.26	80.50	78.17	79.41
S	76.61	100.00	45.93	91.83	46.45	49.55	86.31	53.70	57.09	46.58	52.69	49.44
Sb												
Se	66.18	35.16	40.65	100.00	53.99	57.14	100.00	65.69	69.26	40.26	62.17	50.55
Si	55.26	14.23	28.76	-162.44	-22.24	-31.84	-71.18	-94.85	-92.39	27.74	-56.98	-12.03
Sn												
Sr	84.00	69.33	20.24	89.40	27.40	31.64	82.72	9.62	17.23	23.69	25.66	24.61
Ti	64.50	31.95	46.69	-121.11	48.65	37.03	-40.88	0.66	-3.67	45.66	20.13	33.67
Tl	100.00	100.00	24.52	100.00	-61.29	-50.26	100.00	-36.96	-22.70	29.83	-38.81	-2.39
V												
Zn	89.00	78.91	74.87	58.83	93.58	91.20	45.35	86.33	82.06	75.15	87.41	80.91
mean percent reduction	76.08	56.10	47.34	32.47	3.34	5.33	40.35	20.93	22.95	47.82	12.65	31.31
mean percent reduction roadway metals (Cr, Cu, Ni, Pb, Zn)	82.64	66.72	82.06	64.83	39.34	41.09	72.52	84.82	83.54	80.98	58.72	70.53

APPENDIX C: Percent Reductions in Analytes Compared to Input

Post-Construction Isco Dissolved Metals Samples Percent reductions compared to TB7Bin Isco

	TB7Bout Isco DM Total mass (%) reduction)	TB7Bout Isco DM Mean Conc (%) reduction)	TB9A Isco DM Mean Conc (% reduction)	TB15Bsw Isco DM Mean Conc (%) reduction)	TB15Bgw Isco DM Mean Conc (%) reduction)	TB15Btot (dry+wet)DM Mean Conc (%) reduction)	TB19sw Isco DM Mean Conc (%) reduction)	TB19gw Isco DM Mean Conc (%) reduction)	TB19TOT DM (dry+wet) Mean Conc (%) reduction)	wet bioswales (tot mass/tot q) Mean Conc (% reduction)	dry bioswales (sum mass/sum q) Mean Conc (% reduction)	all bioswales Mean Conc (%) reduction)
Al	-98.147	-210.852	20.571	-785.526	-770.230	-771.387	-1390.094	-1096.455	-1124.825	-0.419	-911.524	-379.176
As												
B	50.851	22.896	14.817	80.620	29.785	33.629	41.619	-6.404	-1.764	15.550	19.596	17.232
Ba	67.821	49.518	-6.264	76.767	-39.728	-30.917	63.298	-72.134	-59.049	-1.205	-42.071	-18.194
Be												
Ca	60.709	38.360	25.017	85.904	-23.351	-15.088	68.828	-55.171	-43.191	26.227	-26.231	4.420
Cd												
Co												
Cr	67.734	49.381	94.106	75.127	73.204	73.349	15.264	39.527	37.183	90.050	59.009	77.146
Cu	54.974	29.364	30.170	47.627	5.605	8.784	-12.033	-13.211	-13.098	30.097	0.108	17.630
Fe	-44.183	-126.195	-19.808	-378.064	-466.998	-460.271	-713.707	-659.104	-664.380	-29.457	-541.199	-242.194
K	70.701	54.036	0.469	75.497	-13.326	-6.608	35.869	-40.025	-32.692	5.327	-16.950	-3.934
Li												
Mg	59.460	36.402	24.048	88.476	19.158	24.400	64.427	-59.895	-47.884	25.168	-4.260	12.935
Mn	68.589	50.723	-143.367	74.500	74.569	74.564	59.561	60.447	60.361	-125.764	68.933	-44.826
Mo	100.000	100.000	-238.086	100.000	-427.787	-387.868	100.000	-9.244	1.311	-207.423	-233.560	-218.288
Na	85.328	76.982	51.180	89.708	29.272	33.843	88.177	33.272	38.577	53.520	35.720	46.121
Ni												
P	-22.854	-92.732	-96.512	-146.282	-290.325	-279.431	-461.639	-217.509	-241.096	-96.169	-264.231	-166.035
Pb	100.000	100.000	100.000	53.627	51.581	51.736	100.000	-291.550	-253.719	100.000	-69.375	29.589
S	56.729	32.117	47.845	92.506	43.740	47.428	86.258	49.739	53.267	46.418	49.743	47.801
Sb						100.000			100.000			100.000
Se	83.862	74.682	77.272	100.000	-71.814	-58.819	100.000	-24.404	-12.384	77.037	-40.408	28.214
Si	52.325	25.208	34.284	-0.485	-158.307	-146.371	-109.780	-222.718	-211.806	33.461	-172.316	-52.083
Sn						100.000			100.000			100.000
Sr	76.209	62.677	26.138	91.769	20.784	26.153	84.092	7.496	14.896	29.452	21.690	26.225
Ti	-296.258	-521.649	-58.722	-1098.988	-1061.693	-1064.514	-2018.657	-1630.790	-1668.265	-100.708	-1303.899	-600.889
Tl	89.431	83.419	56.884	95.776	20.901	26.564	100.000	-71.203	-54.662	59.291	-5.642	32.298
V												
Zn	67.041	48.294	17.166	40.057	67.250	65.193	-31.234	53.068	44.922	19.990	57.156	35.440
pH												
alkalinity	55.863	30.758	3.666	62.074	-93.961	-82.160	-10.107	-147.820	-134.515	6.123	-102.918	-39.207
TDS, 180 C	82.607	72.714	47.616	88.952	24.948	29.789	85.125	24.528	30.383	49.892	30.025	41.633
TSS	45.331	14.236	63.309	-84.385	84.110	71.366	2.124	74.652	67.645	58.858	69.891	63.445
oPO4-P	-179.756	-338.880	-289.546	-1142.272	-855.051	-876.775	-2496.547	-913.014	-1066.011	-294.020	-951.806	-567.470
NH3 -N	51.752	24.308	39.416	2.710	83.135	77.052	-148.961	60.579	40.334	38.046	62.494	48.209
F	65.122	45.284	37.984	81.425	32.212	35.934	57.570	32.456	34.882	38.646	35.517	37.345
Cl	85.594	77.399	48.881	89.703	27.800	32.482	88.778	28.585	34.400	51.467	33.242	43.891
NO3 -N	67.422	48.892	22.842	47.642	-75.042	-65.763	-84.943	-247.580	-231.867	25.204	-131.622	-39.990
SO4	54.471	28.575	47.231	92.157	43.546	47.222	85.572	49.067	52.594	45.539	49.352	47.124
total NVOC	60.124	37.442	33.881	18.959	24.712	24.277	-9.747	7.684	6.000	34.204	17.030	27.065
dissolved NVOC	46.560	16.163	-7.882	30.111	-45.792	-40.052	-62.908	-74.179	-73.090	-5.701	-53.151	-25.427
mean	37.044	1.235	3.269	-57.947	-113.659	-97.125	-194.494	-166.604	-153.457	3.084	-133.177	
mean reduction	72.437	56.760	60.361	54.109	49.410	49.766	17.999	-53.042	-46.178	60.034	11.724	52.066
roadway metals (Cr, Cu, Ni, Pb, Zn)												

Appendix D: Results of Geochemical Analysis of Blank Samples

Date collected	Sample location	Sample ID	Aluminum	Arsenic	Boron	Barium	Beryllium	Calcium	Cadmium	Cobalt	Chromium	Copper	Iron	Potassium	Lithium	Magnesium	Manganese	Molybdenum	Sodium	Nickel	Phosphorus	Lead	Sulfur
			Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
			MDL: 0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
3/6/08	blank	TOLLWAY 23	0.0611					0.812					0.0415	0.067		0.153			1.32				
3/13/08	blank	TOLLWAY 28						0.015															
3/27/08	blank	TOLLWAY 33			0.043			0.065					0.0060	0.021					0.516				
4/10/08	blank	TOLLWAY JM 37						0.013											0.45				
4/23/08	blank	TOLLWAY JM 45						0.054								0.0187	0.0016		1.81				
5/28/08	blank	TOLLWAY 58	0.0263					0.763						0.134		0.133			1.21		0.077		
6/11/08	blank	TOLLWAY 63			0.024			0.018								0.0067			0.039				
7/8/08	blank	TOLLWAY 75						0.123								0.0536	0.0039		0.033				
7/23/08	blank	TOLLWAY 88			0.028			0.027								0.0032		0.061	0.031				
8/7/08	blank	TOLLWAY 102						0.019						0.018		0.0045							
8/20/08	blank	TOLLWAY 105			0.026								0.012										
9/4/08	blank	TOLLWAY 110			0.0330																		
9/16/08	blank	TOLLWAY 113																					
10/2/08	blank	TOLLWAY 138						0.072								0.0163							
10/16/08	blank	TOLLWAY 147	0.0097			0.00167		0.188						0.030		0.0414			0.209				
10/28/08	blank	TOLLWAY 157						0.013								0.0036			0.027				
11/13/08	blank	TOLLWAY 152						0.028								0.0053			0.031				
12/3/08	blank	TOLLWAY 164						0.034															
12/17/08	blank	TOLLWAY 172						0.049															
1/8/09	blank	TOLLWAY 182						0.068								0.0041							
2/18/09	blank	TOLLWAY 186						0.048								0.0033	0.0018		0.034				
3/5/09	blank	TOLLWAY 133						0.116								0.0084	0.0045						
4/1/09	blank	TOLLWAY 197	0.214			0.00322		1.69				0.00092	0.134	1.20		0.123	0.0016		44.1				0.483
4/30/09	blank	TOLLWAY 212						0.064											0.495				
5/12/09	blank	TOLLWAY 217						0.039								0.016			0.618				
5/28/09	blank	TOLLWAY 221						0.035										0.043					
6/11/09	blank	TOLLWAY 226						0.104								0.0202			0.042				
7/1/09	blank	TOLLWAY 229						0.020															
7/8/09	blank	TOLLWAY 240						0.495								0.178			0.041				
7/14/09	blank	TOLLWAY 244						0.281							0.020	0.108			0.072				
7/28/09	blank	TOLLWAY 245	0.115			0.00321		0.902					0.0561	3.41		0.154	0.0017		36.9				0.596
8/25/09	blank	TOLLWAY 253						0.032											0.078				
9/10/09	blank	TOLLWAY 260						0.051											0.032				
9/22/09	blank	TOLLWAY 265	0.045					0.244								0.052			1.03				
10/8/09	blank	TOLLWAY 274						0.080				0.00388	0.0228	0.043			0.0027		0.229				
10/21/09	blank	TOLLWAY 287						0.043					0.0068	0.028			0.0021		0.102		0.065		
11/4/09	blank	TOLLWAY 300						0.052															
11/17/09	blank	TOLLWAY 303						0.037					0.0064										
12/3/09	blank	TOLLWAY 321						0.017															
12/17/09	blank	TOLLWAY 341						0.133					0.0109	0.028					0.149				
12/30/09	blank	TOLLWAY 356						0.026											0.032				
1/14/10	blank	TOLLWAY 370						0.150					0.0077						0.052	0.015			
1/28/10	blank	TOLLWAY 390						0.117					0.0107						0.214				
2/18/10	blank	TOLLWAY 407						0.489								0.128			0.039				
2/18/10	blank 2	TOLLWAY 408						0.289					0.0097	0.037		0.032			0.107				
3/4/10	blank	TOLLWAY 425						0.085															
3/4/10	blank 2	TOLLWAY 426						0.139					0.0077						0.043				
3/18/10	blank	TOLLWAY 445						0.175								0.046			0.113				0.217
4/1/10	blank	TOLLWAY 464						0.072						0.094		0.087			1.38	0.017			
4/15/10	blank	TOLLWAY 487						0.119								0.029			0.109				
4/28/10	blank	TOLLWAY 502						0.081						0.069					0.436				
5/13/10	blank	TOLLWAY 525						0.138					0.0138			0.031							
5/27/10	blank	TOLLWAY 545						0.121											0.036				
6/10/10	blank	TOLLWAY 570						0.095					0.0078	0.039									
6/24/10	blank	TOLLWAY 590						0.061					0.0123										
7/8/10	blank	TOLLWAY 612						0.111															
7/22/10	blank	TOLLWAY 629						0.133					0.0092										
8/5/10	blank	TOLLWAY 648						0.141								0.032			0.072				
8/18/10	blank	TOLLWAY 664						0.129											0.060				
		# detects	6.00	0.00	5.00	3.00	0.00	56.00	0.00	0.00	0.00	2.00	18.00	19.00	0.00	27.00	10.00	2.00	38.00	2.00	2.00	0.00	3.00
		min	0.010	0.000	0.024	0.002	0.000	0.013	0.000	0.000	0.000	0.001	0.006	0.016	0.000	0.003	0.002	0.043	0.027	0.015	0.065	0.000	0.217
		max	0.214	0.000	0.043	0.003	0.000	1.690	0.000	0.000	0.000	0.004	0.134	3.410	0.000	0.178	0.004	0.061	44.100	0.017	0.077	0.000	0.596
		mean	0.079	0.000	0.031	0.003	0.000	0.170	0.000	0.000	0.000	0.002	0.023	0.290	0.000	0.055	0.002	0.052	2.429	0.016	0.071	0.000	0.432

Appendix D: Results of Geochemical Analysis of Blank Samples

Date collected	Sample location	Sample ID	Antimony Sb mg/L	Selenium Se mg/L	Silicon Si mg/L	Tin Sn mg/L	Strontium Sr mg/L	Titanium Ti mg/L	Thalium Tl mg/L	Vanadium V mg/L	Zinc Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L
		MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
3/6/08	blank	TOLLWAY 23			0.134		0.00315	0.00110				5.65							0.72			0.45	0.47
3/13/08	blank	TOLLWAY 28										5.55							0.10				
3/27/08	blank	TOLLWAY 33										6.49							0.099			0.33	
4/10/08	blank	TOLLWAY JM 37										5.68											
4/23/08	blank	TOLLWAY JM 45					0.00063					5.72							1.18			0.39	
5/28/08	blank	TOLLWAY 58					0.00371	0.00057				6.49		4					0.52			0.47	
6/11/08	blank	TOLLWAY 63					0.00040					5.73										0.43	0.31
7/8/08	blank	TOLLWAY 75					0.00044					5.97										0.92	0.82
7/23/08	blank	TOLLWAY 88										5.48										1.00	0.82
8/7/08	blank	TOLLWAY 102						0.00095				5.62											0.45
8/20/08	blank	TOLLWAY 105										5.51										0.43	0.48
9/4/08	blank	TOLLWAY 110										5.41										0.77	0.80
9/16/08	blank	TOLLWAY 113										5.51											
10/2/08	blank	TOLLWAY 138										5.56										0.52	1.00
10/16/08	blank	TOLLWAY 147					0.00132					5.65											0.46
10/28/08	blank	TOLLWAY 157										5.64										0.64	0.53
11/13/08	blank	TOLLWAY 152										5.63										0.65	0.64
12/3/08	blank	TOLLWAY 164										5.71										1.02	0.55
12/17/08	blank	TOLLWAY 172										5.95											
1/8/09	blank	TOLLWAY 182										6.22											
2/18/09	blank	TOLLWAY 186										5.91							0.10				
3/5/09	blank	TOLLWAY 133					0.00039					6.01										0.50	0.90
4/1/09	blank	TOLLWAY 197			0.580		0.0143	0.00526				5.94				0.03			2.74			0.63	7.07
4/30/09	blank	TOLLWAY 212					0.00040					6.03										0.47	0.65
5/12/09	blank	TOLLWAY 217										5.99									0.16		
5/28/09	blank	TOLLWAY 221				0.086						5.74										0.63	
6/11/09	blank	TOLLWAY 226				0.086	0.00080					5.79							0.10			0.51	
7/1/09	blank	TOLLWAY 229										5.82				0.01							0.57
7/8/09	blank	TOLLWAY 240					0.00049					5.74							0.17				0.41
7/14/09	blank	TOLLWAY 244					0.00062					5.71							0.21		0.34		0.56
7/28/09	blank	TOLLWAY 245			0.212		0.0210	0.00125				5.66				0.01			1.33			0.47	0.35
8/25/09	blank	TOLLWAY 253										6.18											1.04
9/10/09	blank	TOLLWAY 260										5.98										0.47	0.73
9/22/09	blank	TOLLWAY 265			0.089		0.00378	0.00067				5.68							0.64			0.44	0.97
10/8/09	blank	TOLLWAY 274					0.00078					5.89							0.23			0.44	0.80
10/21/09	blank	TOLLWAY 287										6.04							0.23			0.81	0.46
11/4/09	blank	TOLLWAY 300					0.00048					5.76							0.18				0.46
11/17/09	blank	TOLLWAY 303										5.39							0.14			1.04	0.95
12/3/09	blank	TOLLWAY 321										5.55										0.65	0.78
12/17/09	blank	TOLLWAY 341					0.00067					5.47							0.65			0.59	0.44
12/30/09	blank	TOLLWAY 356										5.69							0.09			0.54	0.64
1/14/10	blank	TOLLWAY 370					0.00045					6.01							0.13			0.37	0.73
1/28/10	blank	TOLLWAY 390							0.021			6.68											0.62
2/18/10	blank	TOLLWAY 407					0.00200					6.34											
2/18/10	blank 2	TOLLWAY 408			17.9		0.00065	0.00073				6.32							0.20			0.72	0.42
3/4/10	blank	TOLLWAY 425										6.35										0.48	0.42
3/4/10	blank 2	TOLLWAY 426					0.00049					6.21										0.48	
3/18/10	blank	TOLLWAY 445					0.00089					6.91		5								0.45	0.61
4/1/10	blank	TOLLWAY 464					0.00120					6.18							0.46				0.62
4/15/10	blank	TOLLWAY 487					0.00088					6.06										0.61	0.52
4/28/10	blank	TOLLWAY 502					0.00100					5.89							0.20			0.70	1.14
5/13/10	blank	TOLLWAY 525					0.00096					5.61										1.53	1.96
5/27/10	blank	TOLLWAY 545					0.00071					6.15										1.19	0.78
6/10/10	blank	TOLLWAY 570					0.00096					6.18										0.62	0.55
6/24/10	blank	TOLLWAY 590										5.73				0.002						0.83	1.20
7/8/10	blank	TOLLWAY 612					0.00057					5.81										0.78	1.17
7/22/10	blank	TOLLWAY 629					0.00064					5.80										1.00	0.88
8/5/10	blank	TOLLWAY 648					0.001					5.76										1.07	1.20
8/18/10	blank	TOLLWAY 664					0.001					5.49										0.83	0.94
		# detects	0.00	0.00	5.00	2.00	32.00	7.00	1.00	0.00	0.00		2.00	0.00	0.00	4.00	0.00	0.00	22.00	1.00	1.00	42.00	45.00
		min	0.000	0.000	0.089	0.086	0.000	0.001	0.021	0.000	0.000		4.281	0.000	0.000	0.002	0.000	0.000	0.091	0.164	0.343	0.334	0.313
		max	0.000	0.000	17.922	0.086	0.021	0.005	0.021	0.000	0.000		4.859	0.000	0.000	0.035	0.000	0.000	2.743	0.164	0.343	1.534	7.073
		mean	0.000	0.000	3.787	0.086	0.002	0.002	0.021	0.000	0.000		4.570	0.000	0.000	0.016	0.000	0.000	0.473	0.164	0.343	0.664	0.864
																							8.707 avg #
																							0.000 min of mins
																							44.100 max of maxes
																							0.357 mean of means

Appendix D: Results of Geochemical Analysis of Blank Samples

Date collected	Sample location	Sample ID	Aluminum	Arsenic	Boron	Barium	Beryllium	Calcium	Cadmium	Cobalt	Chromium	Copper	Iron	Potassium	Lithium	Magnesium	Manganese	Molybdenum	Sodium	Nickel	Phosphorus	Lead	Sulfur		
			Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L		
		MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217		
8/31/10	blank	TOLLWAY 678				0.0129		0.28								0.0316				0.104					
9/13/10	blank	TOLLWAY 680						0.17								0.0288				0.179					
9/29/10	blank	TOLLWAY 701						0.16								0.0804									
10/13/10	blank	TOLLWAY 710						0.0587								0.0324									
10/26/10	blank	TOLLWAY 715						0.134					0.00604			0.0401	0.00198				0.0815				
11/9/10	blank	TOLLWAY 724						0.0797								0.0668				0.159					
12/8/10	blank	TOLLWAY 732						0.083												0.0475					
1/5/11	blank	TOLLWAY 747						0.0831					0.00644												
1/20/11	blank	TOLLWAY 756						0.274								0.0652				0.069					
2/16/11	blank	TOLLWAY 766						0.211								0.0393									
3/1/11	blank	TOLLWAY 769						0.147								0.0987				0.0903					
3/14/11	blank	TOLLWAY 784				0.00148		1.5				0.000802		0.0427		1.14				0.675			0.221		
3/29/11	blank	TOLLWAY 810						0.112												0.0347					
4/13/11	blank	TOLLWAY 833						0.191						0.0174											
4/27/11	blank	TOLLWAY 853						0.284																	
5/11/11	blank	TOLLWAY 881						0.401													0.0748				
5/25/11	blank	TOLLWAY 911						0.193												0.0586					
6/8/11	blank	TOLLWAY 935						0.328							0.0296										
6/21/11	blank	TOLLWAY 970						0.171												0.0431		0.0847			
7/7/11	blank	TOLLWAY 990						0.128													0.075				
7/19/11	blank	TOLLWAY 1006						0.33								0.0654				0.026					
8/3/11	blank	TOLLWAY 1040						0.189								0.0439									
8/16/11	blank	TOLLWAY 1068	0.0479					0.148																	
		# detects	1	0	0	2	0	23	0	0	0	1	2	2	0	13	1	0	11	0	4	0	1		
		min	0.0479			0.00148		0.0587				0.000802	0.00604	0.0174		0.0288	0.00198		0.026		0.0748		0.221		
		max	0.0479			0.0129		1.5				0.000802	0.00644	0.0427		1.14	0.00198		0.675		0.0847		0.221		
		mean	0.0479			0.0072		0.246				0.000802	0.00624	0.03		0.136	0.00198		0.135		0.079		0.221		
			Antimony	Selenium	Silicon	Tin	Strontium	Titanium	Thalium	Vanadium	Zinc	pH	alkalinity	TDS, 180	TSS	oPO ₄ -P	NH ₃ -N	F	Cl	NO ₃ -N	SO ₄	total	dissolved	# detects per	
			Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	mg/L as CaCO ₃	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	blank sample
			MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073	4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31		
8/31/10	blank	TOLLWAY 678					0.000979					5.51		2								1.65	1.59	9	
9/13/10	blank	TOLLWAY 680					0.000563					5.22										2.02	2.36	7	
9/29/10	blank	TOLLWAY 701					0.00143			0.00763		5.73						0.828			0.618	1.14	0.525	9	
10/13/10	blank	TOLLWAY 710										5.92											0.36	4	
10/26/10	blank	TOLLWAY 715										5.8										1.09	1.19	8	
11/9/10	blank	TOLLWAY 724					0.00028					5.98										0.434	0.545	7	
12/8/10	blank	TOLLWAY 732										5.73										0.66	0.793	5	
1/5/11	blank	TOLLWAY 747										4.99										0.987	1.06	5	
1/20/11	blank	TOLLWAY 756					0.000916					5.69										1.52	1.34	7	
2/16/11	blank	TOLLWAY 766					0.00131					5.92										0.628	0.86	6	
3/1/11	blank	TOLLWAY 769										5.35										0.674	0.957	6	
3/14/11	blank	TOLLWAY 784					0.0153					5.35							2.12			0.644	0.639	12	
3/29/11	blank	TOLLWAY 810					0.000536					5.84										0.589	0.575	6	
4/13/11	blank	TOLLWAY 833										5.48					0.0731					0.852	0.916	6	
4/27/11	blank	TOLLWAY 853					0.000561					5.99										0.65	1.13	5	
5/11/11	blank	TOLLWAY 881					0.00192					6.16								0.0602		0.869	1.09	7	
5/25/11	blank	TOLLWAY 911					0.00082					5.83										0.911	0.866	6	
6/8/11	blank	TOLLWAY 935					0.00129					6.03					0.136					1.01	1.63	7	
6/21/11	blank	TOLLWAY 970					0.000848					5.57										0.939	0.975	7	
7/7/11	blank	TOLLWAY 990					0.00097					5.99										0.57	0.69	6	
7/19/11	blank	TOLLWAY 1006					0.000648					6.22										0.62	0.919	7	
8/3/11	blank	TOLLWAY 1040					0.000678					5.76										0.697	0.879	6	
8/16/11	blank	TOLLWAY 1068					0.000712					6.05				0.00634						0.81	0.874	7	
		# detects	0	0	0	0	17	0	0	0	1	23	0	1	0	1	3	0	2	0	1	22	23	6.739 average # of detects per blank sample	
		min					0.00028				0.00763	4.99		2		0.00634	0.0602		0.828		0.618	0.434	0.36	3.690 avg # detects per analyte	
		max					0.0153				0.00763	6.22		2		0.00634	0.136		2.12		0.618	2.02	2.36	0.458 avg max	
		mean					0.00175				0.00763	5.74		2		0.00634	0.0897		1.47		0.618	0.907	0.99	0.304 avg mean	

APPENDIX D: Results of Geochemical Analysis of Blank Samples

Date collected	Sample location	Sample ID	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
		MDL:	0.037	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
8/16/11	blank	TOLLWAY 1068	0.048					0.148																
9/1/11	blank	TOLLWAY 1105						0.156											0.053			0.078		
9/14/11	blank	TOLLWAY 1125						0.224								0.056								
9/29/11	blank	TOLLWAY 1151						0.070																
10/12/11	blank	TOLLWAY 1182						0.097						0.022										
10/27/11	blank	TOLLWAY 1212						0.032											0.061					
11/9/11	blank	TOLLWAY 1247						0.110						0.018		0.028								
12/1/11	blank	TOLLWAY 1277												0.023					0.048			0.082		
12/14/11	blank	TOLLWAY 1308																	0.070					
1/6/12	blank	TOLLWAY 1336						0.049																
1/19/12	blank	TOLLWAY 1371						0.160											0.150					
2/2/12	blank	TOLLWAY 1401						0.049																
2/16/12	blank	TOLLWAY 1423						0.230								0.042			0.409					
3/1/12	blank	TOLLWAY 1461						0.374														0.091		
3/14/12	blank	TOLLWAY 1486						0.136																
3/28/12	blank	TOLLWAY 1514						0.243								0.035			0.026					
4/13/12	blank	TOLLWAY 1546						0.123								0.030								
4/26/12	blank	TOLLWAY 1569						0.197															0.084	
5/9/12	blank	TOLLWAY 1612						0.207								0.062							0.094	
5/24/12	blank	TOLLWAY 1628	0.045					0.339								0.053							0.116	
6/5/12	blank	TOLLWAY 1656						0.197															0.097	
6/20/12	blank	TOLLWAY 1675						0.237								0.034								
7/3/12	blank	TOLLWAY 1685						0.283								0.046								
7/19/12	blank	TOLLWAY 1696						0.254																
7/31/12	blank	TOLLWAY 1714						0.166																
8/15/12	blank	TOLLWAY 1733						0.135																
26 total samples		# detects	2	0	0	0	0	24	0	0	0	0	0	3	0	9	0	0	7	0	7	0	0	
		min	0.045					0.032						0.018		0.028			0.026		0.078			
		max	0.048					0.374						0.023		0.062			0.409		0.116			
		mean	0.046					0.176						0.021		0.043			0.117		0.092			

Date collected	Sample location	Sample ID	Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO ₄ -P	NH ₃ -N	F	Cl	NO ₃ -N	SO ₄	total NVOC	dissolved NVOC	# detects per blank sample	
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L as CaCO ₃	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		
		MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3.0	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31		
8/16/11	blank	TOLLWAY 1068					0.00071					6.05				0.006						0.81	0.87	7	
9/1/11	blank	TOLLWAY 1105					0.00078					5.74				NA						0.87	0.92	7	
9/14/11	blank	TOLLWAY 1125					0.00129					6.32	5.94			NA						0.97	1.15	7	
9/29/11	blank	TOLLWAY 1151										6.02				NA						0.55	0.65	4	
10/12/11	blank	TOLLWAY 1182					0.00082					5.62				NA						1.11	0.69	6	
10/27/11	blank	TOLLWAY 1212										5.82				NA						0.42	0.49	5	
11/9/11	blank	TOLLWAY 1247					0.00046					5.88				NA						0.41	0.56	7	
12/1/11	blank	TOLLWAY 1277										6.02				NA						0.66	0.48	6	
12/14/11	blank	TOLLWAY 1308										6.04				NA						0.39	0.54	4	
1/6/12	blank	TOLLWAY 1336										5.93				NA						0.62	1.33	4	
1/19/12	blank	TOLLWAY 1371										5.85				NA			0.26			0.55	0.62	6	
2/2/12	blank	TOLLWAY 1401										5.90				NA						0.34	0.78	4	
2/16/12	blank	TOLLWAY 1423										5.93				NA			0.10			0.34	0.38	7	
3/1/12	blank	TOLLWAY 1461					0.00145					6.09				NA							0.51	5	
3/14/12	blank	TOLLWAY 1486					0.00051					5.85				NA						0.32	0.61	5	
3/28/12	blank	TOLLWAY 1514										6.10				NA						0.37	0.55	6	
4/13/12	blank	TOLLWAY 1546										5.96				NA						0.75	1.25	5	
4/26/12	blank	TOLLWAY 1569					0.00055					5.80				NA						0.40	0.51	6	
5/9/12	blank	TOLLWAY 1612					0.00060					6.02				NA								5	
5/24/12	blank	TOLLWAY 1628					0.00173					6.19				NA						0.45	0.49	8	
6/5/12	blank	TOLLWAY 1656					0.00044					6.18				NA						0.42	0.58	6	
6/20/12	blank	TOLLWAY 1675										6.07				NA						0.51	0.59	5	
7/3/12	blank	TOLLWAY 1685					0.00111					6.18				NA						0.42	0.51	6	
7/19/12	blank	TOLLWAY 1696					0.00054					6.21				NA						0.92	0.94	5	
7/31/12	blank	TOLLWAY 1714										5.97				NA								0.44	3
8/15/12	blank	TOLLWAY 1733										5.76				NA						0.40	1.02	4	
26 total samples		# detects	0	0	0	0	13	0	0	0	0	1	0	0	1	0	0	0	2	0	0	23	25	5.500	
		min					0.000					5.94			NA	0.006			0.095			0.320	0.376	2.925	
		max					0.002					5.94			NA	0.006			0.259			1.110	1.332	0.580	
		mean					0.001					5.94			NA	0.006			0.177			0.566	0.700	0.806	
																									0.657

APPENDIX D: Results of Geochemical Analysis of Blank Samples

Date collected	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
		MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.0016	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
9/5/13	blank	TOLLWAY 2358						0.059															
9/17/13	blank	TOLLWAY 2370						0.090															
10/1/13	blank	TOLLWAY 2389						0.056											0.083				
10/17/13	blank	TOLLWAY 2420						0.124						0.048					0.041				
10/29/13	blank	TOLLWAY 2433						0.051											0.026				
11/14/13	blank	TOLLWAY 2460						0.073											0.061				
11/25/13	blank	TOLLWAY 2468						0.050															
12/4/13	blank	TOLLWAY 2490																					
12/19/13	blank	TOLLWAY 2503						0.055															
1/16/14	blank	TOLLWAY 2530						0.046											0.055				
1/31/14	blank	TOLLWAY 2548						0.044															
2/20/14	blank	TOLLWAY 2573						0.098															
3/7/14	blank	TOLLWAY 2588						0.095															
3/20/14	blank	TOLLWAY 2629						0.094															
4/2/14	blank	TOLLWAY 2653						0.052															
4/17/14	blank	TOLLWAY 2685						0.053															
5/1/14	blank	TOLLWAY 2711																			0.087		
5/15/14	blank	TOLLWAY 2745						0.053															
5/28/14	blank	TOLLWAY 2754						0.100															
6/12/14	blank	TOLLWAY 2794						0.101															
6/25/14	blank	TOLLWAY 2812						0.146													0.089		
7/10/14	blank	TOLLWAY 2852						0.051															
7/23/14	blank	TOLLWAY 2871						0.050															
8/7/14	blank	TOLLWAY 2904						0.080															
8/21/14	blank	TOLLWAY 2926																					
25 total samples		# detects	0	0	0	0	0	22	0	0	0	0	0	0	0	1	0	0	5	0	2	0	0
		min						0.044								0.048			0.026		0.087		
		max						0.146								0.048			0.083		0.089		
		mean						0.074								0.048			0.053		0.088		

Date collected	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L	
		MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097			4	12	3.0	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31
9/5/13	blank	TOLLWAY 2358										5.90				NA						0.91	1.00	3
9/17/13	blank	TOLLWAY 2370										5.84				NA						0.55	0.55	4
10/1/13	blank	TOLLWAY 2389					0.000425					5.70				NA						0.44	0.63	4
10/17/13	blank	TOLLWAY 2420										6.07				NA						0.53	0.47	6
10/29/13	blank	TOLLWAY 2433					0.000388					5.75				NA				0.17		0.68	0.56	5
11/14/13	blank	TOLLWAY 2460										5.51				NA						0.54	0.88	4
11/25/13	blank	TOLLWAY 2468										5.74				NA						0.60	0.74	3
12/4/13	blank	TOLLWAY 2490										5.44				NA						0.46	0.45	2
12/19/13	blank	TOLLWAY 2503										5.73		13		NA						0.62		3
1/16/14	blank	TOLLWAY 2530										5.60				NA								2
1/31/14	blank	TOLLWAY 2548										5.57				NA							0.40	2
2/20/14	blank	TOLLWAY 2573										5.93				NA						0.39	0.52	4
3/7/14	blank	TOLLWAY 2588					0.000551					5.73				NA						0.38	0.51	3
3/20/14	blank	TOLLWAY 2629										5.66				NA						0.79	0.55	3
4/2/14	blank	TOLLWAY 2653										5.92				NA						0.36	0.4	3
4/17/14	blank	TOLLWAY 2685								0.03213		5.68				NA						0.50	0.54	4
5/1/14	blank	TOLLWAY 2711										5.47				NA						0.32	0.67	3
5/15/14	blank	TOLLWAY 2745										5.92				NA						0.32	0.39	3
5/28/14	blank	TOLLWAY 2754										5.77				NA								1
6/12/14	blank	TOLLWAY 2794										5.70				NA						2.53	2.36	3
6/25/14	blank	TOLLWAY 2812					0.00060					5.72				NA						0.63	0.67	5
7/10/14	blank	TOLLWAY 2852										5.44				NA						0.61	0.60	3
7/23/14	blank	TOLLWAY 2871										5.75				NA						0.67	0.72	3
8/7/14	blank	TOLLWAY 2904										5.63				NA						0.79	0.92	3
8/21/14	blank	TOLLWAY 2926										5.43				NA						0.38	0.38	2
25 total samples		# detects	0	0	0	0	4	0	0	0	1	25	0	1	0.0	0	0	0	1	0	0	22	22	3.240 average # of detects per blank sample
		min					0.00040				0.03213	4.84			13				0.17			0.31	0.39	2.524 average # of detects per analyte
		max					0.00068				0.03213	6.09			13				0.17			2.17	10.98	1.776 mean of mins
		mean					0.00054				0.03213	5.66			13				0.17			0.70	1.14	2.230 mean of maxes
																								1.862 mean of means

Appendix E: Results of Geochemical Analysis of Duplicate Samples

			Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S
Sample ID			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		MDL:	0.0061	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
3/26/08	TB20 Grab	Tollway 30	0.0530	<0.108	0.042	0.216	<0.00055	132	<0.012	<0.013	<0.0058	0.00872	0.0427	7.67	0.024	34.1	0.0625	<0.022	1784	0.030	<0.063	<0.041	42.3
3/26/08	TB20 Grab dupe	Tollway 31	0.0519	<0.108	0.039	0.210	<0.00055	131	<0.012	<0.013	<0.0058	0.00847	0.0371	7.49	0.023	34.1	0.0630	<0.022	1764	0.019	0.075	<0.041	39.4
		difference	0.00110	<MDL	0.00300	0.00646	<MDL	1.00000	<MDL	<MDL	<MDL	0.00025	0.00560	0.18000	0.00090	0.00000	0.00050	<MDL	20.00000	0.01100	<MDL	<MDL	2.90000
		% difference	2.08	<MDL	7.14	2.98	<MDL	0.76	<MDL	<MDL	<MDL	2.87	13.11	2.35	3.83	0.00	0.80	<MDL	1.12	36.67	<MDL	<MDL	6.86
		> 20% ?																		36.67			
4/9/08	TB20 Grab	TOLLWAY JM 34	0.0456	<0.108	0.041	0.147	<0.00055	86.5	<0.012	<0.013	<0.0058	0.00772	0.0387	7.45	0.019	27.0	0.0727	<0.022	1477	<0.014	<0.063	<0.041	39.2
4/9/08	TB20 Grab dupe	TOLLWAY JM 35	0.0472	<0.108	0.042	0.147	<0.00055	84.7	<0.012	<0.013	<0.0058	0.00809	0.0406	7.57	0.018	26.9	0.0722	<0.022	1463	0.017	0.085	0.042	38.6
		difference	0.00160	<MDL	0.00100	0.00011	<MDL	1.80000	<MDL	<MDL	<MDL	0.00037	0.00190	0.12000	0.00120	0.14000	0.00050	<MDL	14.00000	<MDL	<MDL	<MDL	0.60000
		% difference	3.51	<MDL	2.44	0.13	<MDL	2.08	<MDL	<MDL	<MDL	4.79	4.91	1.61	6.22	0.52	0.69	<MDL	0.95	<MDL	<MDL	<MDL	1.53
		> 20% ?																					
4/14/08	TB20 Isco	TOLLWAY JM 41	0.0973	<0.108	0.026	0.0698	<0.00055	49.2	<0.012	<0.013	<0.0058	0.0101	0.0831	5.81	<0.018	13.2	0.0297	<0.022	741	<0.014	0.08	<0.041	22.2
4/14/08	TB20 Isco dupe	TOLLWAY JM 42	0.140	<0.108	0.032	0.0699	<0.00055	49.0	<0.012	<0.013	<0.0058	0.00994	0.124	5.90	<0.018	13.1	0.0295	<0.022	742	<0.014	<0.063	<0.041	22.0
		difference	0.04270	<MDL	0.00600	0.00011	<MDL	0.20000	<MDL	<MDL	<MDL	0.00014	0.04120	0.09000	<MDL	0.07000	0.00020	<MDL	1.00000	<MDL	<MDL	<MDL	0.20000
		% difference	43.88	<MDL	23.08	0.16	<MDL	0.41	<MDL	<MDL	<MDL	1.39	49.58	1.55	<MDL	0.53	0.67	<MDL	0.13	<MDL	<MDL	<MDL	0.90
		> 20% ?	43.88		23.08								49.58										
4/23/08	TB19 Grab	TOLLWAY JM 43	0.0391	<0.108	0.129	0.162	<0.00055	67.3	<0.012	<0.013	<0.0058	0.00582	0.0328	18.2	0.047	52.7	0.0138	<0.022	3772	0.041	0.137	<0.041	135
4/23/08	TB19 Grab dupe	TOLLWAY JM 44	0.0461	<0.108	0.128	0.161	<0.00055	63.1	<0.012	<0.013	<0.0058	0.00725	0.0303	18.9	0.042	50.3	0.0118	<0.022	3776	0.024	0.097	<0.041	133
		difference	0.00700	<MDL	0.00100	0.00062	<MDL	4.20000	<MDL	<MDL	<MDL	0.00143	0.00250	0.70000	0.00450	0.00200	<MDL	4.00000	0.01700	0.04000	<MDL	<MDL	2.00000
		% difference	17.90	<MDL	0.78	0.38	<MDL	6.24	<MDL	<MDL	<MDL	24.57	7.62	3.85	9.68	4.57	14.49	<MDL	0.11	41.46	29.20	<MDL	1.48
		> 20% ?										24.57								41.46	29.20		
5/6/08	TB19 Grab	TOLLWAY 49	0.0404	<0.108	0.119	0.16775	<0.00055	66.1	<0.012	<0.013	<0.0058	0.00637	0.0131	13.3	0.036	40.4	0.0256	<0.022	2785	<0.014	0.065	0.057	95.4
5/6/08	TB19 Grab dupe	TOLLWAY 47	0.0597	<0.108	0.123	0.168	<0.00055	67.8	<0.012	<0.013	<0.0058	0.00606	0.0399	13.2	0.038	39.9	0.0277	<0.022	2832	0.023	<0.063	0.044	98.1
		difference	0.01930	<MDL	0.00400	0.00051	<MDL	1.70000	<MDL	<MDL	<MDL	0.00031	0.02680	0.10000	0.00190	0.54000	0.00210	<MDL	47.00000	<MDL	<MDL	0.01300	2.70000
		% difference	47.77	<MDL	3.36	0.30	<MDL	2.57	<MDL	<MDL	<MDL	4.87	204.58	0.75	5.26	1.34	8.20	<MDL	1.69	<MDL	<MDL	22.81	2.83
		> 20% ?	47.77										204.58									22.81	
5/20/08	TB19 Grab	TOLLWAY 50	0.0117	<0.108	0.106	0.131	<0.00055	52.2	<0.012	<0.013	<0.0058	<0.00079	0.0372	8.55	0.021	31.7	0.0610	<0.022	2192	0.025	<0.063	<0.041	72.7
5/20/08	TB19 Grab dupe	TOLLWAY 51	0.0106	<0.108	0.106	0.134	<0.00055	53.0	<0.012	<0.013	<0.0058	<0.00079	0.0441	8.67	0.022	31.5	0.0609	<0.022	2226	<0.014	0.087	<0.041	74.2
		difference	0.00110	<MDL	0.00000	0.00229	<MDL	0.80000	<MDL	<MDL	<MDL	<MDL	0.00690	0.12000	0.00090	0.15000	0.00010	<MDL	34.00000	<MDL	<MDL	<MDL	1.50000
		% difference	9.40	<MDL	0.00	1.74	<MDL	1.53	<MDL	<MDL	<MDL	<MDL	18.55	1.40	4.31	0.47	0.16	<MDL	1.55	<MDL	<MDL	<MDL	2.06
		> 20% ?																					
5/28/08	TB19 Grab	TOLLWAY 52	0.108	<0.108	0.123	0.125	<0.00055	37.2	<0.012	<0.013	<0.0058	0.00663	<0.0059	8.45	0.021	23.9	0.0090	0.026	2136	0.028	0.119	<0.041	77.7
5/28/08	TB19 Grab dupe	TOLLWAY 56	0.115	<0.108	0.131	0.129	<0.00055	37.7	<0.012	<0.013	<0.0058	0.00664	<0.0059	9.73	0.022	26.0	0.0084	0.025	2182	0.018	<0.063	<0.041	78.7
		difference	0.00780	<MDL	0.00800	0.00350	<MDL	0.50000	<MDL	<MDL	<MDL	0.00001	<MDL	1.28000	0.00100	2.02000	0.00060	0.00100	46.00000	0.01000	<MDL	<MDL	1.00000
		% difference	7.26	<MDL	6.50	2.80	<MDL	1.34	<MDL	<MDL	<MDL	0.15	<MDL	15.15	4.81	8.44	6.67	3.85	2.15	35.71	<MDL	<MDL	1.29
		> 20% ?																		35.71			
6/9/08	TB19 Grab	TOLLWAY 55	0.397	<0.108	0.127	0.0715	<0.00055	36.9	<0.012	<0.013	<0.0058	0.00681	0.219	5.06	<0.018	14.8	0.0175	<0.022	874	0.023	<0.063	<0.041	33.2
6/9/08	TB19 Grab dupe	TOLLWAY 59	0.491	<0.108	0.118	0.0743	<0.00055	37.3	<0.012	<0.013	<0.0058	0.00611	0.279	5.27	<0.018	15.3	0.0178	<0.022	917	0.018	<0.063	<0.041	34.2
		difference	0.09440	<MDL	0.00900	0.00284	<MDL	0.40000	<MDL	<MDL	<MDL	0.00070	0.05990	0.21000	<MDL	0.46000	0.00030	<MDL	43.00000	0.00500	<MDL	<MDL	1.00000
		% difference	23.78	<MDL	7.09	3.97	<MDL	1.08	<MDL	<MDL	<MDL	10.28	27.39	4.15	<MDL	3.11	1.71	<MDL	4.92	21.74	<MDL	<MDL	3.01
		> 20% ?	23.78										27.39							21.74			
7/9/08	TB19 Grab	TOLLWAY 82	0.0530	<0.108	0.113	0.120	<0.00055	47.3	<0.012	<0.013	<0.0058	0.00406	0.0936	3.60	<0.018	14.2	0.0514	<0.022	982	0.021	<0.063	<0.041	39.3
7/9/08	TB19 Grab dupe	TOLLWAY 81	0.0546	<0.108	0.114	0.121	<0.00055	47.7	<0.012	<0.013	<0.0058	0.00425	0.0973	3.64	<0.018	15.3	0.0514	<0.022	998	<0.014	<0.063	<0.041	39.9
		difference	0.00160	<MDL	0.00100	0.00116	<MDL	0.40000	<MDL	<MDL	<MDL	0.00019	0.00370	0.04000	<MDL	1.12000	0.00000	<MDL	16.00000	<MDL	<MDL	<MDL	0.60000
		% difference	3.02	<MDL	0.88	0.97	<MDL	0.85	<MDL	<MDL	<MDL	4.68	3.95	1.11	<MDL	7.90	0.00	<MDL	1.63	<MDL	<MDL	<MDL	1.53
		> 20% ?																					
7/22/08	TB19 Gerlach	TOLLWAY 86	0.0199	<0.108	0.031	0.113	<0.00055	19.0	<0.012	<0.013	<0.0058	0.00536	0.538	1.78	<0.018	2.82	0.106	<0.022	20.9	<0.014	<0.063	<0.041	6.02
7/22/08	TB19 Gerlach dupe	TOLLWAY 87	0.0173	<0.108	0.035	0.114	<0.00055	19.1	<0.012	<0.013	<0.0058	0.00448	0.514	1.79	<0.018	2.82	0.106	<0.022	20.9	0.019	<0.063	<0.041	6.02
		difference	0.00260	<MDL	0.00400	0.00089	<MDL	0.10000	<MDL	<MDL	<MDL	0.00088	0.02400	0.01000	<MDL	0.00400	0.00050	<MDL	0.00000	<MDL	<MDL	<MDL	0.00000
		% difference	13.07	<MDL	12.90	0.79	<MDL	0.53	<MDL	<MDL	<MDL	16.42	4.46	0.56	<MDL	0.14	0.47	<MDL	0.00	<MDL	<MDL	<MDL	0.00
		> 20% ?																					
8/6/08	TB19 Grab	TOLLWAY 96	0.111	<0.108	0.0930	0.0835	<0.00055	42.5	<0.012	<0.013	<0.0058	0.00707	0.116	2.12	<0.018	11.1	0.0147	<0.022	525	<0.014	<0.063	<0.041	16.8
8/6/08	TB19 Grab dupe	TOLLWAY 97	0.0742	<0.108	0.0910	0.0844	<0.00055	44.3	<0.012	<0.013	<0.0058	0.00732	0.0857	2.13	<0.018	11.4	0.0142	<0.022	533	<0.014	<0.063	<0.041	17.0
		difference	0.03690	<MDL	0.00200	0.00090																	

Appendix E: Results of Geochemical Analysis of Duplicate Samples

		Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO ₄ -P	NH ₃ -N	F	Cl	NO ₃ -N	SO ₄	total NVOC	dissolved NVOC	mean relative % difference between dupe and sample	
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L as CaCO ₃	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		
MDL:		0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31		
3/26/08	TB20 Grab	Tollway 30	<0.059	<0.131	2.51	<0.086	1.22	<0.00056	<0.017	<0.047	0.0616	7.92	160	5160		0.01	<0.06	<0.08	2932	<0.07	107	11.3	10.2	
3/26/08	TB20 Grab dupe	Tollway 31	<0.059	<0.131	2.38	<0.086	1.12	<0.00056	0.017	<0.047	0.0614	7.94	159	5118		<0.01	<0.06	<0.08	2978	<0.07	103	11.7	10.5	
		difference	<MDL	<MDL	0.13000	<MDL	0.10310	<MDL	<MDL	<MDL	0.00020	0.02400	0.66300	42.00000	NA	<MDL	<MDL	<MDL	46.31167	<MDL	3.70461	0.39389	0.30292	
		% difference	<MDL	<MDL	5.18	<MDL	8.42	<MDL	<MDL	<MDL	0.32	0.30	0.41	0.81	NA	<MDL	<MDL	<MDL	1.58	<MDL	3.46	3.49	2.98	4.68
		> 20% ?																						
4/9/08	TB20 Grab	TOLLWAY JM 34	<0.059	<0.131	1.90	<0.086	0.817	<0.00056	<0.017	<0.047	0.0339	8.07	145	4086		<0.01	<0.06	<0.08	2320	<0.07	106	13.0	10.5	
4/9/08	TB20 Grab dupe	TOLLWAY JM 35	<0.059	<0.131	1.88	<0.086	0.820	<0.00056	<0.017	<0.047	0.0344	8.09	145	4074		<0.01	<0.06	<0.08	2347	<0.07	107	12.3	10.6	
		difference	<MDL	<MDL	0.02000	<MDL	0.00329	<MDL	<MDL	<MDL	0.00050	0.01600	0.73200	12.00000	NA	<MDL	<MDL	<MDL	27.75018	<MDL	0.41728	0.60931	0.02796	
		% difference	<MDL	<MDL	1.05	<MDL	0.40	<MDL	<MDL	<MDL	1.47	0.20	0.50	0.29	NA	<MDL	<MDL	<MDL	1.20	<MDL	0.39	4.70	0.27	1.81
		> 20% ?																						
4/14/08	TB20 Isco	TOLLWAY JM 41	<0.059	<0.131	2.88	<0.086	0.378	0.00122	<0.017	<0.047	0.0080	7.92	109	2090	294	<0.01	0.09	0.15	1145	0.38	62.9	38.0	10.1	
4/14/08	TB20 Isco dupe	TOLLWAY JM 42	<0.059	<0.131	2.99	<0.086	0.380	0.00205	0.017	<0.047	0.0083	7.92	110	2095	270	<0.01	0.08	0.15	1130	0.37	62.9	36.3	10.9	
		difference	<MDL	<MDL	0.11000	<MDL	0.00210	0.00083	<MDL	<MDL	0.00030	0.00700	0.27400	5.00000	24.00000	<MDL	0.01083	0.00508	15.11624	0.00393	0.02059	1.69208	0.72991	
		% difference	<MDL	<MDL	3.82	<MDL	0.56	68.03	<MDL	<MDL	3.75	0.09	0.25	0.24	8.16	<MDL	12.17	3.48	1.32	1.04	0.03	4.45	7.21	9.11
		> 20% ?					68.03																	
4/23/08	TB19 Grab	TOLLWAY JM 43	<0.059	<0.131	0.319	<0.086	0.969	<0.00056	0.02	<0.047	<0.0073	9.39	121	10136	18	0.02	<0.06	<0.08	6099	0.08	355	28.3	20.2	
4/23/08	TB19 Grab dupe	TOLLWAY JM 44	<0.059	<0.131	0.321	<0.086	0.963	<0.00056	0.021	<0.047	<0.0073	9.38	119	10209	17	0.02	<0.06	<0.08	5915	0.08	329	28.1	18.6	
		difference	<MDL	<MDL	0.00200	<MDL	0.00518	<MDL	0.00100	<MDL	<MDL	0.00400	2.83500	73.00000	1.00000	0.00631	<MDL	<MDL	184.22210	0.00026	25.25609	0.23755	1.61195	
		% difference	<MDL	<MDL	0.63	<MDL	0.53	<MDL	5.00	<MDL	<MDL	0.04	2.34	0.72	5.56	26.33	<MDL	<MDL	3.02	0.34	7.12	0.84	7.97	8.25
		> 20% ?													26.33									
5/6/08	TB19 Grab	TOLLWAY 49	<0.059	<0.131	0.477	<0.086	0.775	<0.00056	<0.017	<0.047	<0.0073	8.78	232	7622	25	0.02	<0.06	<0.08	4371	0.47	279	18.5	15.9	
5/6/08	TB19 Grab dupe	TOLLWAY 47	<0.059	<0.131	0.535	<0.086	0.776	<0.00056	0.026	<0.047	<0.0073	8.78	231	7558		0.02	<0.06	<0.08	4452	0.47	259	19.5	16.4	
		difference	<MDL	<MDL	0.05800	<MDL	0.00178	<MDL	<MDL	<MDL	<MDL	0.00200	0.42500	64.00000	NA	0.00160	<MDL	<MDL	81.25879	0.00443	20.49456	0.99423	0.52687	
		% difference	<MDL	<MDL	12.16	<MDL	0.23	<MDL	<MDL	<MDL	<MDL	0.02	0.18	0.84	NA	10.27	<MDL	<MDL	1.86	0.94	7.34	5.38	3.31	14.54
		> 20% ?																						
5/20/08	TB19 Grab	TOLLWAY 50	<0.059	<0.131	0.520	<0.086	0.615	<0.00056	<0.017	<0.047	<0.0073	7.72	269	6058	30.4	0.02	<0.06	<0.08	3353	1.76	188	13.5	11.8	
5/20/08	TB19 Grab dupe	TOLLWAY 51	<0.059	<0.131	0.526	<0.086	0.624	<0.00056	<0.017	<0.047	<0.0073	7.77	276	6005		0.02	<0.06	<0.08	3321	1.76	185	13.8	12.4	
		difference	<MDL	<MDL	0.00600	<MDL	0.00924	<MDL	<MDL	<MDL	<MDL	0.04900	7.70200	53.00000	NA	0.00120	<MDL	<MDL	32.36334	0.00542	2.77510	0.35372	0.59903	
		% difference	<MDL	<MDL	1.15	<MDL	1.50	<MDL	<MDL	<MDL	<MDL	0.63	2.87	0.87	NA	7.72	<MDL	<MDL	0.97	0.31	1.48	2.63	5.06	3.02
		> 20% ?																						
5/28/08	TB19 Grab	TOLLWAY 52	<0.059	<0.131	0.414	<0.086	0.494	<0.00056	<0.017	<0.047	0.0127	8.94	283	5687	11.2	0.02	<0.06	0.60	3123	2.38	221	13.9	12.1	
5/28/08	TB19 Grab dupe	TOLLWAY 56	<0.059	<0.131	0.417	<0.086	0.510	<0.00056	<0.017	<0.047	<0.0073	8.94	281	5678		0.02	<0.06	0.60	3124	2.40	219	14.0	12.2	
		difference	<MDL	<MDL	0.00300	<MDL	0.01602	<MDL	<MDL	<MDL	<MDL	0.00200	2.35900	9.00000	NA	0.00311	<MDL	0.00275	0.48266	0.01857	2.25799	0.14952	0.08018	
		% difference	<MDL	<MDL	0.72	<MDL	3.24	<MDL	<MDL	<MDL	<MDL	0.02	0.83	0.16	NA	16.87	<MDL	0.46	0.02	0.78	1.02	1.08	0.66	4.88
		> 20% ?																						
6/9/08	TB19 Grab	TOLLWAY 55	<0.059	<0.131	5.69	<0.086	0.327	0.00811	<0.017	<0.047	0.0115	8.46	253	2320	282	0.02	0.06	0.59	1160	1.75	95.1	21.0	11.8	
6/9/08	TB19 Grab dupe	TOLLWAY 59	<0.059	<0.131	6.06	<0.086	0.337	0.0115	<0.017	<0.047	0.0078	8.45	258	2379	327	0.01	0.07	0.61	1231	1.93	97.0	21.1	12.5	
		difference	<MDL	<MDL	0.37000	<MDL	0.00977	0.00343	<MDL	<MDL	0.00370	0.00700	5.41300	59.00000	45.00000	0.00165	0.00742	0.01700	71.00000	0.17887	1.91540	0.06300	0.70300	
		% difference	<MDL	<MDL	6.50	<MDL	2.99	42.29	<MDL	<MDL	32.17	0.08	2.14	2.54	15.96	10.20	12.05	2.88	6.12	10.21	2.01	0.30	5.94	9.52
		> 20% ?						42.29																
		> 20% ?																						
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7/9/08	TB19 Grab	TOLLWAY 82	<0.059	<0.131	5.35	<0.086	0.369	0.00085	<0.017	<0.047	0.0097	7.89	284	2620	36.0	0.01	<0.06	0.53	1326	<0.07	104	20.1	17.7	
7/9/08	TB19 Grab dupe	TOLLWAY 81	<0.059	<0.131	5.46	<0.086	0.372	0.00083	<0.017	<0.047	0.0100	7.88	284	2607	30.0	0.02	<0.06	0.55	1337	<0.07	104	19.8	17.8	
		difference	<MDL	<MDL	0.11000	<MDL	0.00364	0.00002	<MDL	<MDL	0.00030													

Appendix E: Results of Geochemical Analysis of Duplicate Samples

		Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	
	Sample ID	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
		MDL:	0.0061	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
10/28/08	SandersSW Gerlach	TOLLWAY 155	0.0494	<0.108	0.033	0.0921	<0.00055	13.6	<0.012	<0.013	<0.0058	0.0158	0.0333	1.41	<0.018	2.03	0.0125	<0.022	27.1	<0.014	<0.063	<0.041	4.69
10/28/08	SandersSW Gerlach dupe	TOLLWAY 156	0.0616	<0.108	0.033	0.0941	<0.00055	13.8	<0.012	<0.013	0.0060	0.0159	0.0417	1.44	<0.018	2.06	0.0130	<0.022	27.6	<0.014	<0.063	<0.041	4.78
		difference	0.01220	<MDL	0.00000	0.00201	<MDL	0.20000	<MDL	<MDL	<MDL	0.00014	0.00840	0.03000	<MDL	0.02200	0.00050	<MDL	0.50000	<MDL	<MDL	<MDL	0.09000
		% difference	24.70	<MDL	0.00	2.18	<MDL	1.47	<MDL	<MDL	<MDL	0.89	25.23	2.13	<MDL	1.08	4.00	<MDL	1.85	<MDL	<MDL	<MDL	1.92
		> 20% ?	24.70									25.23											
11/12/08	SandersSW Grab	TOLLWAY 158	0.130	<0.108	0.040	0.0884	<0.00055	69.6	<0.012	<0.013	<0.0058	0.0125	0.0455	4.24	<0.018	22.9	0.0088	<0.022	794	0.016	<0.063	<0.041	40.2
11/12/08	SandersSW Grab dupe	TOLLWAY 159	0.129	<0.108	0.038	0.0872	<0.00055	68.1	<0.012	<0.013	<0.0058	0.0123	0.0426	4.14	<0.018	21.7	0.0084	<0.022	774	<0.014	<0.063	<0.041	39.4
		difference	0.00090	<MDL	0.00200	0.00122	<MDL	1.50000	<MDL	<MDL	<MDL	0.00018	0.00290	0.10000	<MDL	1.23000	0.00040	<MDL	20.00000	<MDL	<MDL	<MDL	0.80000
		% difference	0.69	<MDL	5.00	1.38	<MDL	2.16	<MDL	<MDL	<MDL	1.44	6.37	2.36	<MDL	5.36	4.55	<MDL	2.52	<MDL	<MDL	<MDL	1.99
		> 20% ?																					
12/2/08	TB19 Gerlach	TOLLWAY 162	<0.037	<0.108	0.056	0.674	<0.00055	77.0	<0.012	<0.013	<0.0058	0.0194	0.0563	7.86	0.021	8.83	0.145	<0.022	4960	<0.014	0.162	0.071	24.7
12/2/08	TB19 Gerlach dupe	TOLLWAY 163	<0.037	<0.108	0.055	0.675	<0.00055	78.4	<0.012	<0.013	0.0070	0.0214	0.0526	7.80	0.021	9.00	0.145	<0.022	4900	0.014	0.077	0.047	24.6
		difference	<MDL	<MDL	0.00100	0.00064	<MDL	1.40000	<MDL	<MDL	<MDL	0.00208	0.00370	0.06000	0.00000	0.17000	0.00030	<MDL	60.00000	<MDL	0.08500	0.02400	0.10000
		% difference	<MDL	<MDL	1.79	0.09	<MDL	1.82	<MDL	<MDL	<MDL	10.75	6.57	0.76	0.00	1.93	0.21	<MDL	1.21	<MDL	52.47	33.80	0.40
		> 20% ?																					
12/16/08	SandersSW Gerlach	TOLLWAY 167	<0.037	<0.108	0.051	0.390	<0.00055	66.6	<0.012	<0.013	<0.0058	0.0237	0.0371	7.27	<0.018	6.16	0.170	<0.022	3440	<0.014	0.089	0.047	25.9
12/16/08	SandersSW Gerlach dupe	TOLLWAY 168	<0.037	<0.108	0.050	0.395	<0.00055	67.7	<0.012	<0.013	<0.0058	0.0244	0.0368	7.39	0.018	6.37	0.173	<0.022	3570	<0.014	<0.063	0.043	26.1
		difference	<MDL	<MDL	0.00100	0.00501	<MDL	1.10000	<MDL	<MDL	<MDL	0.00068	0.00030	0.12000	<MDL	0.20300	0.00300	<MDL	130.00000	<MDL	<MDL	0.00400	0.20000
		% difference	<MDL	<MDL	1.96	1.29	<MDL	1.65	<MDL	<MDL	<MDL	2.87	0.81	1.65	<MDL	3.29	1.76	<MDL	3.78	<MDL	<MDL	8.51	0.77
		> 20% ?																					
1/6/09	SandersSW Isco	TOLLWAY 175	<0.037	<0.108	<0.023	0.155	<0.00055	88.4	<0.012	<0.013	<0.0058	0.00738	0.0344	4.14	<0.018	19.3	0.0336	<0.022	1306	0.015	0.076	<0.041	20.1
1/6/09	SandersSW Isco dupe	TOLLWAY 179	<0.037	<0.108	<0.023	0.158	<0.00055	88.1	<0.012	<0.013	<0.0058	0.00741	0.0351	4.18	<0.018	19.6	0.0327	<0.022	1341	0.019	0.112	<0.041	20.4
		difference	<MDL	<MDL	<MDL	0.00347	<MDL	0.30000	<MDL	<MDL	<MDL	0.00003	0.00070	0.04000	<MDL	0.25000	0.00090	<MDL	35.00000	0.00400	0.03600	<MDL	0.30000
		% difference	<MDL	<MDL	<MDL	2.24	<MDL	0.34	<MDL	<MDL	<MDL	0.41	2.03	0.97	<MDL	1.29	2.68	<MDL	2.68	26.67	47.37	<MDL	1.49
		> 20% ?																					
2/17/09	TB19 Grab	TOLLWAY 183	<0.037	<0.108	0.050	0.146	<0.00055	115	<0.012	<0.013	0.0095	0.00732	0.0220	34.4	<0.018	45.1	0.105	<0.022	2162	0.030	<0.063	<0.041	59.9
2/17/09	TB19 Grab dupe	TOLLWAY 184	<0.037	<0.108	0.053	0.153	<0.00055	119	<0.012	<0.013	0.0093	0.00701	0.0219	35.7	<0.018	47.0	0.109	0.024	2248	0.034	0.071	<0.041	62.1
		difference	<MDL	<MDL	0.00263	0.00675	<MDL	3.79818	<MDL	<MDL	0.00017	0.00031	0.00012	1.39700	<MDL	1.88963	0.00425	<MDL	86.00000	0.00364	<MDL	<MDL	2.18190
		% difference	<MDL	<MDL	5.24	4.61	<MDL	3.29	<MDL	<MDL	1.74	4.18	0.55	4.07	<MDL	4.19	4.06	<MDL	3.98	12.00	<MDL	<MDL	3.64
		> 20% ?																					
3/3/09	TB19 Grab	TOLLWAY 189	<0.037	<0.108	0.068	0.103	<0.00055	91.3	<0.012	<0.013	<0.0058	0.00717	0.0145	34.2	<0.018	51.2	0.0431	<0.022	1398	0.026	<0.063	<0.041	49.6
3/3/09	TB19 Grab dupe	TOLLWAY 234	<0.037	<0.108	0.068	0.105	<0.00055	93.6	<0.012	<0.013	<0.0058	0.00760	0.0147	34.7	<0.018	52.1	0.0451	<0.022	1421	0.027	<0.063	<0.041	51.1
		difference	<MDL	<MDL	0.00008	0.00160	<MDL	2.30725	<MDL	<MDL	<MDL	0.00043	0.00027	0.52700	<MDL	0.87835	0.00203	<MDL	23.00000	0.00131	<MDL	<MDL	1.43703
		% difference	<MDL	<MDL	0.12	1.55	<MDL	2.53	<MDL	<MDL	<MDL	6.03	1.87	1.54	<MDL	1.72	4.70	<MDL	1.65	5.04	<MDL	<MDL	2.90
		> 20% ?																					
4/1/09	TB15B Isco	TOLLWAY 195	<0.037	<0.108	0.026	0.0966	<0.00055	54.0	<0.012	<0.013	0.0069	0.0113	0.0225	21.6	<0.018	1.91	0.0038	<0.022	1050	<0.014	0.081	<0.041	11.9
4/1/09	TB15B Isco dupe	TOLLWAY 196	<0.037	<0.108	0.025	0.0964	<0.00055	54.3	<0.012	<0.013	0.0069	0.0121	0.0270	21.7	<0.018	1.93	<0.0015	<0.022	1050	<0.014	0.085	<0.041	11.8
		difference	<MDL	<MDL	0.00100	0.00019	<MDL	0.30000	<MDL	<MDL	0.00000	0.00085	0.00450	0.10000	<MDL	0.01600	<MDL	<MDL	0.00000	<MDL	0.00400	<MDL	0.10000
		% difference	<MDL	<MDL	3.85	0.20	<MDL	0.56	<MDL	<MDL	0.00	7.56	20.00	0.46	<MDL	0.84	<MDL	<MDL	0.00	<MDL	4.94	<MDL	0.84
		> 20% ?																					
4/14/09	TB15B Grab	TOLLWAY 203	<0.037	<0.108	0.046	0.167	<0.00055	66.5	<0.012	<0.013	0.0132	0.0311	0.0177	66.6	<0.018	0.763	<0.0015	0.030	1550	<0.014	0.063	<0.041	19.0
4/14/09	TB15B Grab dupe	TOLLWAY 204	<0.037	<0.108	0.042	0.168	<0.00055	65.6	<0.012	<0.013	0.0134	0.0311	0.0146	66.0	<0.018	0.702	<0.0015	0.026	1514	<0.014	0.091	<0.041	18.6
		difference	<MDL	<MDL	0.00400	0.00099	<MDL	0.90000	<MDL	<MDL	0.00020	0.00001	0.00310	0.60000	<MDL	0.06090	<MDL	0.00400	35.92493	<MDL	0.02800	<MDL	0.40000
		% difference	<MDL	<MDL	8.70	0.59	<MDL	1.35	<MDL	<MDL	1.52	0.03	17.51	0.90	<MDL	7.98	<MDL	13.33	2.32	<MDL	44.44	<MDL	2.11
		> 20% ?																					
4/29/09	WRP1-W	TOLLWAY 206	0.044	<0.108	0.138	0.0288	<0.00055	72.9	<0.012	<0.013	<0.0058	0.0130	0.0788	3.69	<0.018	26.3	0.0724	0.026	27.1	0.024	0.567	<0.041	61.8
4/29/09	WRP1 dupe	TOLLWAY 207	<0.037	<0.108	0.139	0.0294	<0.00055	74.1	<0.012	<0.013	<0.0058	0.0135	0.0388	3.71	<0.018	26.9	0.0613	0.025	27.4	0.025	0.534	<0.041	61.5
		difference	<MDL	<MDL																			

Appendix E: Results of Geochemical Analysis of Duplicate Samples

			Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO ₄ -P	NH ₃ -N	F	Cl	NO ₃ -N	SO ₄	total NVOC	dissolved NVOC	mean relative % difference between dupe and sample
Sample ID		MDL:	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L as CaCO ₃	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
10/28/08	SandersSW Gerlach	TOLLWAY 155	<0.059	<0.131	1.36	<0.086	0.0885	0.00064	<0.017	<0.047	0.0507	6.91	34.9	121	7.2	0.01	0.29	0.45	36.7	0.55	12.2	10.6	7.14	
10/28/08	SandersSW Gerlach dupe	TOLLWAY 156	<0.059	<0.131	1.40	<0.086	0.0899	0.00071	<0.017	<0.047	0.0501	6.90	34.8	123	6.4	0.01	0.26	0.46	36.7	0.56	12.3	10.8	7.59	
		difference	<MDL	<MDL	0.04000	<MDL	0.00137	0.00007	<MDL	<MDL	0.00060	0.01600	0.06390	2.00000	0.80000	0.00066	0.03116	0.00815	0.00445	0.00307	0.07058	0.16575	0.45663	
		% difference	<MDL	<MDL	2.94	<MDL	1.55	10.94	<MDL	<MDL	1.18	0.23	0.18	1.65	11.11	4.94	10.81	1.82	0.01	0.55	0.58	1.56	6.40	4.51
		> 20% ?																						
11/12/08	SandersSW Grab	TOLLWAY 158	<0.059	<0.131	4.29	<0.086	0.395	0.00081	<0.017	<0.047	<0.0073	7.70	259	2328	4.4	0.03	<0.06	0.17	1161	0.10	115	16.0	14.9	
11/12/08	SandersSW Grab dupe	TOLLWAY 159	<0.059	<0.131	4.19	<0.086	0.386	0.00083	<0.017	<0.047	<0.0075	7.71	259	2336	4.4	0.03	<0.06	0.18	1164	0.10	114	15.3	14.9	
		difference	<MDL	<MDL	0.10000	<MDL	0.00957	0.00002	<MDL	<MDL	<MDL	0.01800	0.32800	8.00000	0.00000	0.00107	<MDL	0.00105	2.77693	0.00073	1.19819	0.75126	0.06116	
		% difference	<MDL	<MDL	2.33	<MDL	2.42	2.47	<MDL	<MDL	<MDL	0.23	0.13	0.34	0.00	3.30	<MDL	0.60	0.24	0.71	1.04	4.68	0.41	2.11
		> 20% ?																						
12/2/08	TB19 Gerlach	TOLLWAY 162	<0.059	<0.131	1.45	<0.086	1.42	<0.00056	<0.017	<0.047	0.180	7.25	45	13223	184	0.04	2.32	<0.8 *	7234	0.85	45.4	54.1	17.7	
12/2/08	TB19 Gerlach dupe	TOLLWAY 163	<0.059	<0.131	1.43	<0.086	1.42	<0.00056	<0.017	<0.047	0.184	7.25	45	13234	189	0.05	2.42	<0.8 *	8066	0.85	45.4	53.1	20.0	
		difference	<MDL	<MDL	0.02000	<MDL	0.00140	<MDL	<MDL	<MDL	0.00420	0.00200	0.15880	11.00000	5.30000	0.00201	0.10477	<MDL	832.06996	0.00151	0.02109	1.02028	2.37199	
		% difference	<MDL	<MDL	1.38	<MDL	0.10	<MDL	<MDL	<MDL	2.33	0.03	0.36	0.08	2.88	4.52	4.52	<MDL	11.50	0.18	0.05	1.89	13.44	5.74
		> 20% ?																						
12/16/08	SandersSW Gerlach	TOLLWAY 167	<0.059	<0.131	1.85	<0.086	0.601	<0.00056	<0.017	<0.047	0.133	7.24	56	9045	119	0.02	0.86	<0.8 *	5808	0.41	63.9	54.2	9.94	
12/16/08	SandersSW Gerlach dupe	TOLLWAY 168	<0.059	<0.131	1.89	<0.086	0.611	<0.00056	<0.017	<0.047	0.136	7.29	56	9028	115	0.02	0.87	<0.8 *	5404	0.40	63.7	32.0	10.1	
		difference	<MDL	<MDL	0.04000	<MDL	0.01016	<MDL	<MDL	<MDL	0.00380	0.04600	0.21390	17.00000	4.00000	0.00092	0.00831	<MDL	403.85012	0.00959	0.21091	22.20910	0.12899	
		% difference	<MDL	<MDL	2.16	<MDL	1.69	<MDL	<MDL	<MDL	2.87	0.64	0.38	0.19	3.36	3.69	0.96	<MDL	6.95	2.32	0.33	40.95	1.30	3.85
		> 20% ?																			40.95			
1/6/09	SandersSW Isco	TOLLWAY 175	<0.059	<0.131	2.33	<0.086	0.544	<0.00056	<0.017	<0.047	0.0295	7.48	77.4	3836	45.2	0.04	0.14	0.11	2300	0.43	54.6	18.9	5.75	
1/6/09	SandersSW Isco dupe	TOLLWAY 179	<0.059	<0.131	2.37	<0.086	0.549	<0.00056	<0.017	<0.047	0.0315	7.52	77.0	3857	48.0	0.04	0.13	0.10	2256	0.44	54.6	11.1	6.23	
		difference	<MDL	<MDL	0.04000	<MDL	0.00550	<MDL	<MDL	<MDL	0.00200	0.04400	0.41590	21.00000	2.80000	0.00119	0.00503	0.01679	44.60022	0.00530	0.01075	7.85003	0.48340	
		% difference	<MDL	<MDL	1.72	<MDL	1.01	<MDL	<MDL	<MDL	6.78	0.59	0.54	0.55	6.19	2.77	3.63	14.75	1.94	1.23	0.02	41.47	8.41	6.91
		> 20% ?																						
2/17/09	TB19 Grab	TOLLWAY 183	<0.059	<0.131	1.63	<0.086	0.954	<0.00056	0.017	<0.047	0.0151	8.71	169	6038	8.4	0.01	0.13	0.40	3500	0.41	154	10.8	11.5	
2/17/09	TB19 Grab dupe	TOLLWAY 184	<0.059	<0.131	1.69	<0.086	0.996	<0.00056	<0.017	<0.047	0.0182	8.72	168	6015	8.0	0.01	<0.06	0.41	3480	0.41	155	11.3	10.2	
		difference	<MDL	<MDL	0.05491	<MDL	0.04173	<MDL	<MDL	<MDL	0.00305	0.01300	1.38400	23.00000	0.40000	0.00006	<MDL	0.01164	19.92625	0.00642	0.91476	0.50260	1.30269	
		% difference	<MDL	<MDL	3.36	<MDL	4.37	<MDL	<MDL	<MDL	20.18	0.15	0.82	0.38	4.76	0.58	<MDL	2.92	0.57	1.58	0.59	4.64	11.31	4.15
		> 20% ?																						
3/3/09	TB19 Grab	TOLLWAY 189	<0.059	<0.131	1.75	<0.086	0.736	<0.00056	<0.017	<0.047	<0.0073	8.64	224	4070	6.8	0.02	<0.06	0.38	2261	1.52	133	16.3	17.0	
3/3/09	TB19 Grab dupe	TOLLWAY 234	<0.059	<0.131	1.80	<0.086	0.746	<0.00056	<0.017	<0.047	<0.0073	8.66	227	4112	6.8	0.02	<0.06	0.37	2276	1.50	133	19.5	16.7	
		difference	<MDL	<MDL	0.04950	<MDL	0.00981	<MDL	<MDL	<MDL	0.01700	0.01700	2.59700	42.00000	0.00000	0.00096	<MDL	0.00702	15.37913	0.02065	0.40700	3.12839	0.28439	
		% difference	<MDL	<MDL	2.82	<MDL	1.33	<MDL	<MDL	<MDL	<MDL	0.20	1.16	1.03	0.00	5.70	<MDL	1.85	0.68	1.36	0.31	19.16	1.67	2.79
		> 20% ?																						
4/1/09	TB15B Isco	TOLLWAY 195	<0.059	<0.131	2.24	<0.086	0.497	<0.00056	<0.017	<0.047	<0.0073	10.62	148	2863	307	0.06	0.32	0.20	1712	0.56	30.7	18.4	7.87	
4/1/09	TB15B Isco dupe	TOLLWAY 196	<0.059	<0.131	2.24	<0.086	0.499	<0.00056	0.019	<0.047	<0.0073	10.60	148	2880		0.06	0.33	0.18	1693	3.33	30.7	15.4	7.45	
		difference	<MDL	<MDL	0.00000	<MDL	0.00256	<MDL	<MDL	<MDL	<MDL	0.02000	0.55500	17.00000	NA	0.00152	0.00896	0.02586	19.43910	2.76600	0.00530	2.99435	0.41232	
		% difference	<MDL	<MDL	0.00	<MDL	0.52	<MDL	<MDL	<MDL	<MDL	0.19	0.38	0.59	NA	2.56	2.82	12.73	1.14	492.03	0.02	16.25	5.24	23.90
		> 20% ?																			492.03			
4/14/09	TB15B Grab	TOLLWAY 203	<0.059	<0.131	3.69	<0.086	1.02	<0.00056	<0.017	<0.047	<0.0073	11.23	202	4147	6.4	0.02	0.33	0.12	2411	0.89	49.2	17.3	16.1	
4/14/09	TB15B Grab dupe	TOLLWAY 204	<0.059	<0.131	3.63	<0.086	1.01	<0.00056	<0.017	<0.047	<0.0073	11.22	206	4155		0.02	0.32	0.14	2402	0.90	49.1	19.1	15.5	
		difference	<MDL	<MDL	0.06000	<MDL	0.01040	<MDL	<MDL	<MDL	<MDL	0.01200	4.19000	8.00000	NA	0.00124	0.01399	0.02548	8.95447	0.00504	0.04835	1.85998	0.56981	
		% difference	<MDL	<MDL	1.63	<MDL	1.02	<MDL	<MDL	<MDL	<MDL	0.11	2.08	0.19	NA	5.47	4.24	21.58	0.37	0.56	0.10	10.76	3.54	6.10
		> 20% ?																						
4/29/09	WRP1-W	TOLLWAY 206	<0.059	<0.131	2.45	<0.086	0.166	0.00164	<0.017	<0.047	<0.0073	7.37	110	499	176	0.48	2.00	0.35	32.5	6.84	186	26.7	21.2	
4/29/09	WRP1 dupe	TOLLWAY 207	<0.059	<0.131	2.50	<0.086	0.169	<0.00056	<0.017	<0.047	<0.0073	7.40	112	516	155	0.46	2.08	0.38	32.2	6.77	185	28.0	21.6	
		difference	<MDL	<MDL	0.05000	<MDL	0.00231	<MDL	<MDL	<MDL	<MDL	0.02500	1.81400	17.00000	21.30000	0.01369	0.07993							

Appendix E: Results of Geochemical Analysis of Duplicate Samples

		Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S	
	Sample ID	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
	MDL:	0.0061	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
7/28/09	TB15B Grab	TOLLWAY 234	0.240	<0.108	0.084	0.0898	<0.00055	15.8	<0.012	<0.013	<0.0058	0.0110	0.0604	63.0	<0.018	3.43	0.0047	0.037	953	<0.014	<0.063	<0.041	18.2
7/28/09	TB15B Grab-dupe	TOLLWAY 246	0.211	<0.108	0.070	0.0895	<0.00055	13.7	<0.012	<0.013	<0.0058	0.0102	0.0348	60.6	<0.058	2.82	0.0037	<0.022	929	<0.014	<0.063	<0.041	18.1
		difference	0.02878	<MDL	0.01395	0.00026	<MDL	2.11717	<MDL	<MDL	<MDL	0.00083	0.02565	2.38820	<MDL	0.60419	0.00096	<MDL	23.61957	<MDL	<MDL	<MDL	0.13838
		% difference	11.99	<MDL	16.61	0.29	<MDL	13.40	<MDL	<MDL	<MDL	7.50	42.46	3.79	<MDL	17.62	20.52	<MDL	2.48	<MDL	<MDL	<MDL	0.76
		> 20% ?										42.46				20.52							
8/25/09	TB9A Grab	TOLLWAY 250	0.051	<0.108	0.077	0.139	<0.00055	36.0	<0.012	<0.013	<0.0058	0.0158	0.0178	97.7	<0.058	13.9	0.0031	0.040	1014	0.022	<0.063	<0.041	62.0
8/25/09	TB9A Grab dupe	TOLLWAY 251	<0.037	<0.108	0.073	0.134	<0.00055	34.9	<0.012	<0.013	<0.0058	0.0150	0.0115	96.2	<0.058	12.3	0.0032	0.031	990	0.020	<0.063	<0.041	59.3
		difference	<MDL	<MDL	0.00465	0.00495	<MDL	1.08244	<MDL	<MDL	<MDL	0.00084	0.00632	1.41445	<MDL	1.53958	0.00013	0.00981	23.72968	0.00178	<MDL	<MDL	2.69764
		% difference	<MDL	<MDL	6.02	3.55	<MDL	3.00	<MDL	<MDL	<MDL	5.32	35.58	1.45	<MDL	11.09	4.23	24.22	2.34	8.06	<MDL	<MDL	4.35
		> 20% ?										35.58					24.22						
9/8/09	TB15B Isco	TOLLWAY 257	0.099	<0.108	0.062	0.0325	<0.00055	19.2	<0.012	<0.013	<0.0058	0.00842	0.115	8.91	<0.058	3.70	<0.0015	<0.022	298	<0.014	0.120	<0.041	17.0
9/8/09	TB15B Isco dupe	TOLLWAY 258	0.047	<0.108	0.062	0.0319	<0.00055	19.2	<0.012	<0.013	<0.0058	0.0101	0.0550	8.90	<0.058	3.70	<0.0015	<0.022	296	<0.014	0.084	<0.041	17.0
		difference	0.05200	<MDL	0.00000	0.00057	<MDL	0.00000	<MDL	<MDL	<MDL	0.00163	0.06010	0.01000	<MDL	0.00100	<MDL	<MDL	2.00000	<MDL	0.03600	<MDL	0.00000
		% difference	52.53	<MDL	0.00	1.75	<MDL	0.00	<MDL	<MDL	<MDL	19.36	52.22	0.11	<MDL	0.03	<MDL	<MDL	0.67	<MDL	30.00	<MDL	0.00
		> 20% ?	52.53									52.22								30.00			
9/22/09	TB15B Grab	TOLLWAY 263	0.188	<0.108	0.082	0.111	<0.00055	21.3	<0.012	<0.013	<0.0058	0.0138	0.0602	68.1	<0.058	3.63	0.0092	0.083	829	0.016	<0.063	<0.041	60.5
9/22/09	TB15B Grab dupe	TOLLWAY 264	0.170	<0.108	0.082	0.113	<0.00055	21.6	<0.012	<0.013	<0.0058	0.0142	0.0477	68.6	<0.058	3.66	0.0084	0.082	839	0.015	<0.063	<0.041	60.9
		difference	0.01800	<MDL	0.00000	0.00154	<MDL	0.30000	<MDL	<MDL	<MDL	0.00040	0.01250	0.50000	<MDL	0.02400	0.00080	0.00100	10.00000	0.00100	<MDL	<MDL	0.40000
		% difference	9.57	<MDL	0.00	1.39	<MDL	1.41	<MDL	<MDL	<MDL	2.89	20.76	0.73	<MDL	0.66	8.70	1.20	10.00000	1.21	6.25	<MDL	0.66
		> 20% ?										20.76											
10/6/09	TB19r Grab dupe	TOLLWAY 269	0.048	<0.108	0.031	0.0441	<0.00055	23.5	<0.012	<0.013	<0.0058	0.00720	0.0212	83.4	<0.058	7.62	0.0027	0.035	449	<0.014	<0.063	<0.041	21.7
10/6/09	TB19r Grab	TOLLWAY 270	0.055	<0.108	0.037	0.0446	<0.00055	23.5	<0.012	<0.013	<0.0058	0.00942	0.0181	85.5	<0.058	7.81	0.0023	0.043	454	<0.014	<0.063	<0.041	21.6
		difference	0.00700	<MDL	0.00600	0.00043	<MDL	0.00000	<MDL	<MDL	<MDL	0.00222	0.00310	2.10000	<MDL	0.19300	0.00040	0.00800	5.00000	<MDL	<MDL	<MDL	0.10000
		% difference	14.58	<MDL	19.35	0.97	<MDL	0.00	<MDL	<MDL	<MDL	30.83	14.62	2.52	<MDL	2.53	14.81	22.86	1.11	<MDL	<MDL	<MDL	0.46
		> 20% ?										30.83						22.86					
10/20/09	TB15B Grab	TOLLWAY 283	0.571	<0.108	0.033	0.0325	<0.00055	8.46	<0.012	<0.013	<0.0058	0.0190	0.184	87.7	<0.058	0.178	0.0023	0.058	655	<0.014	0.089	<0.041	21.7
10/20/09	TB15B Grab dupe	TOLLWAY 282	0.559	<0.108	0.034	0.0310	<0.00055	8.11	<0.012	<0.013	<0.0058	0.0180	0.173	86.5	<0.058	0.171	0.0022	0.061	646	<0.014	0.096	<0.041	21.1
		difference	0.01200	<MDL	0.00100	0.00155	<MDL	0.35000	<MDL	<MDL	<MDL	0.00100	0.01080	1.20000	<MDL	0.00700	0.00010	0.00300	9.00000	<MDL	0.00700	<MDL	0.60000
		% difference	2.10	<MDL	3.03	4.77	<MDL	4.14	<MDL	<MDL	<MDL	5.25	5.89	1.37	<MDL	3.94	4.35	5.17	1.37	<MDL	7.87	<MDL	2.76
		> 20% ?																					
11/2/09	TB15B Grab dupe	TOLLWAY 291	0.681	<0.108	0.031	0.0612	<0.00055	15.8	<0.012	<0.013	<0.0058	0.0156	0.0701	65.5	<0.058	0.049	<0.0015	0.035	393	<0.014	<0.063	<0.041	14.2
11/2/09	TB15B Grab	TOLLWAY 292	0.673	<0.108	0.030	0.0613	<0.00055	15.7	<0.012	<0.013	<0.0058	0.0157	0.0657	66.1	<0.058	0.048	<0.0015	0.031	396	<0.014	<0.063	<0.041	14.0
		difference	0.00757	<MDL	0.00062	0.00012	<MDL	0.13033	<MDL	<MDL	<MDL	0.00015	0.00442	0.65095	<MDL	0.00138	<MDL	0.00449	3.12650	<MDL	<MDL	<MDL	0.22148
		% difference	1.11	<MDL	2.02	0.19	<MDL	0.82	<MDL	<MDL	<MDL	0.99	6.31	0.99	<MDL	2.82	<MDL	12.69	0.80	<MDL	<MDL	<MDL	1.56
		> 20% ?																					
11/16/19	WRP1-W	TOLLWAY 301	<0.037	<0.108	0.258	0.0499	<0.00055	149	<0.012	<0.013	<0.0058	0.00367	0.0167	7.06	<0.058	63.0	0.155	<0.022	76.2	0.047	0.189	<0.041	77.1
11/16/09	WRP1 dupe	TOLLWAY 302	<0.037	<0.108	0.263	0.0510	<0.00055	152	<0.012	<0.013	<0.0058	0.00387	0.0175	7.26	<0.058	63.8	0.154	<0.022	78.8	0.066	0.172	<0.041	77.9
		difference	<MDL	<MDL	0.00474	0.00114	<MDL	2.66718	<MDL	<MDL	<MDL	0.00020	0.00084	0.20261	<MDL	0.77998	0.00049	<MDL	2.62567	0.01847	0.01775	<MDL	0.79181
		% difference	<MDL	<MDL	1.83	2.28	<MDL	1.79	<MDL	<MDL	<MDL	5.53	5.06	2.87	<MDL	1.24	0.32	<MDL	3.45	39.02	9.38	<MDL	1.03
		> 20% ?																	39.02				
12/1/09	TB9A Grab	TOLLWAY 308	<0.037	<0.108	0.057	0.089	<0.00055	51.4	<0.012	<0.013	<0.0058	0.0108	0.0094	66.2	<0.058	16.9	0.0032	0.042	674	<0.014	<0.063	<0.041	72.8
12/1/09	TB9A Grab dupe	TOLLWAY 309	<0.037	<0.108	0.057	0.089	<0.00055	51.0	<0.012	<0.013	<0.0058	0.0110	0.0125	66.9	<0.058	16.4	0.0034	0.040	675	<0.014	<0.063	<0.041	72.5
		difference	<MDL	<MDL	0.00028	0.00060	<MDL	0.44932	<MDL	<MDL	<MDL	0.00015	0.00311	0.72391	<MDL	0.52126	0.00020	0.00154	0.88354	<MDL	<MDL	<MDL	0.32404
		% difference	<MDL	<MDL	0.50	0.68	<MDL	0.87	<MDL	<MDL	<MDL	1.43	33.14	1.09	<MDL	3.08	6.18	3.69	0.13	<MDL	<MDL	<MDL	0.45
		> 20% ?										33.14											
12/14/09	OR-1	TOLLWAY 326	<0.037	<0.108	0.035	0.0459	<0.00055	76.6	<0.012	<0.013	<0.0058	0.00094	0.402	9.76	<0.058	33.7	0.888	<0.022	62.5	0.027	0.235	<0.041	9.65
12/14/09	OR-1 dupe	TOLLWAY 327	<0.037	<0.108	0.033	0.0461	<0.00055	77.2	<0.012	<0.013	<0.0058	<0.00079	0.403	9.85	<0.058	34.8	0.883	<0.022	63.5	0.027			

Appendix E: Results of Geochemical Analysis of Duplicate Samples

			Sb	Se	Si	Sn	Sr	Ti	TI	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO ₄ -P	NH ₃ -N	F	Cl	NO ₃ -N	SO ₄	total NVOC	dissolved NVOC	mean relative
	Sample ID		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L as CaCO ₃	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% difference
	MDL:		0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31	and sample
7/28/09	TB15B Grab	TOLLWAY 234	<0.059	<0.131	0.878	<0.086	0.467	0.00125	<0.017	<0.047	<0.0073	9.03	162	2594	29.2	0.02	<0.06	0.28	760	<0.07	48.6	28.6	22.0	
7/28/09	TB15B Grab-dupe	TOLLWAY 246	<0.059	<0.131	0.703	<0.086	0.444	0.00064	<0.017	<0.047	<0.0073	9.03	162	2555	NA	0.01	0.06	0.28	759	<0.07	48.5	28.5	20.5	
		difference	<MDL	<MDL	0.17517	<MDL	0.02279	0.00061	<MDL	<MDL	<MDL	0.00400	0.66800	39.00000	NA	0.01014	<MDL	0.00584	1.03003	<MDL	0.01298	0.11111	1.50686	
		% difference	<MDL	<MDL	19.95	<MDL	4.88	48.62	<MDL	<MDL	<MDL	0.04	0.41	1.50	NA	45.12	<MDL	2.11	0.14	<MDL	0.03	0.39	6.84	11.63
		> 20% ?						48.62								45.12								
8/25/09	TB9A Grab	TOLLWAY 250	<0.059	<0.131	2.12	<0.086	1.01	<0.00056	<0.017	<0.047	<0.0073	9.21	91	2982	17	<0.01	0.34	0.10	1638	0.29	169	18.2	16.7	
8/25/09	TB9A Grab dupe	TOLLWAY 251	<0.059	<0.131	2.03	<0.086	0.975	<0.00056	<0.017	<0.047	<0.0073	9.19	91	3007	NA	<0.01	0.34	0.09	1645	0.29	171	18.0	17.5	
		difference	<MDL	<MDL	0.08672	<MDL	0.02967	<MDL	<MDL	<MDL	<MDL	0.02000	0.56080	25.00000	NA	<MDL	0.00082	0.00544	6.80841	0.00295	1.23878	0.13155	0.81884	
		% difference	<MDL	<MDL	4.10	<MDL	2.95	<MDL	<MDL	<MDL	<MDL	0.22	0.61	0.84	NA	<MDL	0.24	5.52	0.42	1.03	0.73	0.72	4.89	5.48
		> 20% ?						<MDL																
9/8/09	TB15B Isco	TOLLWAY 257	<0.059	<0.131	3.94	<0.086	0.170	0.00238	0.018	<0.047	<0.0073	8.06	129	774	237	0.10	0.12	0.24	349	0.34	48.6	21.8	10.3	
9/8/09	TB15B Isco dupe	TOLLWAY 258	<0.059	<0.131	3.83	<0.086	0.170	0.00110	<0.017	<0.047	<0.0073	8.06	129	775	NA	0.09	0.13	0.23	348	0.33	48.5	22.5	9.82	
		difference	<MDL	<MDL	0.11000	<MDL	0.00060	0.00128	<MDL	<MDL	<MDL	0.00100	0.07700	1.00000	NA	0.00826	0.00195	0.00769	0.84484	0.00486	0.07887	0.74603	0.48949	
		% difference	<MDL	<MDL	2.79	<MDL	0.35	53.78	<MDL	<MDL	<MDL	0.01	0.06	0.13	NA	8.56	1.58	3.22	0.24	1.43	0.16	3.43	4.75	9.49
		> 20% ?						53.78																
9/22/09	TB15B Grab	TOLLWAY 263	<0.059	<0.131	3.66	<0.086	0.481	0.00109	<0.017	<0.047	<0.0073	9.18	99	2392	9.6	0.010	0.10	0.17	1282	0.11	162	27.2	21.0	
9/22/09	TB15B Grab dupe	TOLLWAY 264	<0.059	<0.131	3.66	<0.086	0.485	0.00060	<0.017	<0.047	<0.0073	9.19	99	2379	NA	0.010	0.09	0.16	1277	0.12	161	27.3	21.1	
		difference	<MDL	<MDL	0.00000	<MDL	0.00443	0.00049	<MDL	<MDL	<MDL	0.01000	0.10160	13.00000	NA	0.00008	0.00583	0.00232	4.99763	0.00312	1.54806	0.04903	0.09741	
		% difference	<MDL	<MDL	0.00	<MDL	0.92	44.95	<MDL	<MDL	<MDL	0.11	0.10	0.54	NA	0.77	5.82	1.41	0.39	2.73	0.95	0.18	0.46	4.25
		> 20% ?						44.95																
10/6/09	TB19r Grab dupe	TOLLWAY 269	<0.059	<0.131	2.23	<0.086	0.508	<0.00056	<0.017	<0.047	<0.0073	10.46	125	1422		<0.003	0.18	0.21	725	0.08	60.4	19.7	19.7	
10/6/09	TB19r Grab	TOLLWAY 270	<0.059	<0.131	2.25	<0.086	0.510	<0.00056	<0.017	<0.047	<0.0073	10.46	125	1408	27.6	0.003	0.15	0.20	714	<0.07	60.7	19.9	19.1	
		difference	<MDL	<MDL	0.02000	<MDL	0.00203	<MDL	<MDL	<MDL	<MDL	0.00100	0.51200	14.00000	NA	<MDL	0.02711	0.01126	10.29870	<MDL	0.26082	0.14428	0.56367	
		% difference	<MDL	<MDL	0.90	<MDL	0.40	<MDL	<MDL	<MDL	<MDL	0.01	0.41	0.98	NA	<MDL	14.99	5.25	1.42	<MDL	0.43	0.73	2.87	6.65
		> 20% ?						<MDL																
10/20/09	TB15B Grab	TOLLWAY 283	<0.059	<0.131	4.69	<0.086	0.256	0.00133	<0.017	<0.047	<0.0073	10.63	158	1883	4.8	0.019	0.56	0.26	977	0.31	64.3	18.1	19.7	
10/20/09	TB15B Grab dupe	TOLLWAY 282	<0.059	<0.131	4.53	<0.086	0.248	0.00104	<0.017	<0.047	<0.0073	10.66	158	1871	NA	0.018	0.56	0.23	977	0.31	63.9	18.1	19.5	
		difference	<MDL	<MDL	0.16000	<MDL	0.00833	0.00029	<MDL	<MDL	<MDL	0.03700	0.21200	12.00000	NA	0.00023	0.00152	0.03344	0.17571	0.00044	0.35103	0.03951	0.17986	
		% difference	<MDL	<MDL	3.41	<MDL	3.25	21.80	<MDL	<MDL	<MDL	0.35	0.13	0.64	NA	1.22	0.27	12.64	0.02	0.14	0.55	0.22	0.91	3.61
		> 20% ?						21.80																
11/2/09	TB15B Grab dupe	TOLLWAY 291	<0.059	<0.131	4.78	<0.086	0.505	<0.00056	<0.017	<0.047	<0.0073	11.3	154	1164		0.013	0.41	0.23	570	0.35	42.0	13.8	12.3	
11/2/09	TB15B Grab	TOLLWAY 292	<0.059	<0.131	4.80	<0.086	0.507	<0.00056	<0.017	<0.047	<0.0073	11.3	155	1164	3.6	0.013	0.42	0.39	581	0.33	41.2	13.4	12.2	
		difference	<MDL	<MDL	0.01966	<MDL	0.00159	<MDL	<MDL	<MDL	<MDL	0.00800	0.39700	0.00000	NA	0.00007	0.00842	0.16024	11.97181	0.02185	0.75781	0.45150	0.03569	
		% difference	<MDL	<MDL	0.41	<MDL	0.31	<MDL	<MDL	<MDL	<MDL	0.07	0.26	0.00	NA	0.50	2.06	68.31	2.10	6.29	1.81	3.27	0.29	4.83
		> 20% ?						<MDL																
11/16/19	WRP1-W	TOLLWAY 301	<0.059	<0.131	4.14	<0.086	0.294	<0.00056	<0.017	<0.047	<0.0073	7.76	339	933	6.0	0.130	<0.06	0.25	123	0.21	272	12.0	11.2	
11/16/09	WRP1 dupe	TOLLWAY 302	<0.059	<0.131	4.21	<0.086	0.301	<0.00056	<0.017	<0.047	<0.0073	7.77	339	939	NA	0.131	<0.06	0.26	120	0.23	267	11.7	11.4	
		difference	<MDL	<MDL	0.07059	<MDL	0.00685	<MDL	<MDL	<MDL	<MDL	0.01200	0.71700	6.00000	NA	0.00016	<MDL	0.00541	2.41864	0.01207	4.75506	0.26446	0.16640	
		% difference	<MDL	<MDL	1.71	<MDL	2.33	<MDL	<MDL	<MDL	<MDL	0.15	0.21	0.64	NA	0.13	<MDL	2.12	1.97	5.63	1.75	2.20	1.48	3.92
		> 20% ?						<MDL																
12/1/09	TB9A Grab	TOLLWAY 308	<0.059	<0.131	2.29	<0.086	0.957	<0.00056	<0.017	<0.047	<0.0073	9.04	104	2130	6.4	<0.003	0.45	0.17	1056	2.44	204	12.4	9.48	
12/1/09	TB9A Grab dupe	TOLLWAY 309	<0.059	<0.131	2.29	<0.086	0.963	<0.00056	<0.017	<0.047	<0.0073	9.03	104	2136	NA	<0.003	0.46	0.18	1026	2.41	204	9.57	9.55	
		difference	<MDL	<MDL	0.00079	<MDL	0.00600	<MDL	<MDL	<MDL	<MDL	0.01000	0.13000	6.00000	NA	<MDL	0.00753	0.00257	29.78208	0.02158	0.32229	2.86514	0.07225	
		% difference	<MDL	<MDL	0.03	<MDL	0.63	<MDL	<MDL	<MDL	<MDL	0.11	0.12	0.28	NA	<MDL	1.66	1.48	2.82	0.89	0.16	23.04	0.76	3.62
		> 20% ?						<MDL																
12/14/09	OR-1	TOLLWAY 326	<0.059	<0.131	3.58	<0.086	0.233	<0.00056	<0.017	<0.047	<0.0073	7.72	260	577	7.2	0.172	<0.06	0.15	134	<0.07	26.7	17.6	16.1	
12/14/09	OR-1 dupe	TOLLWAY 327	<0.059	<0.131	3.56	<0.086	0.234	<0.00056	<0.017	<0.047	<0.0073	7.65	262	580	NA	0.175	<0.06	0.15	135	<0.07	26.8	18.0	15.7	
		difference	<MDL	<MDL																				

Appendix E: Results of Geochemical Analysis of Duplicate Samples

Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L	
MDL:	0.0061	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217	
3/29/10 OR-4	TOLLWAY 448	<0.037	<0.108	0.063	0.0300	<0.00055	92.2	<0.012	<0.013	<0.0058	<0.00079	0.0233	4.21	<0.058	42.9	0.108	<0.022	102	0.018	<0.063	<0.041	45.2
3/29/10 OR-4 dupe	TOLLWAY 449	<0.037	<0.108	0.059	0.0285	<0.00055	86.5	<0.012	<0.013	<0.0058	<0.00079	0.0172	3.99	<0.058	42.6	0.103	<0.022	95.5	0.018	<0.063	<0.041	42.9
	difference	<MDL	<MDL	0.00440	0.00158	<MDL	5.70431	<MDL	<MDL	<MDL	<MDL	0.00609	0.21543	<MDL	0.22049	0.00467	<MDL	6.45505	0.00017	<MDL	<MDL	2.26855
	% difference > 20% ?	<MDL	<MDL	6.94	5.25	<MDL	6.19	<MDL	<MDL	<MDL	<MDL	26.17	5.12	<MDL	0.51	4.34	<MDL	6.33	0.94	<MDL	<MDL	5.02
																						26.17
4/14/10 TB9A Grab	TOLLWAY 479	<0.037	<0.108	0.087	0.365	<0.00055	145	<0.012	<0.013	0.0080	0.0453	<0.0059	138	<0.058	12.7	<0.0015	0.043	4126	0.024	0.085	<0.041	84.0
4/14/10 TB9A Grab dupe	TOLLWAY 480	<0.037	<0.108	0.078	0.361	<0.00055	146	<0.012	<0.013	0.0070	0.0446	<0.0059	136	<0.058	12.9	<0.0015	0.048	4076	0.022	0.078	<0.041	83.2
	difference	<MDL	<MDL	0.00895	0.00376	<MDL	1.48784	<MDL	<MDL	0.00096	0.00070	<MDL	1.67281	<MDL	0.17674	<MDL	0.00465	49.25586	0.00261	0.00769	<MDL	0.85019
	% difference > 20% ?	<MDL	<MDL	10.30	1.03	<MDL	1.03	<MDL	<MDL	12.02	1.54	<MDL	1.22	<MDL	1.39	<MDL	10.78	1.19	10.81	9.00	<MDL	1.01
5/11/10 TB9A Grab	TOLLWAY 510	0.738	<0.108	0.041	0.058	<0.00055	49.4	<0.012	<0.013	0.006	0.0108	0.503	12.2	<0.058	12.0	0.0216	<0.022	384	<0.014	<0.063	<0.041	30.6
5/11/10 TB9A Grab dupe	TOLLWAY 511	0.965	<0.108	0.041	0.062	<0.00055	50.3	<0.012	<0.013	0.006	0.0116	0.641	12.7	<0.058	12.3	0.0240	<0.022	395	<0.014	<0.063	<0.041	31.6
	difference	0.22766	<MDL	0.00016	0.00434	<MDL	0.91621	<MDL	<MDL	0.00040	0.00079	0.13854	0.44782	<MDL	0.22149	0.00242	<MDL	10.75650	<MDL	<MDL	<MDL	0.97715
	% difference > 20% ?	30.86	<MDL	0.40	7.47	<MDL	1.86	<MDL	<MDL	6.56	7.31	27.55	3.66	<MDL	1.84	11.22	<MDL	2.80	<MDL	<MDL	<MDL	3.20
		30.86										27.55										
5/25/10 OR-1	TOLLWAY 530	<0.037	<0.108	0.031	0.0374	<0.00055	53.3	<0.012	<0.013	<0.0058	<0.00079	0.257	6.02	<0.058	23.8	1.57	<0.022	72.7	<0.014	0.077	<0.041	6.84
5/25/10 OR-1 dupe	TOLLWAY 531	<0.037	<0.108	0.028	0.0371	<0.00055	52.4	<0.012	<0.013	<0.0058	0.00117	0.257	5.97	<0.058	23.4	1.55	<0.022	71.9	<0.014	0.075	<0.041	6.73
	difference	<MDL	<MDL	0.00243	0.00032	<MDL	0.85056	<MDL	<MDL	<MDL	<MDL	0.00028	0.04344	<MDL	0.38074	0.02176	<MDL	0.79855	<MDL	0.00157	<MDL	0.11444
	% difference > 20% ?	<MDL	<MDL	7.90	0.85	<MDL	1.60	<MDL	<MDL	<MDL	<MDL	0.11	0.72	<MDL	1.60	1.39	<MDL	1.10	<MDL	2.04	<MDL	1.67
6/8/10 TB9A Grab	TOLLWAY 548	0.086	<0.108	0.051	0.181	<0.00055	62.9	<0.012	<0.013	<0.0058	0.0131	0.0871	65.2	<0.058	13.3	0.0689	0.026	1284	0.018	<0.063	<0.041	42.6
6/8/10 TB9A Grab dupe	TOLLWAY 549	0.103	<0.108	0.051	0.185	<0.00055	63.4	<0.012	<0.013	<0.0058	0.0133	0.0914	66.5	<0.058	13.7	0.0700	0.028	1309	<0.014	<0.063	<0.041	43.1
	difference	0.01726	<MDL	0.00021	0.00362	<MDL	0.54003	<MDL	<MDL	<MDL	0.00027	0.00434	1.32626	<MDL	0.41018	0.00116	0.00168	24.80713	<MDL	<MDL	<MDL	0.47163
	% difference > 20% ?	20.08	<MDL	0.41	2.00	<MDL	0.86	<MDL	<MDL	<MDL	2.07	4.98	2.03	<MDL	3.08	1.68	6.40	1.93	<MDL	<MDL	<MDL	1.11
6/22/10 TB9A Grab	TOLLWAY 578	0.231	<0.108	0.052	0.0668	<0.00055	22.6	<0.012	<0.013	<0.0058	0.0121	0.126	37.1	<0.058	5.26	0.0070	0.022	618	0.017	<0.063	<0.041	18.5
6/22/10 TB9A Grab dupe	TOLLWAY 579	0.208	<0.108	0.053	0.0687	<0.00055	23.2	<0.012	<0.013	<0.0058	0.0124	0.114	38.2	<0.058	5.47	0.0087	<0.022	638	0.016	<0.063	<0.041	19.0
	difference	0.02289	<MDL	0.00093	0.00198	<MDL	0.67121	<MDL	<MDL	<MDL	0.00037	0.01145	1.07544	<MDL	0.21053	0.00177	<MDL	20.10492	0.00111	<MDL	<MDL	0.52621
	% difference > 20% ?	9.89	<MDL	1.78	2.96	<MDL	2.98	<MDL	<MDL	<MDL	3.04	9.11	2.90	<MDL	4.01	25.42	<MDL	3.26	6.46	<MDL	<MDL	2.85
																25.42						
7/7/10 TB7B-1	TOLLWAY 597	<0.037	<0.108	0.155	0.0464	<0.00055	62.1	<0.012	<0.013	<0.0058	<0.00079	5.38	3.75	<0.058	24.9	0.347	<0.022	507	<0.014	0.069	<0.041	39.7
7/7/10 TB7B-1 dupe	TOLLWAY 598	<0.037	<0.108	0.151	0.0462	<0.00055	60.7	<0.012	<0.013	<0.0058	<0.00079	5.36	3.77	<0.058	23.3	0.341	<0.022	507	<0.014	<0.063	<0.041	39.4
	difference	<MDL	<MDL	0.00387	0.00025	<MDL	1.44382	<MDL	<MDL	<MDL	<MDL	0.01691	0.01055	<MDL	1.56256	0.00608	<MDL	0.43768	<MDL	<MDL	<MDL	0.33978
	% difference > 20% ?	<MDL	<MDL	2.49	0.53	<MDL	2.32	<MDL	<MDL	<MDL	<MDL	0.31	0.28	<MDL	6.28	1.75	<MDL	0.09	<MDL	<MDL	<MDL	0.86
7/19/10 TB15B Isco	TOLLWAY 627	0.985	<0.108	0.035	0.0306	<0.00055	15.9	<0.012	<0.013	0.0074	0.00547	0.607	6.64	<0.058	3.02	0.0075	<0.022	122	<0.014	<0.063	<0.041	7.46
7/19/10 TB15B Isco dupe	TOLLWAY 628	1.06	<0.108	0.034	0.0312	<0.00055	16.1	<0.012	<0.013	0.0081	0.00588	0.661	6.67	<0.058	3.12	0.0085	<0.022	122	<0.014	0.084	<0.041	7.57
	difference	0.07338	<MDL	0.00129	0.00065	<MDL	0.19292	<MDL	<MDL	0.00071	0.00041	0.05392	0.02707	<MDL	0.09652	0.00100	<MDL	0.29977	<MDL	<MDL	<MDL	0.11439
	% difference > 20% ?	7.45	<MDL	3.69	2.13	<MDL	1.21	<MDL	<MDL	9.58	7.55	8.88	0.41	<MDL	3.19	13.35	<MDL	0.25	<MDL	<MDL	<MDL	1.53
8/2/10 TB7B-1	TOLLWAY 630	0.041	<0.108	0.170	0.040	<0.00055	58.9	<0.012	<0.013	<0.0058	<0.00079	4.60	3.52	<0.058	21.1	0.324	<0.022	462	0.014	0.121	<0.041	39.2
8/2/10 TB7B-1 dupe	TOLLWAY 631	<0.037	<0.108	0.162	0.040	<0.00055	57.8	<0.012	<0.013	<0.0058	<0.00079	5.13	3.45	<0.058	21.0	0.328	<0.022	467	<0.014	0.105	<0.041	40.0
	difference	<MDL	<MDL	0.00750	0.00016	<MDL	1.08384	<MDL	<MDL	<MDL	<MDL	0.52418	0.07131	<MDL	0.15646	0.00409	<MDL	4.57034	<MDL	0.01560	<MDL	0.86067
	% difference > 20% ?	<MDL	<MDL	4.42	0.39	<MDL	1.84	<MDL	<MDL	<MDL	<MDL	11.39	2.03	<MDL	0.74	1.26	<MDL	0.99	<MDL	12.93	<MDL	2.20
8/16/10 OR-1	TOLLWAY 649	<0.037	<0.108	0.053	0.037	<0.00055	55.6	<0.012	<0.013	<0.0058	<0.00079	0.199	7.33	<0.058	23.3	0.548	<0.022	64.6	<0.014	0.082	<0.041	4.79
8/16/10 OR-1 dupe	TOLLWAY 650	<0.037	<0.108	0.052	0.037	<0.00055	54.7	<0.012	<0.013	<0.0058	<0.00079	0.191	7.17	<0.058	23.9	0.536	<0.022	63.1	<0.014	0.098	<0.041	4.73
	difference	<MDL	<MDL	0.00097	0.00081	<MDL	0.90289	<MDL	<MDL	<MDL	<MDL	0.00809	0.15722	<MDL	0.60453	0.01206	<MDL	1.54872	<MDL	0.01679	<MDL	0.06049
	% difference > 20% ?	<MDL	<MDL	1.85	2.17	<MDL	1.62	<MDL	<MDL	<MDL	<MDL	4.07	2.15	<MDL	2.59	2.20	<MDL	2.40	<MDL	20.57	<MDL	1.26
																				20.57		

Appendix E: Results of Geochemical Analysis of Duplicate Samples

			Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO ₄ -P	NH ₃ -N	F	Cl	NO ₃ -N	SO ₄	total NVOC	dissolved NVOC	mean relative % difference between dupe and sample
		Sample ID	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L as CaCO ₃	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31	
3/29/10	OR-4	TOLLWAY 448	<0.059	<0.131	2.37	<0.086	0.276	<0.00056	0.030	<0.047	<0.0073	8.21	236	714	3.2	0.012	<0.06	0.14	161	<0.07	121	7.34	6.42	
3/29/10	OR-4 dupe	TOLLWAY 449	<0.059	<0.131	2.24	<0.086	0.261	<0.00056	<0.017	<0.047	<0.0073	8.23	234	719		0.012	<0.06	0.14	161	<0.07	121	7.45	6.54	
		difference	<MDL	<MDL	0.13890	<MDL	0.01445	<MDL	<MDL	<MDL	<MDL	0.02000	1.77500	5.00000	NA	0.00018	<MDL	0.00010	0.28662	<MDL	0.06822	0.10176	0.12133	
		% difference > 20% ?	<MDL	<MDL	5.85	<MDL	5.24	<MDL	<MDL	<MDL	<MDL	0.24	0.75	0.70	NA	1.53	<MDL	0.08	0.18	<MDL	0.06	1.39	1.89	4.03
4/14/10	TB9A Grab	TOLLWAY 479	<0.059	<0.131	0.939	<0.086	3.07	<0.00056	<0.017	<0.047	0.0083	10.0	53	11755	12.8	0.006	1.23	<0.8 *	7121	0.43	217	15.1	20.0	
4/14/10	TB9A Grab dupe	TOLLWAY 480	<0.059	<0.131	0.940	<0.086	3.05	<0.00056	<0.017	<0.047	0.0073	10.0	54	11806		0.006	1.24	<0.8 *	7424	0.48	216	14.2	20.7	
		difference	<MDL	<MDL	0.00095	<MDL	0.02203	<MDL	<MDL	<MDL	0.00095	0.01700	0.82440	51.00000	NA	0.00001	0.01612	<MDL	302.66571	0.05263	1.25775	0.87336	0.75082	
		% difference > 20% ?	<MDL	<MDL	0.10	<MDL	0.72	<MDL	<MDL	<MDL	11.43	0.17	1.55	0.43	NA	0.20	1.31	<MDL	4.25	12.25	0.58	5.80	3.76	4.15
5/11/10	TB9A Grab	TOLLWAY 510	<0.059	<0.131	3.65	<0.086	0.434	0.0238	<0.017	<0.047	0.0089	9.47	106	1188	40.8	0.014	0.31	0.19	612	0.31	84.9	13.4	9.89	
5/11/10	TB9A Grab dupe	TOLLWAY 511	<0.059	<0.131	4.29	<0.086	0.444	0.0326	<0.017	<0.047	0.0107	9.44	106	1190		0.015	0.29	0.17	605	0.33	84.9	13.6	9.74	
		difference	<MDL	<MDL	0.64091	<MDL	0.01055	0.00879	<MDL	<MDL	0.00180	0.02500	0.20400	2.00000	NA	0.00129	0.01657	0.01479	7.18000	0.01813	0.05865	0.25511	0.14690	
		% difference > 20% ?	<MDL	<MDL	17.55	<MDL	2.43	37.01	<MDL	<MDL	20.13	0.26	0.19	0.17	NA	9.40	5.36	7.80	1.17	5.82	0.07	1.91	1.49	7.98
5/25/10	OR-1	TOLLWAY 530	<0.059	<0.131	0.489	<0.086	0.175	<0.00056	<0.017	<0.047	<0.0073	7.50	174	475	3.6	0.055	<0.06	0.17	135	<0.07	19.3	14.0	12.2	
5/25/10	OR-1 dupe	TOLLWAY 531	<0.059	<0.131	0.485	<0.086	0.173	<0.00056	<0.017	<0.047	<0.0073	7.52	174	493		0.056	0.07	0.16	135	<0.07	19.3	13.6	11.9	
		difference	<MDL	<MDL	0.00355	<MDL	0.00161	<MDL	<MDL	<MDL	<MDL	0.02000	0.42400	18.00000	NA	0.00142	<MDL	0.01025	0.37085	<MDL	0.02209	0.32975	0.24094	
		% difference > 20% ?	<MDL	<MDL	0.73	<MDL	0.92	<MDL	<MDL	<MDL	<MDL	0.27	0.24	3.79	NA	2.61	<MDL	6.04	0.27	<MDL	0.11	2.36	1.98	1.82
6/8/10	TB9A Grab	TOLLWAY 548	<0.059	<0.131	3.81	<0.086	1.12	0.00138	<0.017	<0.047	0.0082	8.68	157	3609	13.2	0.005	0.77	0.25	2034	0.12	116	15.0	16.0	
6/8/10	TB9A Grab dupe	TOLLWAY 549	<0.059	<0.131	3.85	<0.086	1.13	0.00190	<0.017	<0.047	0.0077	8.67	156	3617		0.005	0.73	0.25	2000	0.12	116	15.6	16.2	
		difference	<MDL	<MDL	0.04332	<MDL	0.01556	0.00052	<MDL	<MDL	0.00046	0.00900	0.80700	8.00000	NA	0.00031	0.03236	0.00475	34.18286	0.00218	0.15207	0.55580	0.14110	
		% difference > 20% ?	<MDL	<MDL	1.14	<MDL	1.40	37.51	<MDL	<MDL	5.62	0.10	0.51	0.22	NA	6.12	4.22	1.92	1.68	1.86	0.13	3.69	0.88	4.21
6/22/10	TB9A Grab	Tollway 578	<0.059	<0.131	2.19	<0.086	0.478	0.00331	<0.017	<0.047	0.0088	9.20	80	1762	16.4	0.021	0.17	0.36	985	<0.07	50.6	14.4	15.9	
6/22/10	TB9A Grab dupe	Tollway 579	<0.059	<0.131	2.23	<0.086	0.493	0.00328	<0.017	<0.047	0.0082	9.21	81	1776		0.020	0.17	0.36	978	<0.07	50.7	13.5	15.1	
		difference	<MDL	<MDL	0.03645	<MDL	0.01474	0.00002	<MDL	<MDL	0.00054	0.00600	0.72770	14.00000	NA	0.00043	0.00300	0.00114	6.71914	<MDL	0.09801	0.85721	0.88141	
		% difference > 20% ?	<MDL	<MDL	1.66	<MDL	3.08	0.61	<MDL	<MDL	6.15	0.07	0.91	0.79	NA	2.10	1.75	0.31	0.68	<MDL	0.19	5.97	5.53	4.02
7/7/10	TB7B-1	Tollway 597	<0.059	<0.131	6.00	<0.086	0.125	<0.00056	<0.017	<0.047	<0.0073	7.33	776	1524		0.020	1.53	0.31	328	<0.07	108	10.4	8.17	
7/7/10	TB7B-1 dupe	Tollway 598	<0.059	<0.131	5.95	<0.086	0.124	<0.00056	<0.017	<0.047	<0.0073	7.33	775	1519		0.016	1.52	0.31	330	0.11	109	10.6	8.33	
		difference	<MDL	<MDL	0.05016	<MDL	0.00091	<MDL	<MDL	<MDL	<MDL	0.00100	1.41800	5.00000	NA	0.00377	0.01516	0.00118	1.57278	<MDL	0.93056	0.14909	0.15951	
		% difference > 20% ?	<MDL	<MDL	0.84	<MDL	0.73	<MDL	<MDL	<MDL	<MDL	0.01	0.18	0.33	NA	18.80	0.99	0.38	0.48	<MDL	0.86	1.43	1.95	2.00
7/19/10	TB15B Isco	TOLLWAY 627	<0.059	<0.131	3.31	<0.086	0.112	0.0301	<0.017	<0.047	0.0092	7.86	60	386	65.0	0.084	<0.06	0.21	169	0.18	21.7	14.2	7.54	
7/19/10	TB15B Isco dupe	TOLLWAY 628	<0.059	<0.131	3.52	<0.086	0.112	0.0335	<0.017	<0.047	0.0087	7.87	60	386		0.086	0.07	0.20	169	0.17	21.6	14.8	12.6	
		difference	<MDL	<MDL	0.21166	<MDL	0.00033	0.00342	<MDL	<MDL	0.00052	0.00600	0.01800	0.00000	NA	0.00273	<MDL	0.00113	0.11468	0.00976	0.07287	0.53220	5.05022	
		% difference > 20% ?	<MDL	<MDL	6.40	<MDL	0.30	11.38	<MDL	<MDL	5.65	0.08	0.03	0.00	NA	3.27	<MDL	0.55	0.07	5.57	0.34	3.74	66.94	6.29
8/2/10	TB7B-1	TOLLWAY 630	<0.059	<0.131	6.05	<0.086	0.106	0.001	<0.017	<0.047	<0.0073	7.31	724	1438		0.073	1.58	0.35	289	<0.07	113	15.5	12.7	
8/2/10	TB7B-1 dupe	TOLLWAY 631	<0.059	<0.131	6.06	<0.086	0.108	0.001	<0.017	<0.047	<0.0073	7.34	702	1392		0.047	1.36	0.33	281	<0.07	112	13.7	12.8	
		difference	<MDL	<MDL	0.01339	<MDL	0.00131	0.00004	<MDL	<MDL	<MDL	0.03000	21.98900	46.00000	NA	0.02645	0.21921	0.01388	7.80003	<MDL	0.86946	1.74190	0.08090	
		% difference > 20% ?	<MDL	<MDL	0.22	<MDL	1.23	6.00	<MDL	<MDL	<MDL	0.41	3.04	3.20	NA	36.20	13.86	4.01	2.70	<MDL	0.77	11.26	0.64	5.29
8/16/10	OR-1	TOLLWAY 649	<0.059	<0.131	3.69	<0.086	0.202	<0.00056	<0.017	<0.047	<0.0073	7.21	188	467	6.0	0.039	<0.06	0.17	123	<0.07	12.7	19.5	19.3	
8/16/10	OR-1 dupe	TOLLWAY 650	<0.059	<0.131	3.59	<0.086	0.197	<0.00056	<0.017	<0.047	<0.0073	7.23	187	463		0.040	<0.06	0.17	122	<0.07	12.6	19.4	19.6	
		difference	<MDL	<MDL	0.09651	<MDL	0.00452	<MDL	<MDL	<MDL	<MDL	0.01400	0.80000	4.00000	NA	0.00046	<MDL	0.00156	0.87012	<MDL	0.08022	0.08798	0.31891	
		% difference > 20% ?	<MDL	<MDL	2.62	<MDL	2.24	<MDL	<MDL	<MDL	<MDL	0.19	0.42	0.86	NA	1.17	<MDL	0.91	0.71	<MDL	0.63	0.45	1.65	2.51
																								mean RPD of all samples
																								5.48

Appendix E: Results of Geochemical Analysis of Duplicate Samples

Date collected	Sample location	Sample ID MDL:	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
8/31/10	OR-2	TOLLWAY 670	<0.037	<0.11	0.047	0.0376	<0.00055	63.3	<0.012	<0.013	<0.0058	<0.00079	0.117	6.45	<0.11	27.2	0.293	<0.022	68.6	0.018	<0.073	<0.041	4.43
8/31/10	OR-2-dupe	TOLLWAY 671	<0.037	<0.11	0.046	0.0379	<0.00055	63.7	<0.012	<0.013	<0.0058	<0.00079	0.116	6.58	<0.11	28.8	0.295	<0.022	70.1	0.016	<0.073	<0.041	4.45
		difference			0.00078	0.00028		0.40699					0.00066	0.12799		1.62333	0.00225		1.49796	0.00135			0.01096
		% difference			1.66	0.75		0.64					0.57	1.98		5.97	0.77		2.18	7.64			0.25
		>20%?																					
9/13/10	OR-2	TOLLWAY 679	<0.037	<0.11	0.058	0.0326	<0.00055	66.2	<0.012	<0.013	<0.0058	<0.00079	0.180	6.17	<0.11	29.8	0.0900	<0.022	78.0	0.020	<0.073	<0.041	3.58
9/13/10	OR-2-dupe	TOLLWAY 681	<0.037	<0.11	0.057	0.0328	<0.00055	67.5	<0.012	<0.013	<0.0058	<0.00079	0.170	6.21	<0.11	30.2	0.0912	<0.022	78.2	0.022	<0.073	<0.041	3.69
		difference			0.00144321	0.0002768		1.32369232					0.009339005	0.03822		0.3953648	0.001150221		0.1926727	0.001553156			0.1144359
		% difference			2.48880244	0.849925327		2.00042176					5.19356086	0.619047		1.3283172	1.277423021		0.246944	7.614417836			3.1967389
		> 20% ?																					
9/27/10	OR-2	TOLLWAY 694	<0.037	<0.11	0.0545196	0.042865466	<0.00055	70.9287338	<0.012	<0.013	<0.0058	<0.00079	0.610650659	6.318085	<0.11	31.07406	0.317226887	<0.022	97.380653	0.02048015	<0.073	<0.041	2.7291813
9/27/10	OR-2-dupe	TOLLWAY 695	<0.037	<0.11	0.05486089	0.042679887	<0.00055	71.1310349	<0.012	<0.013	<0.0058	<0.00079	0.610147417	6.251206	<0.11	30.147568	0.315763205	<0.022	96.713806	0.025626168	<0.073	<0.041	2.7368038
		difference			0.00034129	0.00185579		0.20230102					0.000503242	0.066879		0.9264927	0.001463681		0.6668472	0.005146017			0.0076225
		% difference			0.62599288	0.432933585		0.2852173					0.082410785	1.05853		2.981563	0.461398911		0.6847841	25.12685307			0.2792955
		> 20% ?																					
10/11/10	OR-3	TOLLWAY 703	<0.037	<0.11	0.16754566	0.065763913	<0.00055	111.084534	<0.012	<0.013	<0.0058	<0.00079	0.025748482	6.87885	<0.11	57.966309	0.418512583	<0.022	125.97024	0.041813064	0.12404979	<0.041	63.297131
10/11/10	OR-3-dupe	TOLLWAY 704	<0.037	<0.11	0.16386382	0.06621182	<0.00055	111.223938	<0.012	<0.013	<0.0058	<0.00079	0.024316112	6.845215	<0.11	57.859203	0.419701606	<0.022	126.73582	0.040107206	0.176577926	<0.041	63.556549
		difference			0.00368184	0.000447906		0.1394043					0.00143237	0.033634		0.1071052	0.001189023		0.7655793	0.001705859	0.052528136	<0.041	0.2594185
		% difference			2.19751348	0.681082495		0.12549389					5.562931438	0.488951		0.1847716	0.284106918		0.6077462	4.079727053	42.34439689	<0.041	0.4098424
		> 20% ?																					
10/26/10	OR-3	TOLLWAY 712	<0.037	<0.11	0.13144745	0.06438788	<0.00055	106.119209	<0.012	<0.013	<0.0058	<0.00079	0.124778867	7.922625	<0.11	53.575531	0.575783134	<0.022	123.60593	0.031220125	0.167227507	<0.041	56.975079
10/26/10	OR-3-dupe	TOLLWAY 713	<0.037	<0.11	0.13092275	0.064026959	<0.00055	110.450264	<0.012	<0.013	<0.0058	<0.00079	0.125861526	7.813187	<0.11	55.437866	0.581637919	<0.022	122.20544	0.038988125	0.182797864	<0.041	57.949291
		difference			0.0005247	0.000360921		4.3310547					0.001082659	0.109438		1.8623352	0.005854785		1.4004898	0.007768	0.015570358	<0.041	0.9742126
		% difference			0.3991707	0.560541981		4.08131075					0.867661911	1.38134		3.4760928	1.016838643		1.133028	24.88138532	9.31088301	<0.041	1.7098926
		> 20% ?																					
11/8/10	OR-3	TOLLWAY 718	<0.037	<0.11	0.09616569	0.06196316	<0.00055	112.516846	<0.012	<0.013	<0.0058	0.002352723	0.039923206	5.696803	<0.11	57.263531	0.356253296	<0.022	124.41344	0.043104127	0.110903941	<0.041	49.200748
11/8/10	OR-3-dupe	TOLLWAY 719	<0.037	<0.11	0.09378966	0.061588544	<0.00055	111.304237	<0.012	<0.013	<0.0058	<0.00079	0.038313326	5.71001	<0.11	57.129856	0.354979307	<0.022	123.66311	0.046659086	0.155984715	<0.041	48.976078
		difference			0.00237603	0.000374615		1.2126083					0.001609881	0.013207		0.1336746	0.00127399		0.7503357	0.003554959	0.045080774	<0.041	0.2246704
		% difference			2.47076424	0.604577304		1.07771267					4.032442936	0.231839		0.2334376	0.357607807		0.6030986	8.247374782	40.64848648	<0.041	0.4566402
		> 20% ?																					
12/6/10	OR-2	TOLLWAY 726	<0.037	<0.11	0.03730252	0.061418742	<0.00055	118.665405	<0.012	<0.013	<0.0058	<0.00079	0.06906011	5.427563	<0.11	52.094608	1.065199733	<0.022	174.53548	0.045723319	0.083198734	<0.041	4.71913
12/6/10	OR-2 dupe	TOLLWAY 727	<0.037	<0.11	0.03706071	0.060187396	<0.00055	114.055092	<0.012	<0.013	<0.0058	<0.00079	0.071316294	5.322372	<0.11	51.202068	1.044411182	<0.022	169.66225	0.038419467	0.114628933	<0.041	4.5953174
		difference			0.00024182	0.001231346		4.6103134					0.002256185	0.105191		0.89254	0.020788551		4.87323	0.007303853	0.0314302	<0.041	0.1238127
		% difference			0.64825667	2.004837875		3.88513686					3.266986996	1.938084		1.7133059	1.951610609		2.7921143	15.97402101	37.77725747	<0.041	2.6236335
		> 20% ?																					
12/20/10	OR-1	TOLLWAY 735	<0.037	<0.11	0.03541271	0.082319237	<0.00055	134.871155	<0.012	<0.013	<0.0058	<0.00079	0.295662254	6.726971	<0.11	62.392231	2.562176466	<0.022	190.54456	0.031838901	0.139725283	<0.041	4.8914723
12/20/10	OR-1 dupe	TOLLWAY 736	<0.037	<0.11	0.04679511	0.084243961	<0.00055	139.01471	<0.012	<0.013	<0.0058	<0.00079	0.279726595	6.867887	<0.11	64.013702	2.642722368	<0.022	195.42957	0.028689185	0.185548112	<0.041	5.1590843
		difference			0.0113824	0.001924723		4.1435547					0.015935659	0.140917		1.6214714	0.080545902		4.8850097	0.003149716	0.045822829	<0.041	0.267612
		% difference			32.1421344	2.338121031		3.07223194					5.38981868	2.094804		2.5988354	3.143651621		2.5637099	9.8926658	32.79494454	<0.041	5.4709904
		> 20% ?			32.1421344																		
1/3/11	OR-2	TOLLWAY 742	<0.037	<0.11	0.03568124	0.049855109	<0.00055	98.3825302	<0.012	<0.013	<0.0058	<0.00079	0.566147625	8.173203	<0.11	46.583973	0.898023605	<0.022	147.44781	<0.014	0.083911397	<0.041	14.112561
1/3/11	OR-2 dupe	TOLLWAY 743	<0.037	<0.11	0.03523279	0.054113552	<0.00055	105.160362	<0.012	<0.013	<0.0058	<0.00079	0.602520645	8.82581	<0.11	49.959	0.975852191	<0.022	160.3665	<0.014	0.087730706	<0.041	15.436381
		difference			0.00044844	0.004258443		6.77783199					0.036373019	0.652607		3.3750267	0.077828586		12.918686	<0.014	0.003819309	<0.041	1.3238201
		% difference			1.25680342	8.541637477		6.88926375					6.424652806	7.984715		7.2450383	8.666652596		8.761531	<0.014	4.551597584	<0.041	9.3804384
		> 20% ?																					
1/19/11	OR-1	TOLLWAY 748	<0.037	<0.11	0.03767972	0.083751999	<0.00055	152.11734	<0.012	<0.013	<0.0058	<0.00079	3.180502653	8.088603	<0.11	71.389107							

Appendix E: Results of Geochemical Analysis of Duplicate Samples

Date collected	Sample location	Sample ID	Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO ₄ -P	NH ₃ -N	F	Cl	NO ₃ -N	SO ₄	total NVOC	dissolved NVOC	mean relative	
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L as CaCO ₃	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	% difference
			MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31	and sample
8/31/10	OR-2	TOLLWAY 670	<0.059	<0.13	3.00	<0.086	0.224	<0.00056	<0.017	<0.047	<0.0073	7.59	214	465	<3.0	0.019	<0.06	0.18	130	<0.07	10.9	21.6	19.9		
8/31/10	OR-2-dupe	TOLLWAY 671	<0.059	<0.13	3.05	<0.086	0.227	<0.00056	<0.017	<0.047	<0.0073	7.60	213	500		0.020	<0.06	0.18	131	<0.07	10.9	21.1	19.7		
		difference			0.04521		0.00283					0.00400	0.82900	35.00000		0.00055		0.00129	0.36182		0.01051	0.51078	0.22575		
		% difference >20%?			1.51		1.26					0.05	0.39	7.53		2.84		0.71	0.28		0.10	2.37	1.13	1.932151291	
9/13/10	OR-2	TOLLWAY 679	<0.059	<0.13	2.69	<0.086	0.224	<0.00056	<0.017	<0.047	<0.0073	7.61	222	541	<3.0	0.020	0.07	0.18	150	<0.07	9.16	18.5	19.2		
9/13/10	OR-2-dupe	TOLLWAY 681	<0.059	<0.13	2.70	<0.086	0.226	<0.00056	<0.017	<0.047	<0.0073	7.62	221	534		0.021	0.08	0.18	149	<0.07	9.18	18.4	18.3		
		difference			0.011473179		0.001150608					0.016	0.188	7		0.000646	0.00916	0.0061616	1.20314531		0.02029937	0.108372007	0.869075514		
		% difference > 20% ?			0.426959779		0.512609046					0.210332588	0.084852479	1.293900185		3.186661405	13.3277074	3.3500526	0.80293933		0.22157124	0.584651172	4.535182114	2.425137173	
9/27/10	OR-2	TOLLWAY 694	<0.059	<0.13	2.934200048	<0.086	0.236208439	<0.00056	<0.017	<0.047	<0.0073	7.56	231.874	585	2.4	0.036892	0.147814	0.1966884	186.314108	<0.07	6.3728592	18.80197548	18.30334693		
9/27/10	OR-2-dupe	TOLLWAY 695	<0.059	<0.13	2.92624259	<0.086	0.23466225	<0.00056	<0.017	<0.047	<0.0073	7.583	233.265	552		0.036366	0.148198	0.1990433	184.963714	<0.07	6.40389349	19.58007413	18.43970169		
		difference			0.007957458		0.001546189					0.023	1.391	33	2.4	0.000526	0.000384	0.0023548	1.35039387		0.03103429	0.778098651	0.13635476		
		% difference > 20% ?			0.271196846		0.654586774					0.304232804	0.59989477	5.641025641		1.425783368	0.25978595	1.1972448	0.72479421		0.48697594	4.138387753	0.74497173	2.203084513	
10/11/10	OR-3	TOLLWAY 703	<0.059	<0.13	3.515579939	<0.086	0.508281529	<0.00056	<0.017	<0.047	<0.0073	7.866	287.207	961	7.6	0.032496	0.172726	0.2237351	206.51764	0.224164452	169.469906	13.74122038	13.61021453		
10/11/10	OR-3-dupe	TOLLWAY 704	<0.059	<0.13	3.526619673	<0.086	0.511028349	<0.00056	<0.017	<0.047	<0.0073	7.872	287.953	940		0.033147	0.178683	0.2191024	206.330637	0.23169949	169.295423	13.82716821	13.23482819		
		difference			0.011039734		0.00274682					0.006	0.746	21	7.6	0.000651	0.005957	0.0046327	0.18700246	0.007535037	0.17448355	0.08594783	0.37538634		
		% difference > 20% ?			0.314023125		0.540413205					0.076277651	0.259742973	2.185223725		2.003323486	3.44881489	2.0706076	0.09055036	3.361388032	0.10295843	0.625474503	2.758122137	3.116811798	
10/26/10	OR-3	TOLLWAY 712	<0.059	<0.13	2.749922752	<0.086	0.480314255	<0.00056	<0.017	<0.047	<0.0073	7.876	285.276	944	12.4	0.037493	0.125787	0.194341	211.22839	<0.07	156.076551	18.88887341	15.27382669		
10/26/10	OR-3-dupe	TOLLWAY 713	<0.059	<0.13	2.764808655	<0.086	0.476973206	<0.00056	<0.017	<0.047	<0.0073	7.864	282.78	920		0.039972	0.128228	0.1897771	212.565047	<0.07	154.078822	19.09391492	15.07336338		
		difference			0.014885903		0.003341049					0.012	2.496	24	12.4	0.002479	0.002441	0.0045639	1.3366574		1.99772915	0.205041517	0.200463311		
		% difference > 20% ?			0.541320769		0.69559647					0.152361605	0.874942161	2.542372881		6.611900888	1.9405821	2.3484196	0.63280196		1.27996751	1.085514802	1.312462915	2.992886516	
11/8/10	OR-3	TOLLWAY 718	<0.059	<0.13	2.764528513	<0.086	0.446173877	<0.00056	0.01883502	<0.047	<0.0073	7.895	324.105	997	6.4	0.017407	0.247251	0.1799043	233.336749	<0.07	132.413915	14.803008	13.92817711		
11/8/10	OR-3-dupe	TOLLWAY 719	<0.059	<0.13	2.762547493	<0.086	0.444122434	<0.00056	<0.017	<0.047	<0.0073	7.91	323.938	989		0.017072	0.249511	0.1755803	233.574215	<0.07	132.438195	14.49401273	14.01886464		
		difference			0.00198102		0.002051443					0.015	0.167	8	6.4	0.000335	0.00226	0.004324	0.23746599		0.02428068	0.308995268	0.090687528		
		% difference > 20% ?			0.071658512		0.459785502					0.189993667	0.051526511	0.802407222		1.924513127	0.9140509	2.4035025	0.10176965		0.01833695	2.087381617	0.65110838	2.98434855	
12/6/10	OR-2	TOLLWAY 726	<0.059	<0.13	3.44201684	<0.086	0.403604776	<0.00056	<0.017	<0.047	<0.0073	7.619	334.443	977	24	0.007412	0.106078	0.1925916	384.763301	<0.07	11.111583	21.82014943	19.64999593		
12/6/10	OR-2 dupe	TOLLWAY 727	<0.059	<0.13	3.371948957	<0.086	0.397374272	<0.00056	<0.017	<0.047	<0.0073	7.615	333.994	965		0.007312	0.116548	0.1957876	377.742569	<0.07	11.1402766	21.70621992	19.67765663		
		difference			0.070067883		0.006230503					0.004	0.449	12	24	0.0001	0.01047	0.003196	7.02073136		0.02869357	0.11392951	0.027660697		
		% difference > 20% ?			2.035663573		1.543713993					0.052500328	0.134253072	1.228249744		1.349163519	9.87009559	1.6594542	1.82468841		0.25823113	0.522129836	0.140766935	4.13887634	
12/20/10	OR-1	TOLLWAY 735	<0.059	<0.13	5.040854931	<0.086	0.441893101	<0.00056	<0.017	<0.047	<0.0073	7.253	414.266	1201	17.2	0.010246	0.286694	0.2320294	436.544201	<0.07	12.9951649	24.09757692	19.04292837		
12/20/10	OR-1 dupe	TOLLWAY 736	<0.059	<0.13	5.147614002	<0.086	0.452813536	<0.00056	<0.017	<0.047	<0.0073	7.277	413.776	1211		0.010226	0.290286	0.1902261	438.958533	<0.07	13.0182364	24.76704638	18.66278768		
		difference			0.106759071		0.010920435					0.024	0.49	10	17.2	2E-05	0.003592	0.0418033	2.41433226		0.02307142	0.669469463	0.380140694		
		% difference > 20% ?			2.117876282		2.471284386					0.33089756	0.118281491	0.832639467		0.195198126	1.25290379	18.016391	0.55305562		0.17753846	2.778160912	1.996230236	5.754015832	
1/3/11	OR-2	TOLLWAY 742	<0.059	<0.13	4.123565674	<0.086	0.330378592	<0.00056	<0.017	<0.047	<0.0073	7.143	312.977	958	16.8	0.056225	0.508072	0.1864015	294.574595	0.183309532	41.5183078	21.86227593	19.26610092		
1/3/11	OR-2 dupe	TOLLWAY 743	<0.059	<0.13	4.424110889	<0.086	0.359882385	<0.00056	<0.017	<0.047	<0.0073	7.152	312.407	939		0.053586	0.503734	0.2060178	290.115902	0.185121151	41.8398863	21.6363733	18.12842188		
		difference			0.300545215		0.029503793					0.009	0.57	19	16.8	0.002639	0.004338	0.0196163	4.45869306		0.00181162	0.32157847	0.225902631	1.137679033	
		% difference > 20% ?			7.288478922		8.930297911					0.12599748	0.182122009	1.983298539		4.693641618	0.85381599	10.523708	1.51360407		0.988284591	0.77454618	1.033298784	5.905081875	4.978195921
1/19/11	OR-1	TOLLWAY 748	<0.059	<0.13	7.102138042	<0.086	0.469700307	<0.00056	<0.017	<0.047	<0.0073	7.075	473.989	1128	18.5	0.424534	0.866615	0.1362401	368.8859	<0.07	35.9283819	26.70654254	24.54353408		
1/19/11	OR-1 dupe	TOLLWAY 749	<0.059	<0.13	7.208257198	<0.086	0.477405876	<0.00056	<0.017	<0.047	<0.0073	7.085	476.778	1147		0.427601	0.86985	0.1490762	371.610382	<0.07	35.9606939	26.29061471	24.55110152		
		difference			0.106119156		0.007705569					0.01	2.789	19	18.5	0.003067	0.003235	0.0128361	7.22448201		0.03231198	0.415927839	0.007567445		
		% difference > 20% ?			1.494186052		1.640528884</																		

Appendix E Results of Geochemical Analysis of Duplicate Samples

Date collected	Sample location	Sample ID MDL:	Sb	Se	Si	Sn	Sr	Ti	Tl	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO ₄ -P	NH ₃ -N	F	Cl	NO ₃ -N	SO ₄	total NVOC	dissolved NVOC	% difference between dupe and sample
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L as CaCO ₃	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	
3/14/11	15-4U	TOLLWAY 781	<0.059	<0.13	4.370531082	<0.086	0.493319035	<0.00056	<0.017	<0.047	<0.0097	7.418	341.773	2020		0.029535	1.299782	0.1057368	872.403881	0.732885335	90.8686116	20.31359671	21.21817796	
3/14/11	15-4U dupe	TOLLWAY 782	<0.059	<0.13	4.330086231	<0.086	0.495048672	<0.00056	<0.017	<0.047	<0.0097	7.445	342.199	2051		0.029507	1.307245	0.1027729	885.147042	0.726185428	91.4520505	21.46799968	22.35887769	
		difference			0.040444851		0.001729637					0.027	0.426	31	0	2.8E-05	0.007463	0.0029639	12.7431616	0.006699906	0.58343887	1.154402969	1.140699732	
		% difference > 20% ?			0.925399002		0.350612338					0.363979509	0.124644135	1.534653465		0.094802776	0.57417321	2.803055	1.4606952	0.914182084	0.64206866	5.682907786	5.376049416	2.227319575
3/29/11	OR-3	TOLLWAY 804	<0.059	<0.13	2.248028517	<0.086	0.277864784	<0.00056	<0.017	<0.047	<0.0097	7.923	217.868	757	5.2	0.007575	<0.03	0.1337061	205.359288	0.089042421	108.222553	10.15412566	10.55164262	
3/29/11	OR-3 dupe	TOLLWAY 805	<0.059	<0.13	2.248783827	<0.086	0.279786855	<0.00056	<0.017	<0.047	<0.0097	7.938	219.096	707	5.2	0.007353	<0.03	0.1480044	207.916438	0.089592958	108.587899	10.44568858	10.07000432	
		difference			0.00075531		0.001922071					0.015	1.228	50	0	0.000222		0.0142983	2.55714984	0.000550537	0.36534584	0.29156292	0.481638294	
		% difference > 20% ?			0.033598773		0.691728895					0.189322226	0.563644041	6.605019815	0	2.930693069		10.693795	1.24520779	0.618286197	0.33758753	2.871373958	4.564581191	2.059718264
4/12/11	TB7B-2	TOLLWAY 829	<0.059	<0.13	4.439397812	<0.086	0.124333859	<0.00056	<0.017	<0.047	<0.0097	7.554	436.034	800		0.010359	0.050161	0.1910277	111.784476	7.339361542	117.49497	4.407601418	4.105679056	
4/12/11	TB7B-2 dupe	TOLLWAY 830	<0.059	<0.13	4.393872738	<0.086	0.125650957	<0.00056	<0.017	<0.047	<0.0097	7.532	445.425	862		0.008419	0.0462	0.1741247	115.804589	6.635513394	120.178786	4.169354914	4.099305418	
		difference			0.045525074		0.001317099					0.022	9.391	62	0	0.00194	0.003961	0.016903	4.02011292	0.703848147	2.6838168	0.238246504	0.006373638	
		% difference > 20% ?			1.025478588		1.059324239					0.291236431	2.153731131	7.75		18.72767642	7.89657303	8.8484577	3.59630699	9.590045993	2.2841972	5.405355005	0.155239562	6.47144104
4/25/11	OR1	TOLLWAY 834	<0.059	<0.13	2.14	<0.086	0.217	<0.00056	<0.017	<0.047	<0.0097	7.80	212	644	<3	0.005	0.06	0.15	193	<0.07	40.4	17.2	16.0	
4/25/11	OR1 dupe	TOLLWAY 835	<0.059	<0.13	2.06	<0.086	0.208	<0.00056	<0.017	<0.047	<0.0097	7.80	212	615		0.005	0.12	0.12	193	<0.07	40.3	16.9	16.4	
		difference			0.07920146		0.008971885					0.003	0.19	29		0.000133	0.055319	0.0220409	0.60728193		0.10330093	0.316200582	0.43005397	
		% difference > 20% ?			3.694999767		4.137957414					0.038641538	0.08961461	4.50310559		2.601212595	85.6755668	15.070232	0.31542958		0.25569196	1.837526923	2.689338311	7.850175765
5/9/11	SBNP DD out dup	TOLLWAY 861	<0.059	<0.13	0.926	<0.086	0.316	<0.00056	<0.017	<0.047	<0.0097	8.06	269	540		<0.003	<0.03	0.33	120	<0.07	62.1	9.56	8.19	
5/9/11	SBNP DD out	TOLLWAY 860	<0.059	<0.13	0.899	<0.086	0.307	<0.00056	<0.017	<0.047	<0.0097	8.04	269	548	<3.0	<0.003	0.14	0.27	120	<0.07	62.1	9.74	8.26	
		difference			0.027195394		0.008777499					0.023	0.673	8			0.0603269	0.01321065		0.01123384	0.182754727	0.070872899		
		% difference > 20% ?			2.936364468		2.778359242					0.285253628	0.250494102	1.481481481			18.252673	0.01101981		0.01809359	1.911368793	0.865041497		3.667644444
5/23/11	OR2	TOLLWAY 891	<0.059	<0.13	0.690	<0.086	0.242	<0.00056	<0.017	<0.047	<0.0097	7.72	235	658	<3.0	0.014	0.06	0.12	206	<0.07	27.8	16.7	14.9	
5/23/11	OR2 dupe	TOLLWAY 892	<0.059	<0.13	0.686	<0.086	0.242	<0.00056	<0.017	<0.047	<0.0097	7.73	233	643		0.016	0.04	0.12	206	<0.07	27.8	17.0	14.9	
		difference			0.004225671		0.000238478					0.017	2.05	15		0.001189	0.019648	0.0056419	0.11441617		0.03469272	0.278166728	0.022565391	
		% difference > 20% ?			0.612191643		0.098668282					0.22032141	0.872503788	2.279635258		8.294963025	32.8726786	4.5602959	0.05561555		0.12478433	1.665193253	0.151822922	3.440342749
6/8/11	TB15B-1L	TOLLWAY 932	<0.059	0.14	8.61	<0.086	3.88	<0.00056	0.031	<0.047	<0.0097	7.23	357	4640		0.012	0.11	<1 *	2501	<0.07	199	3.24	2.53	
6/8/11	dup	TOLLWAY 931	<0.059	0.19	8.52	<0.086	3.86	<0.00056	0.024	<0.047	<0.0097	7.29	358	4507		0.012	0.13	<1 *	2482	<0.07	199	3.11	2.59	
		difference		0.054688	0.086894989		0.026997805		0.0074295			0.056	0.866	133	0	0.000228	0.020362		18.7998557		0.39656874	0.13248918	0.055565634	
		% difference > 20% ?		39.43467	1.009790813		0.695294313		23.6495747			0.774443369	0.242447318	2.86637931		1.882586079	18.2919051		0.75184269		0.19975456	4.088162426	2.192818156	6.302929024
6/20/11	OR3	TOLLWAY 948	<0.059	<0.13	2.37	<0.086	0.295	<0.00056	0.025	<0.047	<0.0097	7.92	235	691	8.8	0.030	0.08	0.14	161	<0.07	86.8	16.7	16.3	
6/20/11	OR3	TOLLWAY 949	<0.059	<0.13	2.27	<0.086	0.284	<0.00056	<0.017	<0.047	<0.0097	7.92	235	677	8.0	0.029	0.09	0.14	161	<0.07	87.0	18.2	16.5	
		difference			0.102680206		0.01139009					0.005	0.543	14	0.8	0.000783	0.009183	0.0035584	0.15681715		0.10980859	1.464687539	0.160520406	
		% difference > 20% ?			4.333661931		3.855939907					0.063139285	0.230976354	2.026049204	9.09090909	2.63140207	11.9247351	2.5905358	0.09738381		0.12643892	8.758283612	0.982001553	3.953456869
7/5/11		TOLLWAY 978	<0.059	<0.13	7.190	<0.086	0.545	<0.00056	<0.017	<0.047	<0.0097	8.100	300.000	702.000	5.200	0.017	<0.03	0.310	138.000	0.370	103.000	6.900	5.990	
7/5/11	dup	TOLLWAY 979	<0.059	<0.13	7.090	<0.086	0.539	<0.00056	<0.017	<0.047	<0.0097	8.100	301.000	693.000		0.017	<0.03	0.290	138.000	0.370	103.000	7.190	5.940	
		difference			0.1		0.006					0	1	9	5.2	0	0	0.02	0	0	0	0.29	0.05	
		% difference > 20% ?			1.390820584		1.100917431					0	0.333333333	1.282051282		0		6.4516129	0	0	0	4.202898551	0.834724541	2.234739515
7/18/11	OR3	TOLLWAY 992	<0.059	<0.13	5.37	<0.086	0.323	0.00150	<0.017	<0.047	<0.0097	7.89	265	856	8.4	0.127	0.18	0.35	235	0.10	53.3	16.3	16.8	
7/18/11	OR3	TOLLWAY 993	<0.059	<0.13	5.14	<0.086	0.310	0.00159	<0.017	<0.047	<0.0097	7.90	265	836		0.136	0.18	0.35	237	0.09	53.3	16.6	16.8	
		difference			0.236203194		0.012789249	9.24E-05				0.005	0.637	20	8.4	0.008361	0.0005	0.0015379	2.38062524	0.009066424	0.04430555	0.269027392	0.035398486	
		% difference > 20% ?			4.394702204		3.956945473	6.171174				0.06334727	0.24019789	2.336448598		6.562485283	0.28123383	0.433487	1.0135845	8.72875597	0.0830494	1.651285943	0.210853527	3.763196328
8/3/11	TB15-1L	TOLLWAY 1034	<0.059	0.22	9.68	<0.086	3.69	<0.00056	<0.017	<0.047	<0.0097	7.22	357	4227		0.020	<0.03	0.31	2348	<0.07	209	3.25	2.58	
8/3/11	TB15-1L	TOLLWAY 1035	<0.059	0.17	9.47	<0.086	3.61	<0.00056	0.023	<0.047	<0.0097	7.22	357	4263		0.021	<0.03	0.25	2341	<0.07	211	3.46	2.34	

Appendix E: Results of Geochemical Analysis of Duplicate Samples

Date collected	Sample location	Sample ID MDL:	Al	As	B	Ba	Be	Ca	Cd	Co	Cr	Cu	Fe	K	Li	Mg	Mn	Mo	Na	Ni	P	Pb	S
			mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
3/14/11	15-4U	TOLLWAY 781	<0.037	<0.11	0.1462274	0.174179152	<0.00055	149.486496	<0.012	<0.013	<0.0058	0.007547597	<0.024	38.47551	<0.11	42.909443	0.180320546	<0.022	568.25946	<0.043	0.18422246	<0.041	33.869411
3/14/11	15-4U dupe	TOLLWAY 782	<0.037	<0.11	0.15089335	0.174059749	<0.00055	148.018601	<0.012	<0.013	<0.0058	0.007230137	<0.024	37.31554	<0.11	42.895939	0.190016866	<0.022	564.20734	<0.043	0.161475703	<0.041	33.717152
		difference			0.00466594	0.000119403		1.4678955				0.00031746		1.159969		0.013504	0.00969632		4.052124		0.022746757		0.1522598
		% difference			3.19088	0.06855189		0.9819586				4.206107202		3.014825		0.031471	5.377268379		0.7130764		12.34743946		0.4495497
		> 20% ?																					
3/29/11	OR-3	TOLLWAY 804	<0.037	<0.11	0.05339115	0.039242748	<0.00055	85.7701416	<0.012	<0.013	<0.0058	<0.00079	0.088614546	5.817227	<0.11	41.305424	0.115393192	<0.022	118.20419	<0.043	0.126738727	<0.041	37.418041
3/29/11	OR-3 dupe	TOLLWAY 805	<0.037	<0.11	0.05219252	0.039869607	<0.00055	85.8240128	<0.012	<0.013	<0.0058	<0.00079	0.092300683	5.675356	<0.11	41.681641	0.116439462	<0.022	116.88779	<0.043	0.124803335	<0.041	37.817173
		difference			0.00119863	0.000626858		0.05387116				0.003686138	0.141871	0.003686138		0.3762169	0.00104627		1.3164062		0.001935393		0.3991318
		% difference			2.2449202	1.597386342		0.06280876				4.159743151	2.438808	0.003686138		0.9108172	0.906700028		1.1136713		1.527072777		1.0666827
		> 20% ?																					
4/12/11	TB7B-2	TOLLWAY 829	<0.037	<0.11	0.16520311	0.035164196	<0.00055	96.2842636	<0.012	<0.013	<0.0058	0.002144913	<0.024	0.646081	<0.11	96.828461	0.036718532	<0.022	70.944305	<0.043	0.141387701	<0.041	42.364388
4/12/11	TB7B-2 dupe	TOLLWAY 830	<0.037	<0.11	0.16106816	0.034627724	<0.00055	98.3486023	<0.012	<0.013	<0.0058	0.00208853	<0.024	0.670305	<0.11	99.194832	0.051620144	<0.022	73.516083	<0.043	0.119820356	<0.041	44.737904
		difference			0.00413495	0.000536472		2.06433868				5.63828E-05	0.024224	0.024224		2.3663712	0.014901612		2.5717773		0.021567345		2.3735161
		% difference			2.50295107	1.525618843		2.14400423				2.628675382	3.749306	0.024224		2.4438798	40.58335403		3.6250652		15.25404575		5.602621
		> 20% ?															40.58335403						
4/25/11	OR1	TOLLWAY 834	<0.037	<0.11	0.035	0.0375	<0.00055	68.5	<0.012	<0.013	<0.0058	<0.00079	0.052	6.28	<0.11	31.7	0.0110	<0.022	102	<0.043	0.139	<0.041	14.1
4/25/11	OR1 dupe	TOLLWAY 835	<0.037	<0.11	0.033	0.0361	<0.00055	66.1	<0.012	<0.013	<0.0058	<0.00079	0.050	5.99	<0.11	30.7	0.0104	<0.022	96.4	<0.043	0.124	<0.041	13.6
		difference			0.00205272	0.001495484		2.49078369				0.002702989	0.288883			1.013916	0.00061466		5.7084046		0.015022449		0.4813576
		% difference			5.81926729	3.982874232		3.63359856				5.157479585	4.599185			3.1975383	5.576418617		5.5885249		10.82520455		3.4146388
		> 20% ?																					
5/9/11	SBNP DD out dup	TOLLWAY 861	<0.037	<0.11	0.083	0.0374	<0.00055	82.6	<0.012	<0.013	<0.0058	0.00113	0.064	1.85	<0.11	39.2	0.0565	<0.022	70.8	<0.043	0.133	<0.041	22.2
5/9/11	SBNP DD out	TOLLWAY 860	<0.037	<0.11	0.081	0.0362	<0.00055	78.0	<0.012	<0.013	<0.0058	0.00131	0.062	1.82	<0.11	37.4	0.0532	<0.022	70.9	<0.043	0.134	<0.041	21.2
		difference			0.00232042	0.001175713		4.64409637				0.000179166	0.001861542	0.026818		1.8003159	0.003356665		0.0406189		0.001610801		1.0301437
		% difference			2.78381494	3.146650795		5.62187509				15.87728317	2.909677073	1.453508		4.5910108	5.940246288		0.0573332		1.213764127		4.6352209
		> 20% ?																					
5/23/11	OR2	TOLLWAY 891	<0.037	<0.11	0.042	0.0417	<0.00055	77.3	<0.012	<0.013	<0.0058	<0.00079	0.078	7.62	<0.11	36.4	0.0694	<0.022	112	<0.043	0.127	<0.041	10.3
5/23/11	OR2 dupe	TOLLWAY 892	<0.037	<0.11	0.041	0.0417	<0.00055	76.2	<0.012	<0.013	<0.0058	<0.00079	0.076	7.71	<0.11	36.1	0.0680	<0.022	112	<0.043	0.143	<0.041	10.0
		difference			0.00056901	1.97663E-05		1.0929184				0.001453645	0.090202			0.2190247	0.001402617		0.2991562		0.015994772		0.2607498
		% difference			1.36153265	0.047412243		1.41342105				1.875049699	1.183786			0.6023814	2.022370736		0.2659909		12.56941994		2.5375023
		> 20% ?																					
6/8/11	TB15B-1L	TOLLWAY 932	<0.037	<0.11	0.109	0.107	<0.00055	472	<0.012	<0.013	<0.0058	<0.00079	0.058	5.71	<0.11	376	0.0168	<0.022	687	<0.043	0.196	<0.041	89.8
6/8/11	dup	TOLLWAY 931	<0.037	<0.11	0.106	0.106	<0.00055	476	<0.012	<0.013	<0.0058	<0.00079	0.069	5.85	<0.11	382	0.0168	<0.022	689	<0.043	0.158	<0.041	87.6
		difference			0.00278623	0.000941858		4.523468				0.010856018	0.13439			5.4803772	2.373E-06		2.0407105		0.038001448		2.1165619
		% difference			2.55380479	0.883101061		0.95843164				18.57754605	2.351589			1.4567684	0.01411516		0.2971096		19.43722432		2.3580066
		> 20% ?																					
6/20/11	OR3	TOLLWAY 948	<0.037	<0.11	0.089	0.0390	<0.00055	82.5	<0.012	<0.013	<0.0058	<0.00079	0.127	5.64	<0.11	39.7	0.189	<0.022	100	<0.043	0.246	<0.041	32.6
6/20/11	OR3	TOLLWAY 949	<0.037	<0.11	0.083	0.0376	<0.00055	78.4	<0.012	<0.013	<0.0058	<0.00079	0.120	5.51	<0.11	38.6	0.181	<0.022	97.3	<0.043	0.229	<0.041	31.3
		difference			0.00596741	0.001387335		4.11001587				0.007283889	0.124189			1.163372	0.007911533		2.9637528		0.017038733		1.3113098
		% difference			6.69625585	3.554729426		4.98298208				5.739732882	2.20302			2.9293011	4.193930927		2.9546017		6.937907124		4.0255903
		> 20% ?																					
7/5/11	dup	TOLLWAY 978	<0.037	<0.11	0.088	0.044	<0.00055	106.000	<0.012	<0.013	<0.0058	<0.00079	<0.024	1.510	<0.11	42.700	0.045	<0.022	96.900	<0.043	0	<0.041	38.500
7/5/11	dup	TOLLWAY 979	<0.037	<0.11	0.087	0.044	<0.00055	104.000	<0.012	<0.013	<0.0058	<0.00079	<0.024	1.510	<0.11	42.100	0.044	<0.022	96.400	<0.043	0	<0.041	37.900
		difference			0.001	0.0004		2				<0.00079	<0.024	0		0.6	0.0008		0.5		0.037		0.6
		% difference			1.13636364	0.900900901		1.88679245				<0.00079	<0.024	0		1.4051522	1.77383592		0.5159959		22.15568862		1.5584416
		> 20% ?																			22.15568862		
7/18/11	OR3	TOLLWAY 992	0.064	<0.11	0.078	0.0469	<0.00055	85.9	<0.012	<0.013	<0.0058	0.00098	0.204	7.18	<0.11	47.5	0.749	<0.022	132	<0.043	0.315	<0.041	19.5
7/18/11	OR3	TOLLWAY 993	0.068	<0.11	0.075	0.0449	<0.00055	82.1	<0.012	<0.013	<0.0058	0.00112	0.196	6.89	<0.11	44.9	0.720	<0.022	126	<0.043	0.321	<0.041	18.6
		difference	0.003644004		0.00360953	0.002081316		3.79040528				0.0001395	0.007944822	0.28838		2.5969582	0.029462814		5.8978729		0.00531435		0.9396496
		% difference	5.672013936		4.61151611	4.433862942		4.41223084				14.29721498	3.889338038	4.015749		5.4684639	3.933033788		4.4790274		1.684993705		4.8181083
		> 20% ?																					
8/3/11	TB15-1L	TOLLWAY 1034	<0.037	<0.11	0.122	0.107	<0.00055	483	<0.012	<0.013	<0.0058	0.00112	<0.024	7.12	<0.11	369	0.0150	<0.022	676	<0.043	0.225	<0.041	77.2
8/3/11	TB15-1L	TOLLWAY 1035	<0.037	<0.11	0.119	0.105	<0.00055	465	<0.012	<0.013	<0.0058	0.00115	<0.024	6.93	<0.11	351	0.0136	<0.022	659	<0.043	0.233	<0.041	76.0
		difference			0.00260039	0.001954041		18.2655945				3.65533E-05	0.189107			17.870667	0.001452937		16.395386		0.007962465		1.272377
</																							

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
		MDL:	0.0061	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
8/29/11	TB19gw grab	TOLLWAY 1080	<0.037	<0.11	0.152	0.105	<0.00055	105	<0.012	<0.013	<0.0058	0.00859	0.076	31.1	<0.11	32.8	0.0534	0.026	215	<0.043	0.156	<0.041	47.7
8/29/11	TB19gw grab duplicate	TOLLWAY 1081	<0.037	<0.11	0.151	0.104	<0.00055	103	<0.012	<0.013	<0.0058	0.00876	0.073	31.0	<0.11	31.1	0.0525	<0.022	214	<0.043	0.179	<0.041	46.8
		difference			0.001	0.0005		2.1				0.00017	0.0024	0.11		1.7	0.0009	0	0.82		0.023		0.85
		% difference			0.41	0.45		2.01				1.98	3.18	0.35		5.19	1.65		0.38		14.68		1.78
		>20%?																					
9/12/11	OR3	TOLLWAY 1106	0.105	<0.11	0.168	0.0532	<0.00055	99.7	<0.012	<0.013	<0.0058	<0.00079	0.209	6.93	<0.11	54.9	0.171	<0.022	118	<0.043	<0.073	<0.041	64.5
9/12/11	OR3 duplicate	TOLLWAY 1107	0.069	<0.11	0.166	0.0525	<0.00055	99.3	<0.012	<0.013	<0.0058	<0.00079	0.185	6.88	<0.11	54.7	0.169	<0.022	117	<0.043	<0.073	<0.041	64.9
		difference	0.036		0.002	0.0007		0.41				0.024	0.04			0.17	0.003		0.78				0.43
		% difference	34.20		1.00	1.29		0.41				11.45	0.64			0.32	1.51		0.66				0.67
		> 20% ?	34.20																				
9/28/11	TB15Bgw grab	TOLLWAY 1138	0.889	<0.11	0.045	0.0428	<0.00055	49.8	<0.012	<0.013	<0.0058	0.00949	0.780	16.4	<0.11	8.04	0.0274	0.023	291	<0.043	0.302	<0.041	26.6
9/28/11	TB15Bgw grab duplicate	TOLLWAY 1139	0.880	<0.11	0.047	0.0434	<0.00055	50.6	<0.012	<0.013	<0.0058	0.00949	0.765	16.7	<0.11	8.10	0.0283	<0.022	296	<0.043	0.298	<0.041	27.0
		difference	0.009		0.001	0.0006		0.83				0.000004	0.015	0.29		0.06	0.0010		5.31		0.004		0.40
		% difference	1.02		2.90	1.32		1.66				0.04	1.86	1.76		0.69	3.49		1.82		1.26		1.50
		> 20% ?																					
10/10/11	TB19gw grab	TOLLWAY 1152	<0.037	<0.11	0.117	0.0831	<0.00055	98.7	<0.012	<0.013	<0.0058	0.00624	0.079	24.8	<0.11	34.0	0.0494	<0.022	233	<0.043	0.211	<0.041	59.6
10/10/11	TB19gw grab duplicate	TOLLWAY 1153	<0.037	<0.11	0.124	0.0841	<0.00055	101	<0.012	<0.013	<0.0058	0.00628	0.078	25.0	<0.11	35.1	0.0504	<0.022	236	<0.043	0.225	<0.041	61.3
		difference			0.007	0.001		2.81				0.00005	0.001	0.20		1.11	0.0010		3.64		0.014		1.73
		% difference			6.00	1.26		2.85				0.77	0.94	0.79		3.27	2.07		1.57		6.45		2.90
		> 20% ?																					
10/26/11	TB19gw grab	TOLLWAY 1201	0.082	<0.11	0.067	0.0514	<0.00055	66.6	<0.012	<0.013	<0.0058	0.00615	0.062	18.4	<0.11	19.5	0.0258	<0.022	190	<0.043	0.118	<0.041	32.5
10/26/11	TB19gw grab duplicate	TOLLWAY 1202	0.085	<0.11	0.066	0.0522	<0.00055	68.7	<0.012	<0.013	<0.0058	0.00651	0.064	18.5	<0.11	20.2	0.0261	<0.022	194	<0.043	0.161	<0.041	33.7
		difference	0.002		0.001	0.0008		2.14				0.00036	0.002	0.12		0.737	0.0004		3.58		0.043		1.15
		% difference	2.66		1.74	1.53		3.21				5.85	3.97	0.64		3.78	1.43		1.88				3.53
		> 20% ?																					
11/7/11	TB9A grab	TOLLWAY 1224	<0.037	<0.11	0.075	0.124	<0.00055	75.7	<0.012	<0.013	<0.0058	0.00796	<0.024	58.9	<0.11	16.7	0.0091	<0.022	1011	<0.043	0.127	<0.041	44.2
11/7/11	TB9A grab duplicate	TOLLWAY 1225	<0.037	<0.11	0.068	0.123	<0.00055	74.9	<0.012	<0.013	<0.0058	0.00729	<0.024	59.4	<0.11	16.6	0.0086	<0.022	1010	<0.043	0.121	<0.041	44.2
		difference			0.007	0.001		0.714				0.00067		0.52		0.07	0.0005		0.775		0.006		0.03
		% difference			9.63	1.05		0.94				8.37		0.88		0.40	5.35		0.08		4.83		0.07
		> 20% ?																					
11/30/11	TB7Bin grab	TOLLWAY 1267	<0.037	<0.11	0.187	0.0653	<0.00055	145	<0.012	<0.013	<0.0058	0.00528	0.067	34.3	<0.11	46.4	0.0273	0.029	1524	<0.043	0.190	<0.041	269
11/30/11	TB7Bin grab duplicate	TOLLWAY 1269	<0.037	<0.11	0.178	0.0644	<0.00055	142	<0.012	<0.013	<0.0058	0.00512	0.063	34.2	<0.11	45.8	0.0267	<0.022	1485	<0.043	0.122	<0.041	262
		difference			0.008	0.0009		2.57				0.00016	0.004	0.11		0.55	0.0006		38.6		0.068		7.68
		% difference			4.52	1.34		1.77				2.99	5.99	0.31		1.18	2.34		2.53		36.00		2.85
		> 20% ?																					
12/12/11	TB19gw grab	TOLLWAY 1288	<0.037	<0.11	0.089	0.0646	<0.00055	87.0	<0.012	<0.013	<0.0058	0.00556	0.031	20.6	<0.11	28.1	0.0355	<0.022	196	<0.043	0.133	<0.041	53.2
12/12/11	TB19gw grab duplicate	TOLLWAY 1289	<0.037	<0.11	0.098	0.0646	<0.00055	86.4	<0.012	<0.013	<0.0058	0.00461	0.026	20.5	<0.11	28.0	0.0353	<0.022	195	<0.043	0.166	<0.041	53.2
		difference			0.009	0.0001		0.56				0.00095	0.006	0.09		0.111	0.0002		1.04		0.033		0.04
		% difference			10.10	0.08		0.64				17.09	18.31	0.46		0.40	0.62		0.53		25.12		0.08
		> 20% ?																					
1/3/12	TB19gw grab	TOLLWAY 1309	<0.037	<0.11	0.054	0.0724	<0.00055	104	<0.012	<0.013	<0.0058	0.00569	<0.024	26.4	<0.11	23.4	0.0108	<0.022	376	<0.043	0.182	<0.041	32.4
1/3/12	TB19gw grab duplicate	TOLLWAY 1310	<0.037	<0.11	0.057	0.0735	<0.00055	104	<0.012	<0.013	<0.0058	0.00540	<0.024	26.9	<0.11	23.8	0.0112	<0.022	379	<0.043	0.211	<0.041	32.6
		difference			0.003	0.0012		0.13				0.00029		0.53		0.40	0.0004		3.77		0.029		0.22
		% difference			6.24	1.60		0.13				5.05		2.02		1.72	3.83		1.00		15.78		0.68
		> 20% ?																					
1/18/12	TB9A grab	TOLLWAY 1360	<0.037	<0.11	0.055	0.249	<0.00055	202	<0.012	<0.013	<0.0058	0.0106	<0.024	51.6	<0.11	39.0	0.0327	<0.022	2480	<0.043	0.135	0.043	108
1/18/12	TB9A grab duplicate	TOLLWAY 1361	<0.037	<0.11	0.054	0.254	<0.00055	207	<0.012	<0.013	<0.0058	0.0117	<0.024	53.2	<0.11	39.9	0.0340	<0.022	2566	<0.043	0.134	<0.041	111
		difference			0.0002	0.004		4.95				0.0011		1.55		0.91	0.0013		86.3		0.0002		2.37
		% difference			0.40	1.77		2.45				10.80		3.00		2.33	4.00		3.48		0.18		2.19
		> 20% ?																					
2/1/12	TB15Bgw grab	TOLLWAY 1384	<0.037	<0.11	0.029	0.179	<0.00055	189	<0.012	<0.013	<0.0058	0.00436	<0.024	37.9	<0.11	18.5	0.0061	<0.022	1572	<0.043	0.217	<0.041	35.6
2/1/12	TB15Bgw grab duplicate	TOLLWAY 1385	0.039	<0.11	0.029	0.181	<0.00055	193	<0.012	<0.013	<0.0058	0.00382	<0.024	38.4	<0.11	18.8	0.0061	<0.022	1619	<0.043	0.204	<0.041	36.3
		difference			0.0001	0.001		3.35				0.00055		0.47		0.30	0.0001		46.8		0.013		0.71

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L	mean relative % difference between duplicate and original sample
		MDL:	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31	
8/29/11	TB19gw grab	TOLLWAY 1080	<0.059	<0.13	8.34	<0.086	0.563	<0.00056	<0.017	<0.047	<0.0097	7.42	348	1025	<3.0	0.038	<0.03	0.30	274	1.80	135	14.5	13.8	
8/29/11	TB19gw grab duplicate	TOLLWAY 1081	<0.059	<0.13	8.25	<0.086	0.561	<0.00056	<0.017	<0.047	<0.0097	7.43	347	1020	NA	0.038	<0.03	0.30	264	1.80	135	14.7	13.9	
		difference			0.09		0.003					0.01	0.97	5.00		0.00004		0.002	9.58	0.0004	0.07	0.12	0.06	
		% difference			1.14		0.45					0.18	0.28	0.49		0.11		0.70	3.50	0.02	0.05	0.82	0.44	1.75
		>20%?																						
9/12/11	OR3	TOLLWAY 1106	<0.059	<0.13	1.82	<0.086	0.452	0.00760	0.023	<0.047	<0.0097	7.96	273	838	6.8	0.026	0.06	0.23	167	0.15	196	14.4	14.0	
9/12/11	OR3 duplicate	TOLLWAY 1107	<0.059	<0.13	1.73	<0.086	0.449	0.00581	<0.017	<0.047	<0.0097	8.02	272	843	NA	0.026	0.06	0.23	173	0.15	196	14.5	13.8	
		difference			0.10		0.003	0.00179				0.07	0.96	5.00		0.0002	0.005	0.001	5.86	0.003	0.15	0.10	0.22	
		% difference			5.29		0.65	23.57				0.84	0.35	0.60		0.63	8.51	0.23	3.51	2.27	0.08	0.68	1.58	4.21
		> 20% ?						23.57																
9/28/11	TB15Bgw grab	TOLLWAY 1138	<0.059	<0.13	6.13	<0.086	0.214	0.0232	<0.017	<0.047	<0.0097	8.07	150	977	3.6	0.159	<0.03	0.34	412	1.38	72.0	15.1	14.1	
9/28/11	TB15Bgw grab duplicate	TOLLWAY 1139	<0.059	<0.13	6.19	<0.086	0.217	0.0228	<0.017	<0.047	<0.0097	8.08	149	981	NA	0.160	<0.03	0.34	414	1.38	72.1	15.6	13.8	
		difference			0.07		0.003	0.0004				0.01	1.32	4.00		0.001		0.003	1.64	0.001	0.16	0.53	0.25	
		% difference			1.06		1.51	1.52				0.12	0.88	0.41		0.55		0.76	0.40	0.06	0.22	3.50	1.79	1.28
		> 20% ?																						
10/10/11	TB19gw grab	TOLLWAY 1152	<0.059	<0.13	6.94	<0.086	0.576	<0.00056	<0.017	<0.047	<0.0097	7.63	278	1053	0.8	0.021	<0.03	0.33	306	2.13	170	13.9	14.3	
10/10/11	TB19gw grab duplicate	TOLLWAY 1153	<0.059	<0.13	7.08	<0.086	0.587	<0.00056	<0.017	<0.047	<0.0097	7.64	277	1057	NA	0.022	<0.03	0.33	311	2.14	170	13.9	14.3	
		difference			0.14		0.010					0.007	1.21	4.00		0.001		0.01	5.48	0.01	0.60	0.01	0.02	
		% difference			2.05		1.80					0.09	0.44	0.38		3.66		1.72	1.79	0.60	0.35	0.08	0.17	1.83
		> 20% ?																						
10/26/11	TB19gw grab	TOLLWAY 1201	<0.059	<0.13	5.83	<0.086	0.344	0.00111	<0.017	<0.047	<0.0097	7.94	206	817	<3.0	0.030	<0.03	0.41	272	1.32	89.4	11.3	11.3	
10/26/11	TB19gw grab duplicate	TOLLWAY 1202	<0.059	<0.13	5.96	<0.086	0.352	0.00127	<0.017	<0.047	<0.0097	7.96	206	813	NA	0.031	<0.03	0.28	275	1.30	89.5	11.5	11.4	
		difference			0.12		0.007	0.00016				0.02	0.88	4.00		0.0003		0.14	2.61	0.02	0.11	0.19	0.09	
		% difference			2.11		2.04	14.26				0.21	0.43	0.49		0.87		33.09	0.96	1.35	0.12	1.66	0.77	4.98
		> 20% ?																33.09						
11/7/11	TB9A grab	TOLLWAY 1224	<0.059	<0.13	0.206	<0.086	0.825	<0.00056	<0.017	<0.047	0.0108	8.60	220	2973	3.2	<0.003	<0.03	0.49	1580	<0.07	116.8	19.6	18.7	
11/7/11	TB9A grab duplicate	TOLLWAY 1225	<0.059	<0.13	0.203	<0.086	0.823	<0.00056	<0.017	<0.047	0.0115	8.61	221	2984	NA	0.004	<0.03	0.50	1577	<0.07	117.0	19.8	19.1	
		difference			0.003		0.002				0.0008	0.008	0.30	11.0		0.007		0.007	2.33		0.28	0.20	0.44	
		% difference			1.50		0.22				7.09	0.09	0.13	0.37				1.45	0.15		0.24	1.00	2.35	2.20
		> 20% ?																						
11/30/11	TB7Bin grab	TOLLWAY 1267	<0.059	<0.13	6.55	<0.086	1.41	<0.00056	<0.017	<0.047	<0.0097	8.22	300	4474	3.2	0.013	<0.03	0.46	1889	0.81	739	12.6	12.2	
11/30/11	TB7Bin grab duplicate	TOLLWAY 1269	<0.059	<0.13	6.38	<0.086	1.39	<0.00056	0.020	<0.047	<0.0097	8.23	302	4491	NA	0.013	<0.03	0.45	1908	0.81	741	12.6	12.3	
		difference			0.18		0.03					0.01	1.38	17.0		0.00003		0.006	19.1	0.0002	2.60	0.05	0.07	
		% difference			2.70		1.89					0.15	0.46	0.38		0.19		1.32	1.01	0.02	0.35	0.41	0.56	3.10
		> 20% ?																						
12/12/11	TB19gw grab	TOLLWAY 1288	<0.059	<0.13	5.21	<0.086	0.494	<0.00056	0.028	<0.047	<0.0097	7.61	241	927	<3.0	0.016	<0.03	0.24	276	1.61	143	12.5	11.8	
12/12/11	TB19gw grab duplicate	TOLLWAY 1289	<0.059	<0.13	5.21	<0.086	0.492	<0.00056	0.020	<0.047	<0.0097	7.65	240	915	NA	0.016	<0.03	0.24	273	1.63	142	11.9	12.3	
		difference			0.001		0.002		0.008			0.05	1.10	12.0		0.0001		0.006	3.18	0.02	0.60	0.64	0.50	
		% difference			0.01		0.49		27.49			0.59	0.46	1.29		0.35		2.32	1.15	0.99	0.42	5.10	4.25	4.93
		> 20% ?							27.49															
1/3/12	TB19gw grab	TOLLWAY 1309	<0.059	<0.13	4.47	<0.086	0.665	<0.00056	<0.017	<0.047	<0.0097	8.19	170	1413	<3.0	0.018	0.04	0.18	652	1.31	92.2	10.4	10.1	
1/3/12	TB19gw grab duplicate	TOLLWAY 1310	<0.059	<0.13	4.50	<0.086	0.672	<0.00056	<0.017	<0.047	<0.0097	8.21	169	1392	NA	0.018	0.06	0.19	651	1.30	92.0	10.1	10.0	
		difference			0.02		0.008					0.02	1.21	21.0		0.00008		0.007	0.92	0.007	0.25	0.22	0.03	
		% difference			0.51		1.16					0.20	0.71	1.49		0.46		51.83	3.76	0.14	0.52	2.14	0.25	4.41
		> 20% ?																51.83						
1/18/12	TB9A grab	TOLLWAY 1360	<0.059	<0.13	2.51	<0.086	1.90	<0.00056	<0.017	<0.047	0.0152	8.30	134	7335	7.6	0.009	0.06	<0.3 *	4250	1.76	194	14.1	13.1	
1/18/12	TB9A grab duplicate	TOLLWAY 1361	<0.059	<0.13	2.58	<0.086	1.95	<0.00056	<0.017	<0.047	0.0160	8.31	133	7461	NA	0.009	0.06	<0.3 *	4116	1.75	288	13.7	13.0	
		difference			0.07		0.05				0.0008	0.009	0.64	126.0		0.0002		0.003	134	0.006	94.0	0.35	0.04	
		% difference			2.78		2.44				5.41	0.11	0.48	1.72		1.67		4.83	3.15	0.33	48.45	2.51	0.32	4.56
		> 20% ?																			48.45			
2/1/12	TB15Bgw grab	TOLLWAY 1384	<0.059	<0.13	3.15	<0.086	1.17	<0.00056	<0.017	<0.047	<0.0097	8.64	115	4744	<3.0	0.042	0.03	0.50	2713	1.19	103	10.3	9.83	
2/1/12	TB15Bgw grab duplicate	TOLLWAY 1385	<0.059	<0.13	3.20	<0.086	1.18	<0.00056	<0.017	<0.047	<0.0097	8.65	115	4735	NA	0.043	0.04	0.52	2706	1.19	103	10.4	10.1	
		difference			0.05		0.02</																	

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
		MDL:	0.0061	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	0.217
2/29/12	TB15Bgw grab	TOLLWAY 1449	0.335	<0.11	0.024	0.0883	<0.00055	97.9	<0.012	<0.013	<0.0058	0.00791	0.202	21.5	<0.11	12.9	0.0021	<0.022	1143	<0.043	0.207	<0.041	27.3
2/29/12	TB15Bgw grab duplicate	TOLLWAY 1450	0.318	<0.11	0.023	0.0864	<0.00055	95.9	<0.012	<0.013	<0.0058	0.00746	0.212	21.3	<0.11	12.8	0.0022	<0.022	1145	<0.043	0.265	<0.041	27.2
		difference	0.017		0.0007	0.0019		1.91				0.00044	0.011	0.24		0.16	0.0001		2.11		0.059		0.12
		% difference	4.93		2.87	2.12		1.95				5.58	5.46	1.12		1.23	6.87		0.18		28.41		0.44
		> 20% ?																			28.41		
3/12/12	TB19gw grab	TOLLWAY 1463	0.094	<0.11	0.044	0.113	<0.00055	116	<0.012	<0.013	<0.0058	0.0118	0.090	31.5	<0.11	25.7	0.0056	<0.022	1070	<0.043	0.232	<0.041	26.8
3/12/12	TB19gw grab duplicate	TOLLWAY 1465	0.097	<0.11	0.051	0.116	<0.00055	119	<0.012	<0.013	<0.0058	0.0120	0.087	32.6	<0.11	26.0	0.0060	<0.022	1119	<0.043	0.138	<0.041	27.3
		difference	0.003		0.007	0.003		3.15				0.0002	0.003	1.02		0.37	0.0004		48.4		0.095		0.49
		% difference	2.80		15.87	2.23		2.71				1.67	3.35	3.23		1.45	6.45		4.52		40.77		1.83
		> 20% ?																			40.77		
3/27/12	TB19gw grab	TOLLWAY 1501	0.078	<0.11	0.094	0.0980	<0.00055	97.6	<0.012	<0.013	<0.0058	0.00894	0.061	29.0	<0.11	38.4	0.0094	<0.022	528	<0.043	0.157	<0.041	33.9
3/27/12	TB19gw grab duplicate	TOLLWAY 1502	0.058	<0.11	0.095	0.100	<0.00055	99.0	<0.012	<0.013	<0.0058	0.00887	0.043	29.7	<0.11	39.9	0.0093	<0.022	539	<0.043	0.182	<0.041	34.8
		difference	0.020		0.001	0.002		1.39				0.00007	0.017	0.68		1.46	0.00005		10.6		0.025		0.98
		% difference	25.93		1.29	2.06		1.42				0.79	28.39	2.35		3.80	0.58		2.01		15.77		2.89
		> 20% ?											28.39										
4/12/12	OR3	TOLLWAY 1540	<0.037	<0.11	0.085	0.0519	<0.00055	114	<0.012	<0.013	<0.0058	<0.00079	<0.024	7.16	<0.11	60.6	0.316	<0.022	126	<0.043	0.208	<0.041	53.0
4/12/12	OR3 duplicate	TOLLWAY 1541	<0.037	<0.11	0.083	0.0513	<0.00055	110	<0.012	<0.013	<0.0058	<0.00079	<0.024	7.20	<0.11	58.7	0.307	<0.022	126	<0.043	0.176	<0.041	51.3
		difference			0.002	0.0006		3.98						0.03		1.96	0.010		0.50		0.032		1.71
		% difference			2.03	1.24		3.49						0.48		3.23	3.05		0.39		15.52		3.23
		> 20% ?																					
4/25/12	TB15Bgw grab	TOLLWAY 1566	<0.037	<0.11	0.046	0.148	<0.00055	119	<0.012	<0.013	<0.0058	0.00423	<0.024	32.4	<0.11	18.5	<0.0015	<0.022	1190	<0.043	0.223	<0.041	37.8
4/25/12	TB15Bgw grab duplicate	TOLLWAY 1567	<0.037	<0.11	0.046	0.148	<0.00055	118	<0.012	<0.013	<0.0058	0.00462	0.042	32.9	<0.11	17.8	<0.0015	<0.022	1234	<0.043	0.234	<0.041	38.2
		difference			0.0003	0.0006		0.96				0.00039	0.50	0.50		0.67			43.7		0.010		0.36
		% difference			0.66	0.40		0.81				9.23	1.56	1.56		3.61			3.67		4.61		0.94
		> 20% ?																					
5/7/12	TB19gw grab	TOLLWAY 1585	1.24	<0.11	0.062	0.0439	<0.00055	43.7	<0.012	<0.013	<0.0058	0.0128	0.897	13.8	<0.11	14.3	0.0160	<0.022	276	<0.043	0.258	<0.041	13.7
5/7/12	TB19gw grab duplicate	TOLLWAY 1586	1.05	<0.11	0.061	0.0435	<0.00055	41.7	<0.012	<0.013	<0.0058	0.0131	0.764	15.2	<0.11	13.9	0.0145	<0.022	286	<0.043	0.221	<0.041	13.4
		difference	0.192		0.0006	0.0004		1.95				0.0003	0.133	1.42		0.46	0.0015		9.7		0.037		0.36
		% difference	15.46		0.93	0.86		4.47				2.26	14.83	10.30		3.23	9.39		3.52		14.29		2.62
		> 20% ?																					
5/23/12	TB15-1L	TOLLWAY 1624	<0.037	<0.11	0.110	0.108	<0.00055	496	<0.012	<0.013	<0.0058	0.00108	0.036	5.22	<0.11	409	0.0063	<0.022	697	<0.043	0.182	<0.041	84.5
5/23/12	TB15-1L duplicate	TOLLWAY 1625	<0.037	<0.11	0.106	0.106	<0.00055	503	<0.012	<0.013	<0.0058	0.00098	0.032	5.21	<0.11	405	0.0065	<0.022	694	<0.043	0.219	<0.041	82.2
		difference			0.004	0.001		7.12				0.00010	0.005	0.003		3.64	0.0003		2.56		0.038		2.24
		% difference			3.28	1.17		1.44				9.59	12.89	0.07		0.89	4.18		0.37		20.67		2.65
		> 20% ?																			20.67		
6/4/12	TB15Bgw grab	TOLLWAY 1635	0.140	<0.11	0.045	0.0979	<0.00055	82.6	<0.012	<0.013	<0.0058	0.0108	0.140	28.1	<0.11	10.9	0.0110	0.028	892	<0.043	0.281	<0.041	30.9
6/4/12	TB15Bgw grab duplicate	TOLLWAY 1636	0.131	<0.11	0.046	0.1000	<0.00055	85.0	<0.012	<0.013	0.0059	0.0111	0.129	29.3	<0.11	11.1	0.0107	0.028	921	<0.043	0.348	<0.041	31.3
		difference	0.009		0.001	0.0020		2.42				0.0002	0.011	1.2		0.16	0.0004	0.0009	28.7		0.067		0.42
		% difference	6.72		2.75	2.08		2.93				2.14	7.97	4.27		1.44	3.22	3.07	3.22		23.99		1.36
		> 20% ?																			23.99		
6/19/12	TB15Bgw grab	TOLLWAY 1666	0.215	<0.11	0.057	0.0761	<0.00055	68.3	<0.012	<0.013	<0.0058	0.0131	0.206	22.5	<0.11	10.9	0.0164	<0.022	622	<0.043	0.136	<0.041	26.6
6/19/12	TB15Bgw grab duplicate	TOLLWAY 1667	0.224	<0.11	0.058	0.0760	<0.00055	69.8	<0.012	<0.013	<0.0058	0.0135	0.196	22.6	<0.11	11.2	0.0162	<0.022	629	<0.043	0.158	<0.041	26.9
		difference	0.009		0.0003	0.00007		1.47				0.0004	0.010	0.06		0.36	0.0001		7.08		0.022		0.31
		% difference	4.32		0.55	0.09		2.15				2.84	4.89	0.26		3.27	0.87		1.14		16.06		1.15
		> 20% ?																					
7/2/12	TB19gw grab	TOLLWAY 1677	<0.037	<0.11	0.086	0.101	<0.00055	88.9	<0.012	<0.013	<0.0058	0.00967	0.030	32.9	<0.11	27.6	0.0208	<0.022	598	<0.043	0.075	<0.041	53.0
7/2/12	TB19gw grab duplicate	TOLLWAY 1678	<0.037	<0.11	0.084	0.102	<0.00055	86.2	<0.012	<0.013	<0.0058	0.00974	0.031	33.4	<0.11	27.1	0.0206	<0.022	602	<0.043	<0.073	<0.041	52.8
		difference			0.002	0.0007		2.68				0.00007	0.001	0.50		0.46	0.0002		4.13				0.26
		% difference			2.22	0.73		3.02				0.72	3.83	1.53		1.65	0.91		0.69				0.48
		> 20% ?																					
7/18/12	TB19gw grab	TOLLWAY 1689	0.052	<0.11	0.095	0.0830	<0.00055	75.9	<0.012	<0.013	<0.0058	0.0103	0.051	26.2	<0.11	25.4	0.0248	<0.022	386	<0.043	0.105	<0.041	47.8
7/18/12	TB19gw grab duplicate	TOLLWAY 1690	0.056	<0.11	0.100	0.0846	<0.00055	77.9	<0.012	<0.013	<0.0058	0.0107	0.047	27.0	<0.11	26.6	0.0244	<0.022	394	<0.043	<0.073	<0.041	48.2
		difference	0.003		0.005	0.0016		2.01				0.0004	0.004	0.77									

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID MDL	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L	mean relative % difference between duplicate and original sample	
2/29/12	TB15Bgw grab	TOLLWAY 1449	<0.059	<0.13	3.71	<0.086	0.533	0.00617	<0.017	<0.047	<0.0097	9.03	141	3208	3.6	0.100	0.05	0.37	1766	1.19	74.5	10.4	9.31		
2/29/12	TB15Bgw grab duplicate	TOLLWAY 1450	<0.059	<0.13	3.67	<0.086	0.525	0.00567	<0.017	<0.047	<0.0097	9.03	141	3258	NA	0.100	0.06	0.35	1799	1.19	74.7	11.1	10.8		
		difference			0.04		0.008	0.00050				0.001	0.27	50.0		0.0004	0.005	0.03	32.8	0.0001	0.23	0.67	1.52		
		% difference			1.16		1.47	8.16				0.01	0.19	1.56		0.37	10.15	6.98	1.86	0.01	0.31	6.44	16.33	4.47	
		> 20% ?																							
3/12/12	TB19gw grab	TOLLWAY 1463	<0.059	<0.13	4.33	<0.086	0.716	0.00197	<0.017	<0.047	<0.0097	8.66	191	3274	<3.0	0.048	0.18	0.25	1767	2.06	74.9	11.7	11.4		
3/12/12	TB19gw grab duplicate	TOLLWAY 1465	<0.059	0.17	4.39	<0.086	0.731	0.00183	<0.017	<0.047	<0.0097	8.64	190	3316	NA	0.049	0.20	0.23	1758	2.07	75.0	11.8	11.6		
		difference			0.07		0.015	0.00014				0.01	1.82	42.0		0.0005	0.01	0.02	9.66	0.01	0.03	0.16	0.18		
		% difference			1.52		2.08	7.19				0.16	0.95	1.28		1.10	6.23	6.74	0.55	0.52	0.04	1.40	1.61	4.55	
		> 20% ?																							
3/27/12	TB19gw grab	TOLLWAY 1501	<0.059	<0.13	6.14	<0.086	0.553	0.00102	<0.017	<0.047	<0.0097	7.80	300	1822	<3.0	0.059	0.05	0.28	818	3.55	92.7	12.3	11.9		
3/27/12	TB19gw grab duplicate	TOLLWAY 1502	<0.059	<0.13	6.21	<0.086	0.567	0.00075	0.021	<0.047	<0.0097	7.80	301	1836	NA	0.059	0.04	0.32	818	3.54	92.5	12.2	12.2		
		difference			0.07		0.014	0.00028				0.01	1.14	14.0		0.0001	0.006	0.031	0.25	0.004	0.19	0.11	0.28		
		% difference			1.15		2.51	27.08				0.08	0.38	0.77		0.20	11.92	11.03	0.03	0.11	0.20	0.85	2.37	5.61	
		> 20% ?																							
4/12/12	OR3	TOLLWAY 1540	<0.059	<0.13	1.43	<0.086	0.379	<0.00056	<0.017	<0.047	<0.0097	8.07	311	877	6.4	0.011	<0.03	0.15	215	<0.04	141	9.42	9.59		
4/12/12	OR3 duplicate	TOLLWAY 1541	<0.059	<0.13	1.39	<0.086	0.375	<0.00056	<0.017	<0.047	<0.0097	8.07	314	880	NA	0.010	<0.03	0.16	214	<0.04	142	9.58	9.26		
		difference			0.04		0.005					0.0	2.98	3.00		0.0004		0.009	0.46		0.26	0.16	0.33		
		% difference			2.81		1.19					0.00	0.96	0.34		3.62		6.07	0.22		0.18	1.66	3.48	2.66	
		> 20% ?																							
4/25/12	TB15Bgw grab	TOLLWAY 1566	<0.059	<0.13	5.44	<0.086	0.924	<0.00056	<0.017	<0.047	<0.0097	7.70	209	3500	<3.0	0.110	<0.03	0.16	1874	2.10	102	14.2	14.2		
4/25/12	TB15Bgw grab duplicate	TOLLWAY 1567	<0.059	<0.13	5.48	<0.086	0.930	<0.00056	<0.017	<0.047	<0.0097	7.73	212	3512	NA	0.107	<0.03	0.13	1873	2.09	101	13.7	13.6		
		difference			0.05		0.006					0.03	2.08	12.0		0.003		0.03	0.52	0.009	0.17	0.45	0.62		
		% difference			0.85		0.62					0.39	0.99	0.34		2.71		17.57	0.03	0.43	0.16	3.19	4.37	2.72	
		> 20% ?																							
5/7/12	TB19gw grab	TOLLWAY 1585	<0.059	<0.13	8.09	<0.086	0.232	0.0343	<0.017	<0.047	<0.0097	7.94	269	929	<3.0	0.082	0.07	0.33	341	0.74	37.1	23.2	19.9		
5/7/12	TB19gw grab duplicate	TOLLWAY 1586	<0.059	<0.13	7.60	<0.086	0.232	0.0286	<0.017	<0.047	<0.0097	7.95	268	929	NA	0.084	0.07	0.34	340	0.74	37.1	22.1	19.8		
		difference			0.50		0.00004	0.0057				0.01	0.76	0		0.002	0.003	0.0008	0.73	0.005	0.03	1.13	0.09		
		% difference			6.14		0.02	16.68				0.06	0.28	0.00		3.00	3.93	0.25	0.21	0.64	0.07	4.87	0.46	4.57	
		> 20% ?																							
5/23/12	TB15-1L	TOLLWAY 1624	<0.059	0.15	8.74	<0.086	3.71	<0.00056	0.027	<0.047	<0.0097	7.22	361	5164	NA	0.019	<0.03	0.67	2589	<0.04	222	2.89	2.25		
5/23/12	TB15-1L duplicate	TOLLWAY 1625	<0.059	<0.13	8.59	<0.086	3.64	<0.00056	0.023	<0.047	<0.0097	7.19	363	4987	NA	0.019	<0.03	0.30	2581	<0.04	219	2.83	2.25		
		difference			0.15		0.07		0.004			0.03	1.94	177		0.00004		0.36	7.88		3.66	0.06	0.01		
		% difference			1.74		1.79		15.94			0.42	0.54	3.43		0.23		54.51	0.30		1.65	2.02	0.40		
		> 20% ?																						6.09	
		> 20% Relative Percent Difference																							
6/4/12	TB15Bgw grab	TOLLWAY 1635	<0.059	<0.13	5.89	<0.086	0.535	0.00314	<0.017	<0.047	<0.0097	7.75	202	2719	<3.0	0.140	<0.03	0.45	1440	1.89	88.6	13.6	13.1		
6/4/12	TB15Bgw grab duplicate	TOLLWAY 1636	<0.059	<0.13	6.03	<0.086	0.549	0.00313	<0.017	<0.047	<0.0097	7.75	200	2713	NA	0.140	<0.03	0.45	1440	1.87	88.7	12.9	13.1		
		difference			0.14		0.014	0.00001				0.002	1.07	6.00		0.001		0.002	0.15	0.02	0.11	0.72	0.03		
		% difference			2.39		2.69	0.27				0.03	0.53	0.22		0.39		0.39	0.01	0.83	0.13	5.26	0.25		
		> 20% ?																						3.02	
		> 20% Relative Percent Difference																							
6/19/12	TB15Bgw grab	TOLLWAY 1666	<0.059	<0.13	6.37	<0.086	0.462	0.00520	<0.017	<0.047	<0.0097	7.95	221	1849	<3.0	0.130	<0.03	0.43	917	1.49	70.2	17.4	16.6		
6/19/12	TB15Bgw grab duplicate	TOLLWAY 1667	<0.059	<0.13	6.46	<0.086	0.468	0.00553	<0.017	<0.047	<0.0097	7.96	222	1855	NA	0.130	<0.03	0.41	920	1.48	69.9	16.5	16.2		
		difference			0.09		0.006	0.00034				0.02	0.50	6.0		0.0005		0.02	3.51	0.01	0.23	0.86	0.41		
		% difference			1.45		1.27	6.48				0.21	0.23	0.32		0.38		3.59	0.38	0.34	0.32	4.96	2.47		
		> 20% ?																						2.40	
		> 20% Relative Percent Difference																							
7/2/12	TB19gw grab	TOLLWAY 1677	<0.059	<0.13	6.87	<0.086	0.657	<0.00056	<0.017	<0.047	<0.0097	7.76	253	2064	<3.0	0.041	<0.03	0.29	937	2.77	149	15.9	16.1		
7/2/12	TB19gw grab duplicate	TOLLWAY 1678	<0.059	<0.13	6.87	<0.086	0.660	<0.00056	<0.017	<0.047	<0.0097	7.77	255	2048	NA	0.041	<0.03	0.28	954	2.77	150	16.2	16.3		
		difference			0.002		0.003					0.002	2.4	16.0		0.0003		0.02	17.1	0.002	0.18	0.23	0.19		
		% difference			0.03		0.43					0.03	0.95	0.78		0.76		5.72	1.83	0.08	0.12	1.43	1.19		
		> 20% ?																						1.32	
		> 20% Relative Percent Difference																							
7/18/12	TB19gw grab	TOLLWAY 1689	<0.059	<0.13	7.10	<0.086	0.506	0.00076	<0.017	<0.047	<0.0097	7.6													

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
		MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
8/27/12	TB19gw grab	TOLLWAY 1746	0.379	<0.11	0.063	0.0571	<0.00055	52.3	<0.012	<0.013	<0.0058	0.0108	0.363	21.2	<0.11	13.7	0.0120	<0.022	269	<0.043	0.088	<0.041	25.4
8/27/12	TB19gw grab duplicate	TOLLWAY 1747	0.474	<0.11	0.065	0.0600	<0.00055	52.9	<0.012	<0.013	<0.0058	0.0111	0.457	21.4	<0.11	14.5	0.0138	<0.022	272	<0.043	<0.073	<0.041	25.7
		difference	0.0957		0.00172	0.00296		0.614				0.000381	0.0942	0.214		0.741	0.00181						0.261
		% difference	25.27		2.71	5.19		1.17				3.54	25.95	1.01		5.39	15.11						1.02
		>20%?	25.27										25.95										
9/10/12	TB9A grab	TOLLWAY 1745	<0.037	<0.11	0.090	0.102	0.00333	53.3	<0.012	<0.013	0.0060	0.00685	0.068	31.9	<0.11	10.5	0.0188	<0.022	575	<0.043	<0.073	<0.041	13.3
9/10/12	TB9A grab duplicate	TOLLWAY 1755	<0.037	<0.11	0.054	0.0963	<0.00055	51.9	<0.012	<0.013	<0.0058	0.00479	0.054	31.1	<0.11	10.6	0.0163	<0.022	550	<0.043	<0.073	<0.041	12.8
		difference			0.0365	0.00577		1.39				0.00206	0.0142	0.757		0.0883	0.00251						0.456
		% difference			40.38	5.65		2.61				30.09	20.93	2.37		0.84	13.32						3.44
		>20%?			40.38							30.09	20.93										
9/25/12	TB19gw grab	TOLLWAY 1774	<0.037	<0.11	0.071	0.0748	<0.00055	80.0	<0.012	<0.013	<0.0058	0.00567	<0.024	24.9	<0.11	23.7	0.0087	<0.022	339	<0.043	0.077	<0.041	52.8
9/25/12	TB19gw grab duplicate	TOLLWAY 1775	<0.037	<0.11	0.065	0.0739	<0.00055	79.5	<0.012	<0.013	<0.0058	0.00551	<0.024	24.3	<0.11	23.9	0.0085	<0.022	332	<0.043	0.088	<0.041	52.0
		difference			0.0059	0.000892		0.559				0.000156		0.615		0.201	0.000147						0.764
		% difference			8.26	1.19		0.70				2.75		2.47		0.85	1.69				13.24		1.45
		>20%?																					
10/8/12	TB19gw grab	TOLLWAY 1782	<0.037	<0.11	0.089	0.0760	<0.00055	80.6	<0.012	<0.013	<0.0058	0.00633	0.025	24.3	<0.11	24.1	0.0118	<0.022	366	<0.043	0.075	<0.041	59.8
10/8/12	TB19gw grab duplicate	TOLLWAY 1783	<0.037	<0.11	0.087	0.0761	<0.00055	79.9	<0.012	<0.013	<0.0058	0.00590	0.024	24.3	<0.11	23.3	0.0119	0.024	366	<0.043	0.076	<0.041	59.6
		difference			0.00221	0.000986		0.764				0.000429	0.00113	0.00203		0.825	0.00062				0.000947		0.224
		% difference			2.48	0.13		0.95				6.77	4.48	0.01		3.42	0.52				1.27		0.37
		>20%?																					
10/22/12	TB19gw grab	TOLLWAY 1806	0.083	<0.11	0.064	0.0462	<0.00055	53.8	<0.012	<0.013	<0.0058	0.00749	0.064	15.7	<0.11	16.8	0.0058	<0.022	238	<0.043	0.099	<0.041	37.3
10/22/12	TB19gw grab duplicate	TOLLWAY 1807	0.064	<0.11	0.062	0.0447	<0.00055	52.3	<0.012	<0.013	<0.0058	0.00738	0.055	14.8	<0.11	16.3	0.0057	<0.022	228	<0.043	0.085	<0.041	36.5
		difference	0.019		0.00215	0.00155		1.57				0.00011	0.00978	0.857		0.491	0.000153						0.791
		% difference	22.89		3.33	3.35		2.91				1.47	15.20	5.46		2.93	2.63				13.82		2.12
		>20%?	22.89																				
11/5/12	TB19gw grab	TOLLWAY 1826	<0.037	<0.11	0.086	0.0608	<0.00055	71.3	<0.012	<0.013	<0.0058	0.00687	<0.024	17.5	<0.11	23.2	0.0042	0.024	258	<0.043	<0.073	<0.041	57.0
11/5/12	TB19gw grab duplicate	TOLLWAY 1827	<0.037	<0.11	0.078	0.0598	<0.00055	69.4	<0.012	<0.013	<0.0058	0.00695	<0.024	17.6	<0.11	23.0	0.0045	<0.022	255	<0.043	<0.073	<0.041	55.2
		difference			0.00791	0.000988		1.95				0.0000867		0.061		0.177	0.000275						1.8
		% difference			9.20	1.58		2.73				1.26		0.35		0.76	6.56						3.16
		>20%?																					
11/19/12	TB19gw grab	TOLLWAY 1853	<0.037	<0.11	0.069	0.0547	<0.00055	68.1	<0.012	<0.013	<0.0058	0.00479	0.038	17.2	<0.11	22.3	0.0037	<0.022	262	<0.043	<0.073	<0.041	49.1
11/19/12	TB19gw grab duplicate	TOLLWAY 1854	<0.037	<0.11	0.068	0.0553	<0.00055	69.0	<0.012	<0.013	<0.0058	0.00490	<0.024	17.5	<0.11	21.9	0.0036	<0.022	265	<0.043	<0.073	<0.041	49.9
		difference			0.00132	0.000641		0.906				0.000105		0.226		0.4	0.0000478						0.835
		% difference			1.91	1.17		1.33				2.20		1.31		1.79	1.31						1.70
		>20%?																					
12/3/12	TB19gw grab	TOLLWAY 1858	<0.037	<0.11	0.063	0.0566	<0.00055	79.1	<0.012	<0.013	<0.0058	0.00417	<0.024	17.3	<0.11	24.8	0.0028	<0.022	275	<0.043	0.167	<0.041	61.9
12/3/12	TB19gw grab duplicate	TOLLWAY 1859	<0.037	<0.11	0.060	0.0552	<0.00055	76.8	<0.012	<0.013	<0.0058	0.00388	<0.024	17.2	<0.11	23.7	0.0025	<0.022	269	<0.043	0.180	<0.041	60.8
		difference			0.00328	0.00134		2.31				0.000288		0.131		1.11	0.000343						1.16
		% difference			5.21	2.36		2.92				6.91		0.76		4.48	12.25				8.09		1.87
		>20%?																					
12/17/12	TB19gw grab	TOLLWAY 1880	0.223	<0.11	0.039	0.0313	<0.00055	44.4	<0.012	<0.013	<0.0058	0.00440	0.107	14.5	<0.11	14.2	0.0055	<0.022	234	<0.043	0.164	<0.041	29.7
12/17/12	TB19gw grab duplicate	TOLLWAY 1881	0.201	<0.11	0.038	0.0309	<0.00055	45.2	<0.012	<0.013	<0.0058	0.00423	0.092	13.6	<0.11	14.6	0.0059	<0.022	226	<0.043	0.119	<0.041	29.3
		difference	0.0218		0.00104	0.000419		0.8				0.000175	0.0146	0.912		0.441	0.000406						0.324
		% difference	9.79		2.68	1.34		1.80				3.97	13.67	6.29		3.11	7.40						1.09
		>20%?																					
1/7/13	TB7B 5U	TOLLWAY 1898	<0.037	<0.11	0.147	0.102	<0.00055	172	<0.012	<0.013	<0.0058	<0.00079	0.677	24.4	<0.11	54.7	1.35	<0.022	1396	<0.043	0.113	<0.041	254
1/7/13	TB7B 5U duplicate	TOLLWAY 1899	<0.037	<0.11	0.143	0.104	<0.00055	179	<0.012	<0.013	<0.0058	<0.00079	0.677	26.0	<0.11	55.6	1.39	<0.022	1402	<0.043	0.150	<0.041	261
		difference			0.0038	0.00169		6.61					0.000353	1.59		0.857	0.0473						7.24
		% difference			2.59	1.65		3.84					0.05	6.52		1.57	3.51						2.85
		>20%?																					
1/11/13	TB9Ac2N grab	TOLLWAY 1921	0.133	<0.11	<0.023	0.0148	<0.00055	7.17	<0.012	<0.013	<0.0058	0.00320	0.059	1.24	<0.11	0.440	0.0067	<0.022	110	<0.043	0.120	<0.041	4.82
1/11/13	TB9Ac2N grab duplicate	TOLLWAY 1922	0.135	<0.11	<0.023	0.0151	<0.00055	7.73	<0.012	<0.013	<0.0058	0.00295	0.064	1.24	<0.11	0.466	0.0080	<0.022	112	<0.043	0.114	<0.041	5.04
		difference	0.002			0.000305		0.562				0.000249	0.0052	0.00201		0.0256	0.00131						0.225
		% difference	1.50																				

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID MDL:	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L	mean relative % difference between duplicate and original sample
8/27/12	TB19gw grab	TOLLWAY 1746	<0.059	<0.13	7.40	<0.086	0.332	0.00903	0.019	<0.047	<0.0097	7.56	230	991	<3.0	0.074	<0.03	0.28	365	2.37	75.5	15.1	14.9	
8/27/12	TB19gw grab duplicate	TOLLWAY 1747	<0.059	<0.13	7.58	<0.086	0.325	0.0129	<0.017	<0.047	<0.0097	7.58	231	985	NA	0.073	<0.03	0.30	368	2.36	75.6	15.2	15.1	
		difference			0.19		0.00689	0.00391				0.016	0.387	6		0.000594		0.0242	2.15	0.0068	0.168	0.081	0.123	
		% difference			2.56		2.08	43.27				0.21	0.17	0.61		0.81		8.65	0.59	0.29	0.22	0.54	0.82	6.19
		>20%?						43.27																
9/10/12	TB9A grab	TOLLWAY 1745	<0.059	<0.13	0.878	<0.086	0.554	0.00357	<0.017	<0.047	0.0161	8.24	210	1663	<3.0	0.050	<0.03	0.33	847	<0.04	36.4	16.6	16.5	
9/10/12	TB9A grab duplicate	TOLLWAY 1755	<0.059	<0.13	0.825	<0.086	0.531	0.00115	<0.017	<0.047	0.0116	8.26	210	1659	NA	0.051	<0.03	0.34	848	<0.04	36.2	16.3	17.3	
		difference			0.0524		0.0234	0.00242			0.00451	0.02	0.563	4		0.00079		0.0131	0.565	<0.04	0.242	0.345	0.886	
		% difference			5.97		4.22	67.86			28.06	0.24	0.27	0.24		1.57		4.01	0.07	0.67	2.08	5.38		10.64
		>20%?						67.86			28.06													
9/25/12	TB19gw grab	TOLLWAY 1774	<0.059	<0.13	7.22	<0.086	0.499	<0.00056	<0.017	<0.047	<0.0097	6.99	263	1254	<3.0	0.039	<0.03	0.29	466	2.24	149	11.5	11.3	
9/25/12	TB19gw grab duplicate	TOLLWAY 1775	<0.059	<0.13	7.13	<0.086	0.488	<0.00056	<0.017	<0.047	<0.0097	7.67	264	1255	NA	0.039	<0.03	0.27	468	2.22	149	11.3	11.3	
		difference			0.0973		0.0109	<0.00056			0.681	1.02	1			0.000539		0.0201	2.08	0.0151	0.205	0.239	0.00351	
		% difference			1.35		2.18	<0.00056			9.75	0.39	0.08			1.39		7.00	0.45	0.68	0.14	2.08	0.03	
		>20%?																						2.74
10/8/12	TB19gw grab	TOLLWAY 1782	<0.059	<0.13	7.00	<0.086	0.523	<0.00056	<0.017	<0.047	<0.0097	7.85	234	1329	<3.0	0.040	<0.03	0.28	508	2.07	160	9.50	9.65	
10/8/12	TB19gw grab duplicate	TOLLWAY 1783	<0.059	<0.13	7.02	<0.086	0.523	<0.00056	<0.017	<0.047	<0.0097	7.86	231	1333	NA	0.039	<0.03	0.35	513	2.07	160	9.57	9.63	
		difference			0.0229		0.0000119	<0.00056			0.012	2.45	4			0.00107		0.0677	4.24	0.00233	0.116	0.0673	0.018	
		% difference			0.33		0.00	<0.00056			0.15	1.05	0.30			2.69		24.30	0.83	0.11	0.07	0.71	0.19	
		>20%?																24.30						2.23
10/22/12	TB19gw grab	TOLLWAY 1806	<0.059	<0.13	6.07	<0.086	0.347	0.00101	<0.017	<0.047	<0.0097	7.97	204	884	<3.0	0.053	<0.03	0.35	300	1.51	109	13.1	12.4	
10/22/12	TB19gw grab duplicate	TOLLWAY 1807	<0.059	<0.13	5.85	<0.086	0.337	0.00064	<0.017	<0.047	<0.0097	7.94	204	884	NA	0.052	<0.03	0.35	302	1.52	109	12.9	13.5	
		difference			0.222		0.00997	0.000374			0.032	0.134	0			0.000247		0.000931	2.01	0.00267	0.533	0.135	1.07	
		% difference			3.66		2.87	0.000374			0.40	0.07	0			0.47		0.27	0.67	0.18	0.49	1.03	8.63	
		>20%?						37.05																5.44
11/5/12	TB19gw grab	TOLLWAY 1826	<0.059	<0.13	6.22	<0.086	0.473	<0.00056	<0.017	<0.047	<0.0097	7.73	256	984	<3.0	0.037	<0.03	0.35	288	1.84	160	12.3	11.7	
11/5/12	TB19gw grab duplicate	TOLLWAY 1827	<0.059	<0.13	6.09	<0.086	0.465	<0.00056	<0.017	<0.047	<0.0097	7.72	255	989	NA	0.037	<0.03	0.32	290	1.84	160	14.4	12.2	
		difference			0.132		0.00816	<0.00056			0.005	0.824	5			0.000122		0.0282	1.95	0.00251	0.0178	2.09	0.424	
		% difference			2.11		1.72	<0.00056			0.06	0.32	0.51			0.33		8.14	0.68	0.14	0.01	16.91	3.61	
		>20%?																						2.91
11/19/12	TB19gw grab	TOLLWAY 1853	<0.059	<0.13	5.67	<0.086	0.439	<0.00056	<0.017	<0.047	<0.0097	7.87	231	1010	<3.0	0.038	<0.03	0.31	325	1.66	146	10.6	9.76	
11/19/12	TB19gw grab duplicate	TOLLWAY 1854	<0.059	<0.13	5.76	<0.086	0.443	<0.00056	<0.017	<0.047	<0.0097	7.90	230	1011	NA	0.038	<0.03	0.31	325	1.66	146	9.72	9.63	
		difference			0.0917		0.00393	<0.00056			0.03	0.531	1			0.00033		0.000867	0.465	0.00274	0.0622	0.913	0.136	
		% difference			1.62		0.90	<0.00056			0.38	0.23	0.10			0.86		0.28	0.14	0.17	0.04	8.59	1.40	
		>20%?																						1.36
12/3/12	TB19gw grab	TOLLWAY 1858	<0.059	<0.13	6.18	<0.086	0.548	<0.00056	<0.017	<0.047	<0.0097	7.59	216	1057	<3.0	0.032	<0.03	0.31	354	1.80	165	8.44	8.33	
12/3/12	TB19gw grab duplicate	TOLLWAY 1859	<0.059	<0.13	6.04	<0.086	0.538	<0.00056	0.035	<0.047	<0.0097	7.58	217	1056	NA	0.033	<0.03	0.32	353	1.82	164	8.50	8.25	
		difference			0.149		0.0106	<0.00056			0.011	0.675	1			0.00156		0.00243	0.87	0.0155	0.375	0.0587	0.0764	
		% difference			2.41		1.94	<0.00056			0.14	0.31	0.09			4.91		0.77	0.25	0.86	0.23	0.70	0.92	
		>20%?																						2.75
12/17/12	TB19gw grab	TOLLWAY 1880	<0.059	<0.13	5.91	<0.086	0.330	0.00355	0.026	<0.047	<0.0097	8.39	172	759	<3.0	0.075	<0.03	0.35	275	1.16	80.1	10.2	10.0	
12/17/12	TB19gw grab duplicate	TOLLWAY 1881	<0.059	<0.13	5.74	<0.086	0.329	0.00302	<0.017	<0.047	<0.0097	8.38	172	751	NA	0.076	<0.03	0.34	275	1.15	80.0	10.0	10.0	
		difference			0.169		0.000968	0.000524			0.003	0.037	8			0.000576		0.00134	0.688	0.009	0.0448	0.13	0.0131	
		% difference			2.86		0.29	14.77			0.04	0.02	1.05			0.77		0.39	0.25	0.78	0.06	1.28	0.13	
		>20%?																						4.19
1/7/13	TB7B 5U	TOLLWAY 1898	<0.059	<0.13	4.88	<0.086	1.53	<0.00056	0.017	<0.047	<0.0097	7.49	308	4279	NA	0.014	1.61	<0.07	1885	0.44	723	11.3	11.7	
1/7/13	TB7B 5U duplicate	TOLLWAY 1899	<0.059	<0.13	4.97	<0.086	1.58	<0.00056	<0.017	<0.047	<0.0097	7.52	308	4264	NA	0.014	1.67	<0.07	1827	0.45	725	11.3	11.9	
		difference			0.0853		0.046	<0.00056			0.031	0.39	15			0.000654	0.0634	<0.07	57.6	0.0118	1.18	0.0654	0.135	
		% difference			1.75		3.00	<0.00056			0.41	0.13	0.35			4.76	3.95	<0.07	3.06	2.67	0.16	0.58	1.15	
		>20%?																						3.53
1/11/13	TB9Ac2N grab	TOLLWAY 1921	<0.059	<0.13	0.479	<0.086	0.0550	0.00117	<0.017	<0.047	<0.0097	7.49	33	300	449	0.040	0.16	0.24	157	0.18	13.1	34.7	2.99	
1/11/13	TB9Ac2N grab duplicate	TOLLWAY 1922	<0.059	<0.13	0.512	<0.086	0.0562	0.00135	<0.017	<0.047	0.0105	7.60	34	304	2434	0.039	0.15	0.24	156	0.18	13.1	37.2	2.87	
		difference		</																				

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
		MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
2/18/13	TB19gw grab	TOLLWAY 1972	<0.037	<0.11	0.039	0.304	<0.00055	271	<0.012	<0.013	<0.0058	<0.0016	0.034	43.0	<0.11	57.7	0.0218	<0.022	1853	<0.043	0.163	<0.041	51.7
2/18/13	TB19gw grab duplicate	TOLLWAY 1973	<0.037	<0.11	0.039	0.316	<0.00055	279	<0.012	<0.013	<0.0058	<0.0016	0.033	44.2	<0.11	62.2	0.0226	<0.022	1821	<0.043	0.192	<0.041	53.8
		difference			0.000823	0.012		7.62				0.00131	1.18			4.54	0.000834		32.3		0.029		2.05
		% difference			2.13	3.95		2.81				3.86	2.74			7.86	3.83		1.74		17.77		3.95
		>20%?																					
3/4/13	TB19gw grab	TOLLWAY 1991	<0.037	<0.11	0.037	0.331	<0.00055	277	<0.012	<0.013	<0.0058	<0.0016	<0.024	43.0	<0.11	58.1	0.0121	<0.022	2177	<0.043	0.118	<0.041	48.4
3/4/13	TB19gw grab duplicate	TOLLWAY 1992	<0.037	<0.11	0.044	0.332	<0.00055	274	<0.012	<0.013	<0.0058	<0.0016	<0.024	43.7	<0.11	57.7	0.0127	<0.022	2172	<0.043	0.129	<0.041	48.3
		difference			0.00727	0.00122		3.47				0.00168	0.000168	0.966		0.409	0.000622		5.83		0.0111		0.078
		% difference			19.81	0.37		1.25				0.725	1.69			0.70	5.15		0.27		9.40		0.16
		>20%?																					
3/18/13	TB19gw grab	TOLLWAY 2015	0.102	<0.11	0.039	0.176	<0.00055	151	<0.012	<0.013	<0.0058	0.00717	0.072	29.0	<0.11	39.5	0.0060	<0.022	1246	<0.043	0.235	<0.041	34.4
3/18/13	TB19gw grab duplicate	TOLLWAY 2017	0.105	<0.11	0.035	0.169	<0.00055	144	<0.012	<0.013	<0.0058	0.00885	0.072	28.0	<0.11	37.4	0.0062	<0.022	1250	<0.043	0.174	<0.041	33.4
		difference	0.00308		0.00388	0.00605		7.59				0.00168	0.000168	0.966		2.14	0.000186		3.75		0.0605		0.997
		% difference	3.02		9.90	3.45		5.02				23.42	0.23	3.34		5.42	3.08		0.30		25.77		2.90
		>20%?																					
4/1/13	TB19gw grab	TOLLWAY 2043	0.658	<0.11	0.034	0.0901	<0.00055	89.3	<0.012	<0.013	<0.0058	0.00618	0.405	12.2	<0.11	26.0	0.0079	<0.022	522	<0.043	0.116	<0.041	20.8
4/1/13	TB19gw grab duplicate	TOLLWAY 2044	0.554	<0.11	0.031	0.0887	<0.00055	84.2	<0.012	<0.013	<0.0058	0.00481	0.346	12.0	<0.11	24.8	0.0063	<0.022	521	<0.043	0.114	<0.041	19.6
		difference	0.104		0.00247	0.00141		5.07				0.00137	0.0589	0.175		1.28	0.00158		1.38		0.00205		1.19
		% difference	15.75		7.29	1.56		5.68				22.18	14.56	1.43		4.91	20.03		0.26		1.77		5.72
		>20%?																					
4/16/13	TB15Bgw grab	TOLLWAY 2072	4.02	<0.11	0.040	0.0518	<0.00055	54.6	<0.012	<0.013	0.0062	0.0253	2.49	12.6	<0.11	10.8	0.0241	<0.022	716	<0.043	0.425	<0.041	38.8
4/16/13	TB15Bgw grab duplicate	TOLLWAY 2073	3.00	<0.11	0.039	0.0502	<0.00055	54.9	<0.012	<0.013	<0.0058	0.0252	1.83	12.6	<0.11	11.0	0.0173	<0.022	727	<0.043	0.432	<0.041	39.2
		difference	1.02		0.000853	0.00166		0.344				0.000086	0.656	0.0056		0.234	0.00683		11		0.00701		0.474
		% difference	25.46		2.14	3.20		0.63				0.34	26.35	0.04		2.17	28.28		1.54		1.65		1.22
		>20%?																					
4/30/13	TB19gw grab	TOLLWAY 2105	0.158	<0.11	0.098	0.0635	<0.00055	66.5	<0.012	<0.013	<0.0058	0.00570	0.108	18.3	<0.11	27.9	0.0028	<0.022	421	<0.043	0.134	<0.041	30.1
4/30/13	TB19gw grab duplicate	TOLLWAY 2106	0.136	<0.11	0.099	0.0638	<0.00055	65.5	<0.012	<0.013	<0.0058	0.00534	0.101	18.7	<0.11	26.8	0.0027	<0.022	427	<0.043	0.132	<0.041	29.9
		difference	0.0226		0.000448	0.000285		0.989				0.000357	0.00689	0.444		1.05	0.00004		5.78		0.00215		0.246
		% difference	14.28		0.46	0.45		1.49				6.26	6.38	2.43		3.75	1.43		1.37		1.61		0.82
		>20%?																					
5/14/13	TB15Bgw grab	TOLLWAY 2138	0.123	<0.11	0.053	0.108	<0.00055	81.2	<0.012	<0.013	<0.0058	0.00243	0.080	28.6	<0.11	10.9	0.0060	0.027	1324	<0.043	0.275	<0.041	54.6
5/14/13	TB15Bgw grab duplicate	TOLLWAY 2139	0.117	<0.11	0.050	0.107	<0.00055	83.4	<0.012	<0.013	<0.0058	0.00226	0.080	27.9	<0.11	11.4	0.0058	0.026	1340	<0.043	0.235	<0.041	54.9
		difference	0.0053		0.00289	0.000342		2.28				0.000173	0.00003	0.753		0.59	0.000246	0.000448	16.1		0.0399		0.267
		% difference	4.31		5.49	0.32		2.81				7.11	0.04	2.63		5.44	4.07	1.67	1.22		14.52		0.49
		>20%?																					
5/28/13	TB15Bgw grab	TOLLWAY 2155	0.543	<0.11	0.056	0.0489	<0.00055	42.2	<0.012	<0.013	<0.0058	0.0110	0.418	14.4	<0.11	6.93	0.0083	<0.022	536	<0.043	0.324	<0.041	30.6
5/28/13	TB15Bgw grab duplicate	TOLLWAY 2156	0.31	<0.11	0.05	0.05	<0.00055	44.00	<0.012	<0.013	<0.0058	0.01	0.25	13.58	<0.11	7.01	0.01	<0.022	522.67	<0.043	0.32	<0.041	31.08
		difference	0.234		0.00107	0.00171		1.76				0.000655	0.173	0.796		0.0771	0.00144		13.6		0.0088		0.501
		% difference	43.04		1.91	3.49		4.17				5.94	41.33	5.54		1.11	17.51		2.54		2.72		1.64
		>20%?																					
6/11/13	TB15Bgw grab	TOLLWAY 2196	0.444	<0.11	0.051	0.0691	<0.00055	64.7	<0.012	<0.013	<0.0058	0.0107	0.351	15.4	<0.11	9.34	0.0120	<0.022	599	<0.043	0.323	<0.041	36.0
6/11/13	TB15Bgw grab duplicate	TOLLWAY 2197	0.430	<0.11	0.052	0.0685	<0.00055	63.2	<0.012	<0.013	<0.0058	0.0115	0.347	15.2	<0.11	9.12	0.0114	<0.022	589	<0.043	0.258	<0.041	35.5
		difference	0.0138		0.00127	0.000576		1.58				0.000823	0.00357	0.198		0.217	0.000648		10.3		0.0648		0.503
		% difference	3.11		2.48	0.83		2.43				7.70	1.02	1.28		2.33	5.40		1.72		20.07		1.40
		>20%?																					
6/25/13	TB15Bgw grab	TOLLWAY 2228	0.400	<0.11	0.061	0.0479	<0.00055	52.6	<0.012	<0.013	<0.0058	0.00975	0.317	11.5	<0.11	7.51	0.0089	<0.022	359	<0.043	0.299	<0.041	22.8
6/25/13	TB15Bgw grab duplicate	TOLLWAY 2229	0.756	<0.11	0.059	0.0471	<0.00055	54.0	<0.012	<0.013	<0.0058	0.0322	0.300	11.2	<0.11	7.81	0.0087	<0.022	354	<0.043	0.285	<0.041	22.7
		difference	0.356		0.00273	0.00084		1.4				0.0224	0.0167	0.304		0.295	0.000135		4.25		0.0143		0.0816
		% difference	88.93		4.44	1.75		2.67				229.89	5.29	2.64		3.93	1.52		1.19		4.79		0.36
		>20%?																					
7/10/13	TB19gw grab	TOLLWAY 2271	0.106	<0.11	0.081	0.0919	<0.00055	77.2	<0.012	<0.013	<0.0058	0.00776	0.059	28.5	<0.11	23.1	0.0103	0.027	561	<0.043	0.116	<0.041	39.5
7/10/13	TB19gw grab duplicate	TOLLWAY 2272	0.080	<0.11	0.083	0.0887	<0.00055	79.2	<0.012	<0.013	<0.0058	0.00831	0.056	27.8	<0.11	23.1	0.0100	0.037	547	<0.043	0.168	<0.041	39.3

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Ti mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L	mean relative % difference between duplicate and original sample
		MDL:	0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097		4	12	3	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31	
2/18/13	TB19gw grab	TOLLWAY 1972	<0.059	<0.13	4.04	<0.086	1.84	<0.00056	<0.017	<0.047	<0.0097	7.68	139	5855	<3.0	0.031	0.13	0.39	3383	3.87	130	10.3	10.1	
2/18/13	TB19gw grab duplicate	TOLLWAY 1973	<0.059	<0.13	4.21	<0.086	1.92	<0.00056	<0.017	<0.047	<0.0097	7.72	138	5888	NA	0.032	0.13	0.40	3404	3.90	130	10.3	10.2	
		difference			0.17		0.074					0.043	0.69	33		0.000287	0.00231	0.0111	20.8	0.0208	0.0757	0.0488	0.0665	
		% difference			4.20		4.01					0.56	0.50	0.56		0.92	1.79	2.88	0.61	0.54	0.06	0.47	0.66	2.97
		>20%?																						
3/4/13	TB19gw grab	TOLLWAY 1991	<0.059	0.14	3.79	<0.086	1.42	<0.00056	<0.017	<0.047	<0.0097	8.54	142	6702	<3.0	0.032	0.27	0.32	3898	3.90	123	8.50	8.95	
3/4/13	TB19gw grab duplicate	TOLLWAY 1992	<0.059	<0.13	3.81	<0.086	1.44	<0.00056	<0.017	<0.047	<0.0097	8.53	141	6642	NA	0.032	0.28	0.33	3920	3.90	123	8.63	8.68	
		difference			0.0207		0.0241					0.005	0.375	60		0.000312	0.00668	0.0141	22.3	0.00103	0.0507	0.128	0.266	
		% difference			0.55		1.70					0.06	0.27	0.90		0.98	2.49	4.43	0.57	0.03	0.04	1.50	2.97	2.51
		>20%?																						
3/18/13	TB19gw grab	TOLLWAY 2015	<0.059	0.17	4.15	<0.086	0.880	0.00197	<0.017	<0.047	<0.0097	8.50	168	3761	<3.0	0.075	0.19	0.39	2085	4.56	91.0	13.2	12.4	
3/18/13	TB19gw grab duplicate	TOLLWAY 2017	<0.059	<0.13	4.08	<0.086	0.838	0.00218	<0.017	<0.047	<0.0097	8.50	168	3741	NA	0.075	0.20	0.40	2079	4.53	90.6	13.1	13.0	
		difference			0.0687		0.0421	0.000215				0.002	0.655	20		0.000259	0.012	0.00523	6.46	0.0224	0.386	0.136	0.66	
		% difference			1.66		4.78	10.94				0.02	0.39	0.53		0.35	6.35	1.33	0.31	0.49	0.42	1.03	5.34	4.61
		>20%?																						
4/1/13	TB19gw grab	TOLLWAY 2043	<0.059	<0.13	5.61	<0.086	0.491	0.0183	<0.017	<0.047	<0.0097	7.89	139	1728	<3.0	0.078	0.05	0.28	893	1.56	55.6	11.9	11.2	
4/1/13	TB19gw grab duplicate	TOLLWAY 2044	<0.059	<0.13	5.28	<0.086	0.482	0.0158	<0.017	<0.047	<0.0097	7.91	139	1708	NA	0.079	0.05	0.28	909	1.55	55.9	12.7	11.6	
		difference			0.333		0.00836	0.00252				0.018	0.096	20		0.00132	0.00633	0.00291	15.2	0.0136	0.325	0.785	0.368	
		% difference			5.93		1.70	13.78				0.23	0.07	1.16		1.70	14.03	1.03	1.71	0.87	0.58	6.58	3.27	5.91
		>20%?																						
4/16/13	TB15Bgw grab	TOLLWAY 2072	<0.059	<0.13	10.4	<0.086	0.330	0.0501	<0.017	<0.047	0.0169	9.16	218	2047	<3.0	0.299	0.08	0.36	965	1.34	108	27.7	24.5	
4/16/13	TB15Bgw grab duplicate	TOLLWAY 2073	<0.059	<0.13	9.03	<0.086	0.331	0.0377	<0.017	<0.047	0.0128	9.15	219	2020	NA	0.293	0.10	0.36	1035	1.34	108	28.6	22.8	
		difference			1.38		0.00187	0.0124			0.00404	0.011	1.37	27		0.00525	0.0248	0.000593	69.6	0.00432	0.0619	0.886	1.68	
		% difference			13.22		0.57	24.74			23.99	0.12	0.63	1.32		1.76	32.19	0.16	7.21	0.32	0.06	3.20	6.89	7.76
		>20%?						24.74			23.99						32.19							
4/30/13	TB19gw grab	TOLLWAY 2105	<0.059	<0.13	5.79	<0.086	0.389	0.00282	<0.017	<0.047	<0.0097	8.30	262	1388	<3.0	0.122	0.06	0.23	589	5.73	81.7	16.6	14.8	
4/30/13	TB19gw grab duplicate	TOLLWAY 2106	<0.059	<0.13	5.81	<0.086	0.390	0.00257	<0.017	<0.047	<0.0097	8.30	260	1381	NA	0.128	0.06	0.24	603	5.72	81.7	16.2	15.6	
		difference			0.0233		0.00161	0.000248				1.56	7			0.00604	0.00405	0.0125	14	0.0045	0.00254	0.386	0.805	
		% difference			0.40		0.41	8.79				0.60	0.50			4.93	6.52	5.41	2.37	0.08	0.00	2.33	5.44	3.02
		>20%?																						
5/14/13	TB15Bgw grab	TOLLWAY 2138	<0.059	<0.13	5.45	<0.086	0.662	0.00216	<0.017	<0.047	<0.0097	8.49	188	3645	<3.0	0.145	<0.03	0.22	1982	2.32	148	16.8	16.6	
5/14/13	TB15Bgw grab duplicate	TOLLWAY 2139	<0.059	<0.13	5.38	<0.086	0.658	0.00216	0.017	<0.047	<0.0097	8.48	187	3629	NA	0.144	<0.03	0.22	1980	2.32	148	17.5	16.8	
		difference			0.0724		0.00372	0.000003				0.005	0.752	16		0.000632		0.00369	1.41	0.0048	0.0246	0.749	0.273	
		% difference			1.33		0.56	0.14				0.06	0.40	0.44		0.44		1.64	0.07	0.21	0.02	4.47	1.65	2.37
		>20%?																						
5/28/13	TB15Bgw grab	TOLLWAY 2155	<0.059	<0.13	6.30	<0.086	0.298	0.0119	<0.017	<0.047	<0.0097	8.07	269	1487	<3.0	0.199	<0.03	0.25	639	1.15	84.8	16.7	16.2	
5/28/13	TB15Bgw grab duplicate	TOLLWAY 2156	<0.059	<0.13	5.80	<0.086	0.29	0.01	<0.017	<0.047	<0.0097	8.07	269.95	1489.00	NA	0.20	<0.03	0.25	649.53	1.15	84.78	16.67	16.01	
		difference			0.501		0.00633	0.00517				0.004	0.504	2		0.00071		0.000749	11	0.00458	0.0222	0.00462	0.186	
		% difference			7.95		2.12	43.35				0.05	0.19	0.13		0.04		0.29	1.73	0.40	0.03	0.03	1.15	7.54
		>20%?						43.35																
6/11/13	TB15Bgw grab	TOLLWAY 2196	<0.059	<0.13	7.28	<0.086	0.362	0.0110	<0.017	<0.047	<0.0097	7.83	285	1742	<3.0	0.192	<0.03	0.24	790	1.29	96.1	16.3	15.1	
6/11/13	TB15Bgw grab duplicate	TOLLWAY 2197	<0.059	<0.13	7.15	<0.086	0.357	0.0106	<0.017	<0.047	<0.0097	7.84	283	1733	NA	0.197	<0.03	0.24	780	1.28	96.2	16.4	15.3	
		difference			0.127		0.00537	0.000386				0.006	2.11	9		0.0045		0.000585	10.3	0.00989	0.088	0.0332	0.232	
		% difference			1.74		1.48	3.52				0.08	0.74	0.52		2.34		0.24	1.31	0.76	0.09	0.20	1.54	2.57
		>20%?																						
6/25/13	TB15Bgw grab	TOLLWAY 2228	<0.059	<0.13	6.76	<0.086	0.271	0.0113	<0.017	<0.047	<0.0097	7.74	271	1057	<3.0	0.175	<0.03	0.23	399	0.86	60.1	15.0	13.9	
6/25/13	TB15Bgw grab duplicate	TOLLWAY 2229	<0.059	<0.13	6.65	<0.086	0.270	0.0102	<0.017	<0.047	<0.0097	7.72	271	1052	NA	0.184	<0.03	0.23	400	0.86	60.1	14.9	13.9	
		difference			0.111		0.000807	0.0011				0.018	0.308	5		0.00867		0.00187	0.631	0.0047	0.0211	0.11	0.0446	
		% difference			1.64		0.30	9.71				0.23	0.11	0.47		4.95		0.82	0.16	0.55	0.04	0.73	0.32	14.70
		>20%?																						
7/10/13	TB19gw grab	TOLLWAY 2271	<0.059	<0.13	7.84	<0.086	0.505	0.00120	0.018	<0.047	<0.0097	7.93	289	1713	<3.0	0.090	<0.03	0.19	764	2.32	106	14.7	13.8	
7/10/13	TB19gw grab duplicate	TOLLWAY 2272	<0.059	<0.13	7.68	<0.086	0.493	0.00090	<0.017															

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
		MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
9/3/13	TB19-GW-grab	TOLLWAY 2347	0.172	<0.11	0.074	0.0662	<0.00055	62.6	<0.012	<0.013	<0.0058	0.00915	0.111	20.4	<0.11	18.3	0.0109	<0.022	438	<0.043	0.142	<0.041	42.7
9/3/13	TB19-GW-grab-dupe	TOLLWAY 2348	0.108	<0.11	0.074	0.0674	<0.00055	63.2	<0.012	<0.013	<0.0058	0.00949	0.101	21.3	<0.11	19.7	0.0113	<0.022	453	<0.043	0.127	<0.041	43.0
		difference	0.06366			0.00055	0.00125		0.60850			0.00035	0.01011	0.91160		1.38260	0.00048		14.38200		0.01547		0.37850
		% difference	37.11			0.74	1.89		0.97			3.77	9.12	4.47		7.54	4.38		3.28		10.87		0.89
		>20%?	37.11																				
9/16/13	TB15-4L	TOLLWAY 2360	<0.037	<0.11	0.207	0.268	<0.00055	697	<0.012	<0.013	<0.0058	<0.0016	1.79	8.43	0.16	506	0.151	<0.022	388	<0.043	0.131	<0.041	81.9
9/16/13	TB15-4L-dupe	TOLLWAY 2361	<0.037	<0.11	0.208	0.268	<0.00055	746	<0.012	<0.013	<0.0058	<0.0016	1.59	8.88	0.17	548	0.151	<0.022	399	<0.043	0.210	<0.041	81.6
		difference			0.00069	0.00038		49.49700					0.20189	0.45883	0.01007	42.17000	0.00038		11.09600		0.07955		0.31630
		% difference			0.33	0.14		7.10					11.26	5.45	6.13	8.34	0.25		2.86		60.80		0.39
		>20%?																			60.80		
9/30/13	TB19-GW-grab	TOLLWAY 2380	0.156	<0.11	0.049	0.0523	<0.00055	51.6	<0.012	<0.013	<0.0058	0.00860	0.126	16.8	<0.11	13.5	0.0051	<0.022	339	<0.043	0.184	<0.041	31.1
9/30/13	TB19-GW-grab-dupe	TOLLWAY 2381	0.174	<0.11	0.052	0.0524	<0.00055	56.5	<0.012	<0.013	<0.0058	0.00832	0.149	15.7	<0.11	13.7	0.0053	0.046	335	<0.043	0.160	<0.041	32.1
		difference	0.01747		0.00352	0.00010		4.97380				0.00028	0.02277	1.08080		0.11960	0.00028		4.68000		0.02363		1.02070
		% difference	11.19		7.22	0.20		9.64				3.22	18.10	6.44		0.88	5.51		1.38		12.85		3.28
		>20%?																					
10/16/13	TB15-4L	TOLLWAY 2414	<0.037	<0.11	0.215	0.283	<0.00055	692	<0.012	<0.013	<0.0058	<0.0016	0.776	8.05	0.15	494	0.131	<0.022	394	<0.043	0.131	<0.041	86.5
10/16/13	TB15-4L-dupe	TOLLWAY 2415	<0.037	<0.11	0.208	0.272	<0.00055	639	<0.012	<0.013	<0.0058	<0.0016	0.598	8.06	0.15	472	0.134	<0.022	398	<0.043	0.152	<0.041	84.0
		difference			0.00746	0.01087		52.67600					0.17794	0.00212	0.00082	22.11200	0.00307		4.36800		0.02104		2.48730
		% difference			3.47	3.84		7.61					22.94	0.03	0.54	4.47	2.34		1.11		16.09		2.88
		>20%?											22.94										
10/29/13	TB15B-GW-grab	TOLLWAY 2428	<0.037	<0.11	0.049	0.0814	<0.00055	84.9	<0.012	<0.013	<0.0058	<0.0016	0.044	16.7	<0.11	15.4	0.0292	<0.022	594	<0.043	0.179	0.057	50.3
10/29/13	TB15B-GW-grab-dupe	TOLLWAY 2429	<0.037	<0.11	0.049	0.0779	<0.00055	79.0	<0.012	<0.013	<0.0058	0.00172	0.038	16.3	<0.11	15.0	0.0276	0.022	588	<0.043	0.210	<0.041	47.8
		difference			0.00032	0.00355		5.91910					0.00532	0.34070		0.37780	0.00152		5.96800		0.03079		2.56030
		% difference			0.66	4.36		6.97					12.16	2.04		2.46	5.20		1.01		17.18		5.09
		>20%?																					
11/12/13	TB7B-in-Isco	TOLLWAY 2452	0.062	<0.11	0.033	0.0336	<0.00055	22.0	<0.012	<0.013	<0.0058	0.0122	0.047	3.61	<0.11	4.03	0.0064	<0.022	119	<0.043	<0.073	<0.041	19.8
11/12/13	TB7B-in-Isco-dupe	TOLLWAY 2453	<0.037	<0.11	0.030	0.0333	<0.00055	21.6	<0.012	<0.013	<0.0058	0.0122	0.058	3.54	<0.11	4.00	0.0067	<0.022	118	<0.043	<0.073	<0.041	19.3
		difference			0.00253	0.00032		0.35430				0.00001	0.01036	0.06947		0.03843	0.00038		1.50700				0.50950
		% difference			7.74	0.97		1.61				0.09	21.89	1.92		0.95	5.98		1.26				2.57
		>20%?											21.89										
12/3/13	TB7B-SU	TOLLWAY 2481	<0.037	<0.11	0.136	0.119	<0.00055	135	<0.012	<0.013	<0.0058	<0.0016	0.717	26.0	<0.11	45.1	0.943	<0.022	1308	<0.043	0.159	<0.041	219
12/3/13	TB7B-SU-dupe	TOLLWAY 2482	<0.037	<0.11	0.138	0.117	<0.00055	132	<0.012	<0.013	<0.0058	<0.0016	0.750	25.2	<0.11	43.9	0.937	<0.022	1241	<0.043	0.140	<0.041	215
		difference			0.00238	0.00236		3.50000					0.03367	0.73320		1.19820	0.00624		66.67000		0.01871		3.67400
		% difference			1.75	1.98		2.59					4.70	2.82		2.66	0.66		5.10		11.75		1.68
		>20%?																					
12/17/13	TB15B-GW-grab	TOLLWAY 2500	<0.037	<0.11	0.030	0.219	<0.00055	199	<0.012	<0.013	<0.0058	<0.0016	0.033	31.2	<0.11	21.4	0.0203	<0.022	1601	<0.043	0.227	<0.041	51.1
12/17/13	TB15B-GW-grab-dupe	TOLLWAY 2501	<0.037	<0.11	0.029	0.227	<0.00055	206	<0.012	<0.013	<0.0058	<0.0016	0.037	32.4	<0.11	21.7	0.0205	<0.022	1663	<0.043	0.265	<0.041	52.5
		difference			0.00108	0.00743		6.50800					0.00388	1.16170		0.39200	0.00016		61.76000		0.03826		1.48310
		% difference			3.64	3.39		3.26					11.83	3.72		1.84	0.80		3.86		16.87		2.90
		>20%?																					
1/14/14	TB9A-grab	TOLLWAY 2521	<0.037	<0.11	0.060	0.286	<0.00055	285	<0.012	<0.013	<0.0058	<0.0016	0.069	21.8	<0.11	65.2	0.646	<0.022	2690	<0.043	0.177	<0.041	133
1/14/14	TB9A-grab-dupe	TOLLWAY 2522	<0.037	<0.11	0.057	0.291	<0.00055	285	<0.012	<0.013	<0.0058	<0.0016	0.071	22.1	<0.11	64.3	0.658	<0.022	2739	<0.043	0.119	<0.041	136
		difference			0.00241	0.00532		0.55800					0.00200	0.30460		0.86290	0.01211		49.10000		0.05828		2.70500
		% difference			4.06	1.86		0.20					2.90	1.39		1.32	1.88		1.83		32.96		2.04
		>20%?																			32.96		
1/30/14	TP-F	TOLLWAY 2536	<0.037	<0.11	0.063	0.0499	<0.00055	85.1	<0.012	<0.013	<0.0058	<0.0016	<0.024	3.94	<0.11	51.6	<0.0015	0.043	132	<0.043	0.148	<0.041	37.9
1/30/14	TP-F-dupe	TOLLWAY 2537	<0.037	<0.11	0.061	0.0502	<0.00055	85.3	<0.012	<0.013	<0.0058	<0.0016	<0.024	3.99	<0.11	53.3	<0.0015	<0.022	132	<0.043	0.193	<0.041	38.2
		difference			0.00192	0.00034		0.20870						0.04957		1.68990			0.34000		0.04437		0.24270
		% difference			3.05	0.67		0.25						1.26		3.27			0.26		29.92		0.64
		>20%?																			29.92		
2/19/14	TB19-GW-grab	TOLLWAY 2559	<0.074	<0.11	<0.046	0.540	<0.00055	415	<0.012	<0.013	<0.0058	0.0065	0.055	25.9	<0.22	89.5	0.0237	0.023	2789	<0.043	0.184	<0.041	85.4
2/19/14	TB19-GW-grab-dupe	TOLLWAY 2560	<0.074	<0.11	<0.046	0.533	<0.00055	417	<0.012	<0.013	<0.0058	0.0058	0.055	29.3	<0.22	89.6	0.0241	<0.022	2765	<0.043</			

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID MDL:	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	TI mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L	mean relative % difference between duplicate and original sample	# analytes exceeding 20%	
9/3/13	TB19-GW-grab	TOLLWAY 1746	<0.059	<0.13	7.40	<0.086	0.407	0.00173	0.022	<0.047	<0.0097	7.87	231	1363	<3.0	0.067	<0.03	0.30	560	2.12	111	17.2	16.8			
9/3/13	TB19-GW-grab-dupe	TOLLWAY 1747	<0.059	<0.13	7.61	<0.086	0.412	0.00185	<0.017	<0.047	<0.0097	7.87	229	1354	NA	0.068	<0.03	0.29	572	2.11	111	16.9	16.1	0.73628		
		difference			0.20912			0.00556	0.00013			0.00700		1.66760		0.00048		0.00325	11.66233	0.00346	0.02084	0.34601	0.73628		4.35	
		% difference			2.83			1.37	7.36			0.09		0.72		0.71		1.10	2.08	0.16	0.18	2.01	4.38		1	
		>20%?																								
9/16/13	TB15-4L	TOLLWAY 1745	<0.059	0.29	11.1	<0.086	6.72	<0.00056	0.025	<0.047	0.0121	7.09	323	4748		0.077	1.35	0.15	2881	0.08	223	4.36	2.87			
9/16/13	TB15-4L-dupe	TOLLWAY 1755	<0.059	0.33	11.4	<0.086	6.96	<0.00056	0.034	<0.047	0.0111	7.11	317	4757		0.060	1.40	0.13	2840	0.06	220	3.34	2.84			
		difference		0.04006	0.29310			0.23742		0.00889		0.00098	0.02800	6.25980		0.01618	0.05065	0.01767	40.92936	0.01840	3.44005	1.01703	0.03204			
		% difference		13.71	2.63			3.53		35.24		8.08	0.40	1.94		21.14	3.76	11.77	1.42	23.15	1.54	23.33	1.11		9.48	
		>20%?																								5
9/30/13	TB19-GW-grab	TOLLWAY 1774	<0.059	<0.13	6.84	<0.086	0.325	0.00395	<0.017	<0.047	<0.0097	7.76	217	1135	<3.0	0.083	<0.03	0.26	459	1.83	87.8	16.7	15.6			
9/30/13	TB19-GW-grab-dupe	TOLLWAY 1775	<0.059	<0.13	6.90	<0.086	0.329	0.00454	<0.017	<0.047	<0.0097	7.76	216	1127	NA	0.083	<0.03	0.26	462	1.82	88.0	16.6	15.7			
		difference			0.05781			0.00343	0.00059			0.00600	0.00970	8.00000		0.00042		0.00445	3.41006	0.00690	0.16832	0.11832	0.08199			
		% difference			0.84			1.06	14.87			0.08	0.05	0.70		0.50		1.69	0.74	0.38	0.19	0.71	0.52		4.09	
		>20%?																								0
10/16/13	TB15-4L	TOLLWAY 1782	<0.059	0.25	11.0	<0.086	7.15	<0.00056	0.024	<0.047	0.0172	7.19	311	4990		0.065	0.13	<0.7 *	2994	<0.04	225	2.89	NA			
10/16/13	TB15-4L-dupe	TOLLWAY 1783	<0.059	0.20	10.8	<0.086	6.98	<0.00056	0.029	<0.047	0.0102	7.18	318	4906		0.065	0.15	<0.7 *	3080	<0.04	222	2.96	NA			
		difference		0.05565	0.25240			0.17398	0.00549		0.00701	0.01300	6.87340	84.00000		0.00017	0.02657		86.23105		2.82443	0.06458				
		% difference		21.83	2.29			2.43	23.02		40.76	0.18	2.21	1.68		0.26	21.11		2.88		1.26	2.23			7.81	
		>20%?																								5
10/29/13	TB15B-GW-grab	TOLLWAY 1806	<0.059	<0.13	5.26	<0.086	0.516	<0.00056	<0.017	<0.047	<0.0097	8.14	188	1847	<3.0	0.108	<0.03	0.22	928	1.07	136	12.1	11.7			
10/29/13	TB15B-GW-grab-dupe	TOLLWAY 1807	<0.059	<0.13	5.13	<0.086	0.482	<0.00056	<0.017	<0.047	<0.0097	8.15	188	1836	NA	0.108	<0.03	0.22	937	1.06	136	12.2	11.6			
		difference			0.13135			0.03446				0.00500	0.02730	11.00000		0.00065		0.00175	8.93020	0.00240	0.26000	0.02993	0.17812			
		% difference			2.50			6.68				0.06	0.01	0.60		0.60		0.78	0.96	0.23	0.19	0.25	1.52		3.25	
		>20%?																								0
11/12/13	TB7B-in-Isco	TOLLWAY 1826	<0.059	<0.13	1.58	<0.086	0.185	0.00098	<0.017	<0.047	0.0378	7.21	57	375	34.0	<0.003	0.05	0.43	149	0.37	52.5	13.9	6.69			
11/12/13	TB7B-in-Isco-dupe	TOLLWAY 1827	<0.059	<0.13	1.57	<0.086	0.182	0.00135	<0.017	<0.047	0.0356	7.22	56	376	NA	<0.003	0.04	0.43	148	0.37	52.3	14.8	6.47			
		difference			0.01139			0.00298	0.00037		0.00219	0.01500	0.43890	1.00000		0.00098	0.00036	0.94359		0.00260	0.18624	0.92867	0.21601			
		% difference			0.72			1.61	37.27		5.78	0.21	0.77	0.27		18.90	0.08	0.63	0.63	0.71	0.36	6.69	3.23		5.09	
		>20%?																								2
12/3/13	TB7B-SU	TOLLWAY 1853	<0.059	<0.13	6.38	<0.086	1.04	<0.00056	<0.017	<0.047	<0.0097	7.68	315	3910		0.015	1.43	0.43	1587	<0.04	634	12.1	11.8			
12/3/13	TB7B-SU-dupe	TOLLWAY 1854	<0.059	<0.13	6.24	<0.086	1.02	<0.00056	<0.017	<0.047	<0.0097	7.68	315	3922		0.015	1.32	0.43	1601	<0.04	637	12.1	11.7			
		difference			0.14697			0.02383				0.00100	0.42560	12.00000		0.00027	0.10358	0.00105	13.98241		3.41056	0.06794	0.09818			
		% difference			2.30			2.29				0.01	0.14	0.31		1.83	7.26	0.25	0.88		0.54	0.56	0.83		2.40	
		>20%?																								0
12/17/13	TB15B-GW-grab	TOLLWAY 1858	<0.059	0.13	4.83	<0.086	1.40	<0.00056	<0.017	<0.047	<0.0097	7.97	118	4986	<3.0	0.100	<0.03	<0.7	2730	1.22	138	10.4	10.2			
12/17/13	TB15B-GW-grab-dupe	TOLLWAY 1859	<0.059	<0.13	5.00	<0.086	1.45	<0.00056	<0.017	<0.047	<0.0097	7.98	118	4920	NA	0.098	<0.03	<0.7	2738	1.22	138	10.5	10.3			
		difference			0.17138			0.04823			0.00300	0.00340	0.33440	66.00000		0.00108			8.32500		0.00195	0.49012	0.08951	0.13989		
		% difference			3.55			3.44			0.04	0.28	1.32	1.32		1.08			0.30	0.16	0.35	0.86	1.37		3.09	
		>20%?																								0
1/14/14	TB9A-grab	TOLLWAY 1880	<0.059	0.23	3.25	<0.086	2.33	<0.00056	<0.017	<0.047	0.0824	7.66	114	7982	<3.0	0.019	0.43	<0.7 *	4564	0.41	357	7.94	7.49			
1/14/14	TB9A-grab-dupe	TOLLWAY 1881	<0.059	0.25	3.34	<0.086	2.38	<0.00056	<0.017	<0.047	0.0832	7.67	114	7997	NA	0.019	0.45	<0.7 *	4530	0.41	361	7.46	7.28			
		difference		0.01639	0.09385			0.05149			0.00080	0.01200	0.47240	15.00000		0.00063	0.01532		33.72537		0.00139	3.83279	0.48258	0.21084		
		% difference		7.13	2.89			2.21			0.97	0.16	0.42	0.19		3.21	3.54		0.74	0.34	1.07	6.08	2.82		3.42	
		>20%?																								1
1/30/14	TP-F	TOLLWAY 1898	<0.059	<0.13	6.63	<0.086	0.138	<0.00056	0.020	<0.047	<0.0097	8.17	285	748	3.6	0.019	<0.03	0.12	189	0.27	104	1.51	1.15			
1/30/14	TP-F-dupe	TOLLWAY 1899	<0.059	<0.13	6.68	<0.086	0.138	<0.00056	<0.017	<0.047	<0.0097	8.16	283	740	NA	0.019	<0.03	0.13	189	0.26	104	1.73	1.08			
		difference			0.04972			0.00003				0.00600	1.70530	8.00000		0.00084		0.01025	0.00296	0.00715	0.12656	0.22236	0.07263			
		% difference			0.75			0.02				0.07	0.60	1.07		4.55		8.63	0.00	2.66	0.12	14.72	6.29		3.94	
		>20%?																								1
2/19/14	TB19-GW-grab	TOLLWAY 1921	<0.118	0.23	4.31	<0.086	2.58	<0.00056	0.043	<0.047	<0.0097	7.45	166	8619	14.8											

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	S mg/L
		MDL:	0.037	0.11	0.023	0.00085	0.00055	0.029	0.012	0.013	0.0058	0.00079	0.024	0.016	0.11	0.027	0.0015	0.022	0.026	0.043	0.073	0.041	0.22
4/15/14	TB9A-grab	TOLLWAY 2668	0.060	<0.11	0.054	0.142	<0.00055	138	<0.012	<0.013	<0.0058	0.0175	0.038	34.5	<0.11	25.5	0.0573	<0.022	1923	<0.043	<0.073	<0.041	78.6
4/15/14	TB9A-grab-dupe	TOLLWAY 2669	0.072	<0.11	0.054	0.142	<0.00055	140	<0.012	<0.013	<0.0058	0.0185	0.038	33.7	<0.11	26.4	0.0577	<0.022	1960	<0.043	<0.073	<0.041	80.0
		difference	0.01173		0.00048	0.00009		1.79300				0.00102	0.00018	0.79810		0.84260	0.00039		37.25000				1.35440
		% difference	19.56		0.90	0.06		1.30				5.81	0.47	2.31		3.30	0.68		1.94				1.72
		>20%?																					
4/30/14	TB15B-GW-grab	TOLLWAY 2708	0.991	<0.11	0.043	0.0606	<0.00055	65.0	<0.012	<0.013	<0.0058	0.0162	0.648	12.7	<0.11	11.3	0.0062	<0.022	839	<0.043	0.324	<0.041	37.0
4/30/14	TB15B-GW-grab-dupe	TOLLWAY 2709	0.906	<0.11	0.047	0.0607	<0.00055	67.8	<0.012	<0.013	<0.0058	0.0160	0.614	11.8	<0.11	11.8	0.0058	<0.022	817	<0.043	0.208	<0.041	38.6
		difference	0.08450		0.00403	0.00014		2.77170				0.00022	0.03363	0.89180		0.48180	0.00039		21.71900		0.11662		1.64200
		% difference	8.53		9.36	0.24		4.26				1.36	5.19	7.03		4.27	6.34		2.59		35.96		4.44
		>20%?																					
5/13/14	TB7B-in-grab	TOLLWAY 2722	0.056	<0.11	0.168	0.0579	<0.00055	138	<0.012	<0.013	0.0138	0.0165	<0.024	36.0	<0.11	42.7	<0.0015	0.022	2849	<0.043	0.241	<0.041	153
5/13/14	TB7B-in-grab-dupe	TOLLWAY 2723	0.057	<0.11	0.173	0.0585	<0.00055	140	<0.012	<0.013	0.0126	0.0155	<0.024	35.7	<0.11	43.4	<0.0015	0.027	2871	<0.043	0.223	<0.041	156
		difference	0.00028		0.00501	0.00065		2.14000			0.00121	0.00096		0.29550		0.78340		0.00427	21.62000		0.01778		2.97100
		% difference	0.50		2.97	1.12		1.55			8.73	5.85		0.82		1.84		18.99	0.76		7.38		1.94
		>20%?																					
5/28/14	TB15B-GW-grab	TOLLWAY 2751	0.467	<0.11	0.076	0.0703	<0.00055	57.5	<0.012	<0.013	<0.0058	0.0248	0.381	20.3	<0.11	8.73	0.0070	<0.022	977	<0.043	0.316	<0.041	44.8
5/28/14	TB15B-GW-grab-dupe	TOLLWAY 2752	0.466	<0.11	0.074	0.0709	<0.00055	56.9	<0.012	<0.013	<0.0058	0.0251	0.373	20.5	<0.11	9.05	0.0074	<0.022	985	<0.043	0.308	<0.041	44.9
		difference	0.00076		0.00210	0.00065		0.61570				0.00030	0.00748	0.18830		0.31119	0.00038		7.94100		0.00835		0.17980
		% difference	0.16		2.78	0.93		1.07				1.20	1.96	0.93		3.56	5.36		0.81		2.64		0.40
		>20%?																					
6/9/14	TB19-GW-grab	TOLLWAY 2758	0.410	<0.11	0.058	0.0586	<0.00055	49.1	<0.012	<0.013	<0.0058	0.0163	0.228	26.1	<0.11	11.3	0.0039	0.026	821	<0.043	0.114	<0.041	37.4
6/9/14	TB19-GW-grab-dupe	TOLLWAY 2759	0.472	<0.11	0.060	0.0654	<0.00055	53.8	<0.012	<0.013	<0.0058	0.0179	0.284	29.4	<0.11	12.4	0.0046	0.025	912	<0.043	0.147	<0.041	41.1
		difference	0.06174		0.00203	0.00681		4.65730				0.00154	0.05586	3.29090		1.05190	0.00069	0.00067	91.26800		0.03317		3.73380
		% difference	15.05		3.49	11.63		9.48				9.45	24.47	12.61		9.29	17.92	2.61	11.12		29.15		9.99
		>20%?																					
6/25/14	TB15B-GW-grab	TOLLWAY 2810	1.35	<0.11	0.062	0.0343	<0.00055	38.7	<0.012	<0.013	<0.0058	0.0142	0.994	9.64	<0.11	7.08	0.0159	<0.022	302	<0.043	0.273	<0.041	22.8
6/25/14	TB15B-GW-grab-dupe	TOLLWAY 2811	1.11	<0.11	0.063	0.0342	<0.00055	39.2	<0.012	<0.013	<0.0063	0.0141	0.855	9.51	<0.11	7.01	0.0147	<0.022	307	<0.043	0.251	<0.041	23.0
		difference	0.24120		0.00110	0.00005		0.48220				0.00007	0.13851	0.12957		0.07416	0.00119		4.10000		0.02185		0.25260
		% difference	17.84		1.78	0.13		1.25				0.47	13.94	1.34		1.05	7.52		1.36		8.01		1.11
		>20%?																					
7/8/14	TB15B-c1n-grab	TOLLWAY 2825	0.506	<0.11	0.044	0.0495	<0.00055	39.0	<0.012	<0.013	<0.0058	0.0058	0.038	16.4	<0.11	0.249	<0.0015	<0.022	428	<0.043	0.087	<0.041	12.7
7/8/14	TB15B-c1n-grab-dupe	TOLLWAY 2826	0.494	<0.11	0.047	0.0501	<0.00055	38.8	<0.012	<0.013	<0.0058	0.0048	0.035	16.0	<0.11	0.262	<0.0015	0.059	430	<0.043	<0.073	<0.041	12.9
		difference	0.01159		0.00274	0.00061		0.23940				0.00106	0.00303	0.39570		0.01347			1.60700				0.16460
		% difference	2.29		6.23	1.23		0.61				18.05	8.00	2.41		5.42			0.38				1.29
		>20%?																					
7/22/14	TB7B-in-lsco	TOLLWAY 2863	0.044	<0.11	0.065	0.0407	<0.00055	51.7	<0.012	<0.013	0.0076	0.0103	0.044	12.3	<0.11	12.9	0.0068	<0.022	759	<0.043	<0.073	<0.041	53.9
7/22/14	TB7B-in-lsco-dupe	TOLLWAY 2864	<0.037	<0.11	0.093	0.0408	<0.00055	52.3	<0.012	<0.013	0.0059	0.0125	0.037	12.5	<0.11	12.9	0.0065	0.030	761	<0.043	<0.073	<0.041	54.1
		difference			0.02803	0.00002		0.60380			0.00164	0.00215	0.00752	0.17950		0.03340	0.00034		2.18500				0.21380
		% difference			43.04	0.06		1.17			21.73	20.85	16.94	1.46		0.26	5.02		0.29				0.40
		>20%?			43.04						21.73	20.85											
8/6/14	TB7B-5U	TOLLWAY 2892	<0.037	<0.11	0.350	0.119	<0.00055	310	<0.012	<0.013	<0.0058	<0.0016	1.17	28.8	<0.11	107	0.655	<0.022	2080	<0.043	<0.073	<0.041	251
8/6/14	TB7B-5U-dupe	TOLLWAY 2893	<0.037	<0.11	0.355	0.121	<0.00055	308	<0.012	<0.013	<0.0058	<0.0016	1.18	29.8	<0.11	107	0.661	<0.022	2130	<0.043	<0.073	<0.041	254
		difference			0.00529	0.00247		2.34500					0.01298	0.99840		0.44900	0.00579		50.20000				2.33900
		% difference			1.51	2.08		0.76					1.11	3.47		0.42	0.88		2.41				0.93
		>20%?																					
8/19/14	TB15B-GW-grab	TOLLWAY 2915	0.041	<0.11	0.076	0.0836	<0.00055	76.9	<0.012	<0.013	<0.0058	0.0046	0.046	19.6	<0.11	12.2	0.0116	0.023	709	<0.043	0.157	<0.041	48.2
8/19/14	TB15B-GW-grab-dupe	TOLLWAY 2916	0.045	<0.11	0.075	0.0824	<0.00055	78.4	<0.012	<0.013	<0.0058	0.0041	0.044	19.3	<0.11	12.3	0.0119	0.024	704	<0.043	0.144	<0.041	48.3
		difference	0.00470		0.00079	0.00123		1.44280				0.00058	0.00174	0.22180		0.09650	0.00034	0.00075	5.52100		0.01286		0.13740
		% difference	11.57		1.04	1.47		1.88				12.42	3.79	1.13		0.79	2.92	3.27	0.78		8.17		0.29
		>20%?																					

>20% Relative Percent Difference

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Date collected	Sample location	Sample ID	Sb mg/L	Se mg/L	Si mg/L	Sn mg/L	Sr mg/L	Ti mg/L	Tl mg/L	V mg/L	Zn mg/L	pH	alkalinity mg/L as CaCO ₃	TDS, 180 C mg/L	TSS mg/L	oPO ₄ -P mg/L	NH ₃ -N mg/L	F mg/L	Cl mg/L	NO ₃ -N mg/L	SO ₄ mg/L	total NVOC mg/L	dissolved NVOC mg/L	mean relative				
																								% difference	% difference			
MDL:			0.059	0.13	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0097		4	12	3	0.003	0.03	0.07	0.16	0.04	0.21	0.31	0.31			between duplicate	and original sample	
4/15/14	TB9A-grab	TOLLWAY 1972	<0.059	<0.13	0.589	<0.086	1.28	<0.00056	0.024	<0.047	0.0149	8.86	87	5479	9.2	0.010	<0.03	0.19	3157	0.09	199	15.6	14.3					
4/15/14	TB9A-grab-dupe	TOLLWAY 1973	<0.059	<0.13	0.599	<0.086	1.28	<0.00056	0.023	<0.047	0.0170	8.85	87	5463	NA	0.010	<0.03	0.20	3167	0.11	199	16.2	14.7					
		difference			0.01027		0.00443		0.00038		0.00205	0.00400	0.21390	16.00000		0.00035		0.00178	9.58430	0.01417	0.31264	0.57207	0.46328					
		% difference			1.74		0.35		1.60		13.74	0.05	0.25	0.29		3.49		0.92	0.30	15.46	0.16	3.66	3.24				3.33	
		>20%?																										0
4/30/14	TB15B-GW-grab	TOLLWAY 1991	<0.059	<0.13	6.58	<0.086	0.340	0.0217	<0.017	<0.047	<0.0097	8.54	171	2367	<3.0	0.192	<0.03	0.32	1212	1.55	103	16.3	16.8					
4/30/14	TB15B-GW-grab-dupe	TOLLWAY 1992	<0.059	<0.13	6.38	<0.086	0.351	0.0198	<0.017	<0.047	0.0104	8.54	171	2348	NA	0.191	0.04	0.32	1214	1.54	103	18.1	18.4					
		difference			0.19637		0.01108	0.00198			0.00000	0.25780	19.00000			0.00062		0.00011	1.41577	0.00641	0.22574	1.86154	1.58024					
		% difference			2.98		3.26	9.11			0.00	0.15	0.80			0.33		0.03	0.12	0.41	0.22	11.43	9.38				5.11	
		>20%?																										1
5/13/14	TB7B-in-grab	TOLLWAY 2015	<0.059	0.17	8.50	<0.086	1.09	<0.00056	<0.017	<0.047	0.0114	8.45	139	7902	44.4	0.018	0.19	0.41	4459	1.70	385	16.0	15.1					
5/13/14	TB7B-in-grab-dupe	TOLLWAY 2017	<0.059	0.15	8.61	<0.086	1.13	<0.00056	<0.017	<0.047	0.0122	8.48	140	7969	NA	0.017	0.18	0.41	4449	1.71	387	16.4	15.3					
		difference		0.02347	0.11116		0.04228				0.00072	0.03700	0.93280	67.00000		0.00058	0.00357	0.00446	9.27142	0.00901	2.34852	0.42027	0.25907					
		% difference		13.43	1.31		3.89				6.32	0.44	0.67	0.85		3.29	1.90	1.10	0.21	0.53	0.61	2.63	1.72				3.38	
		>20%?																										0
5/28/14	TB15B-GW-grab	TOLLWAY 2043	<0.059	<0.13	8.39	<0.086	0.369	0.0124	0.022	<0.047	0.0097	7.79	240	2786	<3.0	0.236	0.06	0.32	1404	2.05	117	21.7	21.6					
5/28/14	TB15B-GW-grab-dupe	TOLLWAY 2044	<0.059	<0.13	8.40	<0.086	0.363	0.0122	0.020	<0.047	<0.0097	7.82	240	2787	NA	0.236	0.05	0.32	1397	2.04	117	22.1	21.5					
		difference			0.00797		0.00611	0.00014	0.00209		0.03200	0.13780	1.00000			0.00004	0.00634	0.00230	7.56893	0.00322	0.16224	0.45019	0.13020					
		% difference			0.09		1.65	1.12	9.58		0.41	0.06	0.04			0.01	11.15	0.73	0.54	0.16	0.14	2.08	0.60				1.86	
		>20%?																										1
6/9/14	TB19-GW-grab	TOLLWAY 2072	<0.059	<0.13	8.67	<0.086	0.335	0.00626	<0.017	<0.047	0.0100	8.64	220	2563	<3.0	0.093	0.07	0.31	1323	2.01	111	21.1	20.5					
6/9/14	TB19-GW-grab-dupe	TOLLWAY 2073	<0.059	<0.13	9.74	<0.086	0.372	0.00803	<0.017	<0.047	<0.0097	8.63	220	2579	NA	0.093	0.06	0.32	1321	2.04	111	20.6	20.1					
		difference			1.07094		0.03637	0.00178			0.00600	0.11350	16.00000			0.00035	0.00736	0.01107	1.55559	0.03393	0.10261	0.52149	0.42062					
		% difference			12.35		10.85	28.41			0.07	0.05	0.62			0.38	10.21	3.55	0.12	1.69	0.09	2.47	2.05				8.86	
		>20%?																										3
6/25/14	TB15B-GW-grab	TOLLWAY 2105	<0.059	<0.13	8.30	<0.086	0.182	0.0321	<0.017	<0.047	<0.0097	8.03	203	965	<3.0	0.227	<0.03	0.30	378	0.59	61.9	16.5	15.1					
6/25/14	TB15B-GW-grab-dupe	TOLLWAY 2106	<0.059	<0.13	8.01	<0.086	0.181	0.0282	<0.017	<0.047	<0.0097	7.89	204	953	NA	0.227	<0.03	0.31	380	0.60	62.0	16.2	15.1					
		difference			0.29474		0.00061	0.00387			0.13400	0.58020	12.00000			0.00033		0.00604	2.66434	0.00804	0.12686	0.36985	0.01982					
		% difference			3.55		0.33	12.06			1.67	0.29	1.24			0.14		2.01	0.71	1.35	0.20	2.24	0.13				3.27	
		>20%?																										0
7/8/14	TB15B-c1n-grab	TOLLWAY 2138	<0.059	<0.13	5.73	<0.086	0.338	0.00058	<0.017	<0.047	<0.0097	11.0	131	1253	79.2	0.030	0.48	0.21	647	0.16	34.7	10.8	9.09					
7/8/14	TB15B-c1n-grab-dupe	TOLLWAY 2139	<0.059	<0.13	5.76	<0.086	0.342	0.00060	<0.017	<0.047	<0.0097	11.0	131	1234	NA	0.030	0.50	0.21	646	0.17	34.6	12.1	8.98					
		difference			0.02866		0.00434	0.00002			0.04300	0.17150	19.00000			0.00030	0.02355	0.00321	1.00360	0.00975	0.09462	1.29039	0.10825					
		% difference			0.50		1.28	2.92			0.39	0.13	1.52			1.00	4.93	1.52	0.16	6.26	0.27	11.98	1.19				3.33	
		>20%?																										0
7/22/14	TB7B-in-Isco	TOLLWAY 2155	<0.059	<0.13	3.84	<0.086	0.507	0.00106	0.019	<0.047	0.0247	7.90	119	2182	42.0	0.013	0.13	0.43	1149	0.78	147	14.9	10.2					
7/22/14	TB7B-in-Isco-dupe	TOLLWAY 2156	<0.059	<0.13	3.91	<0.086	0.549	0.00095	<0.017	<0.047	0.0293	7.93	118	2207	NA	0.014	0.14	0.44	1138	0.78	147	16.2	11.7					
		difference			0.06919		0.04216	0.00011			0.00464	0.02900	0.13110	25.00000		0.00126	0.00383	0.01065	10.93527	0.00380	0.07224	1.31400	1.44081					
		% difference			1.80		8.32	10.32			18.79	0.37	0.11	1.15		9.91	2.89	2.47	0.95	0.49	0.05	8.83	14.11				7.37	
		>20%?																										3
8/6/14	TB7B-SU	TOLLWAY 2196	<0.059	<0.13	7.61	<0.086	2.04	<0.00056	<0.017	<0.047	<0.0097	7.53	501	6915		0.025	0.49	0.65	3365	<0.04	677	13.6	12.6					
8/6/14	TB7B-SU-dupe	TOLLWAY 2197	<0.059	<0.13	7.71	<0.086	2.07	<0.00056	<0.017	<0.047	<0.0097	7.55	497	6957		0.025	0.48	0.67	3310	<0.04	694	14.5	14.4					
		difference			0.10022		0.03716				0.01200	3.53710	42.00000			0.00016	0.00671	0.01758	55.07855		16.15092	0.88235	1.80254					
		% difference			1.32		1.82				0.16	0.71	0.61			0.64	1.38	2.70	1.64		2.38	6.47	14.31				2.27	
		>20%?																										0
8/19/14	TB15B-GW-grab	TOLLWAY 2228	<0.059	<0.13	7.69	<0.086	0.430	0.00092	<0.017	<0.047	<0.0097	7.95	262	2104	<3.0	0.187	<0.03	0.32	980	1.09	134	11.1	10.9					
8/19/14	TB15B-GW-grab-dupe	TOLLWAY 2229	<0.059	<0.13	7.67	<0.086	0.431	0.00108	<0.017	<0.047	<0.0097	7.96	262</															

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Sample ID	Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	
MDL:	0.0061	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.018	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	
9/3/14 TB15B-GW-grab	TOLLWAY 2936	0.064	<0.11	0.072	0.0571	<0.00055	66.7	<0.012	<0.013	<0.0058	0.0064	0.072	12.5	<0.11	12.0	0.0114	<0.022	416	<0.043	0.132	<0.041
9/3/14 TB15B-GW-grab-dupe	TOLLWAY 2937	0.066	<0.11	0.077	0.0615	<0.00055	69.7	<0.012	<0.013	<0.0058	0.0078	0.068	13.5	<0.11	12.2	0.0121	<0.022	433	<0.043	0.167	<0.041
	difference	0.00127		0.00515	0.00445		3.04850			0.00140	0.00359	1.00720			0.17400	0.00069		16.38900		0.03490	
	% difference	1.97		7.13	7.80		4.57			21.93	5.01	8.03			1.45	6.02		3.94		26.34	
	>20%?																				
9/16/14 TB9A-lsco	TOLLWAY 2968	<0.037	<0.11	0.054	0.0654	<0.00055	44.3	<0.012	<0.013	<0.0058	0.0050	0.099	11.5	<0.11	10.3	0.0259	<0.022	369	<0.043	0.082	<0.041
9/16/14 TB9A-lsco-dupe	TOLLWAY 2969	<0.037	<0.11	0.052	0.0652	<0.00055	44.5	<0.012	<0.013	<0.0058	0.0046	0.098	11.6	<0.11	10.3	0.0257	<0.022	370	<0.043	<0.073	<0.041
	difference			0.00214	0.00013		0.25960			0.00039	0.00103	0.05760			0.04980	0.00017		0.84300			
	% difference			3.94	0.19		0.59			7.74	1.04	0.50			0.49	0.65		0.23			
	>20%?																				
9/30/14 TB15B-GW-grab	TOLLWAY 2984	<0.037	<0.11	0.064	0.0729	<0.00055	93.4	<0.012	<0.013	<0.0058	0.0047	0.033	14.9	<0.11	16.9	0.0168	<0.022	581	<0.043	0.104	<0.041
9/30/14 TB15B-GW-grab-dupe	TOLLWAY 2985	0.043	<0.11	0.063	0.0724	<0.00055	90.9	<0.012	<0.013	<0.0058	0.0048	0.029	14.9	<0.11	16.6	0.0153	<0.022	574	<0.043	0.126	<0.041
	difference			0.00100	0.00052		2.56430			0.00017	0.00352	0.06090			0.29090	0.00152		6.63100		0.02189	
	% difference			1.56	0.72		2.74			3.67	10.77	0.41			1.72	9.04		1.14		21.10	
	>20%?																				
10/14/14 TB7Bout-grab	TOLLWAY 3016	0.208	<0.11	0.068	0.0604	<0.00055	69.6	<0.012	<0.013	<0.0058	0.0072	0.173	8.07	<0.11	19.0	0.0102	<0.022	117	<0.043	0.119	<0.041
10/14/14 TB7Bout-grab-dupe	TOLLWAY 3017	0.296	<0.11	0.067	0.0610	<0.00055	59.5	<0.012	<0.013	<0.0058	0.0069	0.221	8.30	<0.11	16.6	0.0112	<0.022	115	<0.043	0.168	<0.041
	difference	0.08853		0.00102	0.00057		10.13010			0.00037	0.04865	0.23492			2.43260	0.00102		1.69500		0.04830	
	% difference	42.60		1.50	0.95		14.55			5.04	28.17	2.91			12.78	10.05		1.45		40.48	
	>20%?	42.60																		40.48	
12/3/14 TB15B-4L	TOLLWAY 3086	<0.037	<0.11	0.175	0.230	<0.00055	675	<0.012	<0.013	<0.0058	<0.0016	<0.024	7.86	0.16	492	0.135	<0.022	345	<0.043	<0.073	<0.041
12/3/14 TB15B-4L-dupe	TOLLWAY 3087	<0.037	<0.11	0.174	0.237	<0.00055	657	<0.012	<0.013	<0.0058	<0.0016	0.026	7.68	0.16	485	0.150	<0.022	343	<0.043	<0.073	<0.041
	difference			0.00057	0.00706		18.15000						0.18540	0.004293	6.96600	0.01532		2.65700			
	% difference			0.33	3.07		2.69						2.36	2.71	1.42	11.36		0.77			
	>20%?																				
12/16/14 TB19-GW-grab	TOLLWAY 3111	<0.037	<0.11	0.033	0.0722	<0.00055	102	<0.012	<0.013	<0.0058	0.0024	<0.024	15.6	<0.11	16.9	0.0019	<0.022	548	<0.043	<0.073	<0.041
12/16/14 TB19-GW-grab-dupe	TOLLWAY 3112	<0.037	<0.11	0.032	0.0721	<0.00055	103	<0.012	<0.013	<0.0058	0.0020	<0.024	15.7	<0.11	16.9	0.0022	<0.022	552	<0.043	<0.073	<0.041
	difference			0.00104	0.00009		1.30500			0.00045			0.16550		0.06150	0.00031		4.16100			
	% difference			3.15	0.12		1.28			18.59			1.06		0.36	16.06		0.76			
	>20%?																				
1/13/2015 TB19-GW-grab	TOLLWAY 3128	<0.037	<0.11	0.035	0.0760	<0.00055	129	<0.012	<0.013	<0.0058	0.0037	<0.024	10.7	<0.11	27.3	0.0033	<0.022	469	<0.043	<0.073	<0.041
1/13/2015 TB19-GW-grab-dupe	TOLLWAY 3129	<0.037	<0.11	0.034	0.0770	<0.00055	129	<0.012	<0.013	<0.0058	0.0032	<0.024	11.6	<0.11	26.9	0.0034	<0.022	464	<0.043	<0.073	<0.041
	difference			0.00030	0.00097		0.31100			0.00047			0.93010		0.38110	0.00007		5.27800			
	% difference			0.86	1.27		0.24			12.76			8.72		1.40	2.20		1.12			
	>20%?																				
1/27/2015 TB19-GW-grab	TOLLWAY 3152	<0.037	<0.11	0.026	0.313	<0.00055	439	<0.012	<0.013	<0.0058	0.0018	<0.024	27.6	<0.11	41.9	0.0052	<0.022	2334	<0.043	<0.073	<0.041
1/27/2015 TB19-GW-grab-dupe	TOLLWAY 3153	<0.037	<0.11	0.026	0.319	<0.00055	430	<0.012	<0.013	<0.0058	0.0024	<0.024	28.0	<0.11	43.1	0.0054	<0.022	2345	<0.043	<0.073	<0.041
	difference			0.00034	0.00553		9.40700			0.00059			0.32400		1.25740	0.00019		11.29000			
	% difference			1.27	1.77		2.14			32.44			1.17		3.00	3.60		0.48			
	>20%?									32.44											
2/10/15 TB19-GW-grab	TOLLWAY 3171	<0.037	<0.11	0.031	0.364	<0.00055	454	<0.012	<0.013	<0.0058	0.0049	<0.024	26.5	<0.11	67.9	0.0075	<0.022	2447	<0.043	0.103	<0.041
2/10/15 TB19-GW-grab-dupe	TOLLWAY 3172	<0.037	<0.11	0.030	0.361	<0.00055	462	<0.012	<0.013	<0.0058	0.0047	<0.024	26.0	<0.11	66.6	0.0073	<0.022	2459	<0.043	0.097	<0.041
	difference			0.00037	0.00260		7.84600			0.00015			0.47750		1.25860	0.00024		12.01000		0.00570	
	% difference			1.20	0.72		1.73			3.08			1.80		1.85	3.18		0.49		5.55	
	>20%?																				
3/4/15 TB15B-GW-grab	TOLLWAY 3194	<0.074 *	<0.11	<0.046 *	0.712	<0.00055	495	<0.012	<0.013	<0.0058	<0.0032 *	<0.024	34.2	<0.22 *	57.2	0.0062	<0.022	5027	<0.043	0.106	<0.041
3/4/15 TB15B-GW-grab-dupe	TOLLWAY 3195	<0.074 *	<0.11	<0.046 *	0.710	<0.00055	495	<0.012	<0.013	<0.0058	<0.0032 *	<0.024	34.2	<0.22 *	57.5	0.0064	<0.022	5026	<0.043	0.106	<0.041
	difference				0.00254		0.31900						0.03340		0.21410	0.00018		0.81000		0.00067	
	% difference				0.36		0.06						0.10		0.37	2.83		0.02		0.63	
	>20%?																				
3/10/15 TB7Bin-grab	TOLLWAY 3203	<0.037	<0.11	0.066	0.108	<0.00055	226	<0.012	<0.013	<0.0058	0.0028	0.053	26.4	<0.11	52.1	0.0379	<0.022	2608	<0.043	<0.073	<0.041
3/10/15 TB7Bin-grab-dupe	TOLLWAY 3204	<0.037	<0.11	0.068	0.114	<0.00055	230	<0.012	<0.013	<0.0058	0.0021	0.046	28.5	<0.11	53.6	0.0386	<0.022	2684	<0.043	<0.073	<0.041
	difference			0.00175	0.00644		3.93600			0.00075	0.00661	2.09460			1.49330	0.00073		75.87000			
	% difference			2.65	5.96		1.74			26.54	12.45	7.93			2.87	1.94		2.91			
	>20%?									26.54											
3/17/15 TB19-GW-grab	TOLLWAY 3225	0.075	<0.11	0.047	0.168	<0.00055	207	<0.012	<0.013	<0.0058	0.0047	0.033	20.7	<0.11	33.5	0.0024	<0.022	1377	<0.043	<0.073	<0.041
3/17/15 TB19-GW-grab-dupe	TOLLWAY 3226	0.061	<																		

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

Sample ID		Al mg/L	As mg/L	B mg/L	Ba mg/L	Be mg/L	Ca mg/L	Cd mg/L	Co mg/L	Cr mg/L	Cu mg/L	Fe mg/L	K mg/L	Li mg/L	Mg mg/L	Mn mg/L	Mo mg/L	Na mg/L	Ni mg/L	P mg/L	Pb mg/L	
MDL:		0.0061	0.108	0.023	0.00085	0.00055	0.012	0.012	0.013	0.0058	0.00079	0.0059	0.016	0.018	0.0025	0.0015	0.022	0.026	0.014	0.063	0.041	
4/14/15	TB15B-GW-grab	TOLLWAY 3276	0.077	<0.11	0.032	0.146	<0.00055	154	<0.012	<0.013	<0.0058	0.0033	0.027	21.6	<0.11	11.5	<0.0015	0.026	1725	<0.043	0.103	<0.041
4/14/15	TB15B-GW-grab-dupe	TOLLWAY 3277	0.076	<0.11	0.029	0.143	<0.00055	150	<0.012	<0.013	0.0061	0.0036	0.026	21.7	<0.11	11.0	<0.0015	0.025	1734	<0.043	0.115	<0.041
		difference	0.00083		0.00216	0.00380		3.85200			0.00031	0.00133	0.09790			0.53920	0.000962	9.22000		0.01136		
		% difference	1.08		6.83	2.59		2.50			9.52	4.89	0.45			4.67	3.73	0.53		11.00		
		>20%?																				
4/29/15	TB15B-GW-grab	TOLLWAY 3307	<0.037	<0.11	0.039	0.179	<0.00055	168	<0.012	<0.013	<0.0058	0.0063	<0.024	24.9	<0.11	16.7	0.0022	0.024	1838	<0.043	<0.073	<0.041
4/29/15	TB15B-GW-grab-dupe	TOLLWAY 3308	<0.037	<0.11	0.038	0.181	<0.00055	169	<0.012	<0.013	<0.0058	0.0054	<0.024	25.3	<0.11	17.6	0.0020	0.024	1890	<0.043	0.125	<0.041
		difference			0.00083	0.00239		1.47200			0.00089		0.42360			0.89090	0.00017	0.000219	52.01000			
		% difference			2.11	1.34		0.88			14.14		1.70			5.34	7.67	0.92	2.83			
		>20%?																				
5/12/15	TB15B-GW-Isco	TOLLWAY 3327	0.839	<0.11	0.030	0.0541	<0.00055	56.7	<0.012	<0.013	<0.0058	0.0097	0.547	8.80	<0.11	6.85	0.0085	<0.022	575	<0.043	0.137	<0.041
5/12/15	TB15B-GW-Isco-dupe	TOLLWAY 3328	0.828	<0.11	0.029	0.0551	<0.00055	56.9	<0.012	<0.013	<0.0058	0.0097	0.538	8.93	<0.11	6.93	0.0085	<0.022	585	<0.043	0.122	<0.041
		difference	0.01017		0.00101	0.00097		0.16830			0.00003	0.00854	0.13236			0.07732	0.00001		10.12000		0.01532	
		% difference	1.21		3.31	1.79		0.30			0.30	1.56	1.50			1.13	0.13		1.76		11.18	
		>20%?																				
5/27/15	TB19-GW-grab	TOLLWAY 3358	1.74	<0.11	0.039	0.0432	<0.00055	43.1	<0.012	<0.013	0.0064	0.0153	1.09	13.7	<0.11	11.1	0.0128	<0.022	629	<0.043	0.117	<0.041
5/27/15	TB19-GW-grab-dupe	TOLLWAY 3359	1.72	<0.11	0.032	0.0426	<0.00055	42.7	<0.012	<0.013	0.0069	0.0154	1.05	12.8	<0.11	11.1	0.0127	<0.022	601	<0.043	0.120	<0.041
		difference	0.02019		0.00732	0.00057		0.40000			0.000548	0.00004	0.03974	0.91340		0.06450	0.00011		28.12900		0.00230	
		% difference	1.16		18.60	1.31		0.93			8.59	0.29	3.66	6.65		0.58	0.87		4.47		1.96	
		>20%?																				
6/9/15	TB15B-GW-Isco	TOLLWAY 3378	0.166	<0.11	0.033	0.0586	<0.00055	59.8	<0.012	<0.013	<0.0058	0.0094	0.131	11.3	<0.11	8.50	0.0034	<0.022	662	<0.043	0.077	<0.041
6/9/15	TB15B-GW-Isco-dupe	TOLLWAY 3379	0.172	<0.11	0.030	0.0563	<0.00055	59.6	<0.012	<0.013	<0.0058	0.0088	0.127	10.9	<0.11	8.23	0.0027	<0.022	639	<0.043	<0.073	<0.041
		difference	0.00580		0.00280	0.00227		0.15500			0.00061	0.00393	0.37300			0.26748	0.00077		22.35600			
		% difference	3.49		8.61	3.88		0.26			6.48	3.01	3.31			3.15	22.35		3.38			
		>20%?															22.35					
6/22/15	TB19-GW-grab	TOLLWAY 3396	0.549	<0.11	0.077	0.0404	<0.00055	50.7	<0.012	<0.013	<0.0058	0.0109	0.345	12.6	<0.11	13.6	0.0067	<0.022	374	<0.043	<0.073	<0.041
6/22/15	TB19-GW-grab-dupe	TOLLWAY 3397	0.546	<0.11	0.077	0.0410	<0.00055	51.5	<0.012	<0.013	<0.0058	0.0110	0.345	12.6	<0.11	14.1	0.0069	<0.022	380	<0.043	<0.073	<0.041
		difference	0.00276		0.00060	0.00056		0.77730			0.00013	0.00018	0.07320			0.46310	0.00024		5.67100			
		% difference	0.50		0.78	1.39		1.53			1.15	0.05	0.58			3.40	3.61		1.52			
		>20%?																				
7/7/15	TB19-GW-Isco	TOLLWAY 3436	1.01	<0.11	0.066	0.0449	<0.00055	52.9	<0.012	<0.013	<0.0058	0.0108	0.686	11.1	<0.11	11.5	0.0125	<0.022	364	<0.043	<0.073	<0.041
7/7/15	TB19-GW-Isco-dupe	TOLLWAY 3437	0.927	<0.11	0.067	0.0441	<0.00055	52.2	<0.012	<0.013	<0.0058	0.0106	0.673	11.0	<0.11	11.2	0.0128	<0.022	360	<0.043	<0.073	<0.041
		difference	0.08110		0.00062	0.00085		0.68390			0.00018	0.01229	0.03670			0.27600	0.00031		4.07100			
		% difference	8.05		0.94	1.89		1.29			1.69	1.79	0.33			2.40	2.48		1.12			
		>20%?																				
7/20/15	TB19-GW-grab	TOLLWAY 3450	0.357	<0.11	0.066	0.0342	<0.00055	47.1	<0.012	<0.013	<0.0058	0.0126	0.258	10.7	<0.11	9.56	0.0059	<0.022	259	<0.043	0.108	<0.041
7/20/15	TB19-GW-grab-dupe	TOLLWAY 3451	0.194	<0.11	0.063	0.0317	<0.00055	44.4	<0.012	<0.013	<0.0058	0.0124	0.150	10.0	<0.11	9.21	0.0047	<0.022	244	<0.043	0.108	<0.041
		difference	0.16315		0.00319	0.00241		2.69280			0.00025	0.10807	0.65350			0.34663	0.00118		14.33300		0.00054	
		% difference	45.67		4.81	7.06		5.72			1.94	41.94	6.13			3.63	19.90				0.50	
		>20%?	45.67									41.94										
8/4/15	TB19-GW-grab	TOLLWAY 3489	0.402	<0.11	0.053	0.0519	<0.00055	58.4	<0.012	<0.013	<0.0058	0.0111	0.299	12.9	<0.11	13.3	0.0077	<0.022	366	<0.043	0.099	<0.041
8/4/15	TB19-GW-grab-dupe	TOLLWAY 3490	0.341	<0.11	0.053	0.0522	<0.00055	60.0	<0.012	<0.013	<0.0058	0.0116	0.258	13.0	<0.11	12.4	0.0071	<0.022	366	<0.043	<0.073	<0.041
		difference	0.06105		0.00060	0.00032		1.54850			0.00057	0.04083	0.13750			0.85990	0.00061		0.35800			
		% difference	15.20		1.12	0.62		2.65			5.11	13.65	1.07			6.48	7.91		0.10			
		>20%?																				
8/19/15	TB9A-C2N-Isco	TOLLWAY 3515	0.054	<0.11	0.052	0.0359	<0.00055	17.1	<0.012	<0.013	0.0127	0.0227	0.041	3.40	<0.11	1.72	0.0150	<0.022	86.3	<0.043	<0.073	<0.041
8/19/15	TB9A-C2N-Isco-dupe	TOLLWAY 3516	0.049	<0.11	0.053	0.0359	<0.00055	16.9	<0.012	<0.013	0.0130	0.0226	0.036	3.41	<0.11	1.67	0.0148	<0.022	87.0	<0.043	<0.073	<0.041
		difference	0.00492		0.00061	0.00004		0.23530			0.000344	0.00013	0.00488	0.00350		0.05609	0.00020		0.72170			
		% difference	9.18		1.17	0.10		1.37			2.71	0.58	11.86	0.10		3.26	1.34		0.84			

APPENDIX E: Results of Geochemical Analysis of Field Duplicate Samples

		S	Sb	Se	Si	Sn	Sr	Ti	TI	V	Zn	pH	alkalinity	TDS, 180 C	TSS	oPO ₄ -P	NH ₃ -N	F	Cl	NO ₃ -N	SO ₄	total NVOC	dissolved NVOC
		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L as CaCO ₃	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
		0.217	0.059	0.131	0.066	0.086	0.00037	0.00056	0.017	0.047	0.0073		4	12	3	0.01	0.06	0.08	0.09	0.07	0.31	0.31	0.31
4/14/15	TB15B-GW-grab	45.9	<0.059	<0.13	5.10	<0.086	1.02	<0.00056	<0.017	<0.047	<0.0097	8.77	130	4694	<3.0	0.084	0.06	0.19	2670	1.14	120	9.91	10.3
4/14/15	TB15B-GW-grab-dupe	44.9	<0.059	<0.13	4.99	<0.086	0.991	<0.00056	<0.017	<0.047	<0.0097	8.77	130	4703	NA	0.087	0.08	0.19	2670	1.15	120	10.7	10.4
		0.96240			0.10548		0.02465					0.00500	0.29020	9.00000		0.00308	0.02470	0.00287	0.76425	0.00563	0.02987	0.77526	0.12994
		2.10			2.07		2.43					0.06	0.22	0.19		3.66	43.90	1.49	0.03	0.49	0.02	7.82	1.26
																	43.90						
4/29/15	TB15B-GW-grab	61.2	<0.059	<0.13	5.56	<0.086	1.10	<0.00056	<0.017	<0.047	<0.0097	7.79	145	5211	<3.0	0.063	<0.03	0.16	3183	1.64	158	8.95	8.83
4/29/15	TB15B-GW-grab-dupe	62.6	<0.059	<0.13	5.64	<0.086	1.11	<0.00056	<0.017	<0.047	<0.0097	7.70	145	5240	NA	0.064	<0.03	0.16	3071	1.68	158	9.01	8.78
		1.42830			0.08066		0.01433					0.08600	0.39980	29.00000		0.00074		0.00710	112.37483	0.03267	0.00934	0.05781	0.05397
		2.34			1.45		1.31					1.10	0.28	0.56		1.17		4.51	3.53	1.99	0.01	0.65	0.61
5/12/15	TB15B-GW-lsco	21.1	<0.059	<0.13	5.49	<0.086	0.328	0.0207	<0.017	<0.047	<0.0097	7.99	137	1631	10.4	0.167	<0.03	0.21	890	0.57	57.1	14.9	10.7
5/12/15	TB15B-GW-lsco-dupe	21.7	<0.059	<0.13	5.57	<0.086	0.335	0.0200	<0.017	<0.047	<0.0097	8.02	136	1630	NA	0.166	<0.03	0.22	876	0.57	56.8	14.8	11.2
		0.60390			0.08473		0.00726	0.00076				0.03500	0.16720	1.00000		0.00054		0.00674	13.17749	0.00302	0.30414	0.01419	0.47401
		2.86			1.54		2.21	3.66				0.44	0.12	0.06		0.33		3.24	1.48	0.53	0.53	0.10	4.42
5/27/15	TB19-GW-grab	27.1	<0.059	<0.13	10.8	<0.086	0.242	0.0416	<0.017	<0.047	<0.0097	8.29	242	1750	<3.0	0.117	0.05	0.26	869	0.97	74.0	16.0	14.6
5/27/15	TB19-GW-grab-dupe	27.2	<0.059	<0.13	10.3	<0.086	0.240	0.0404	<0.017	<0.047	<0.0097	8.30	243	1744	NA	0.121	<0.03	0.25	848	0.97	74.0	15.3	14.3
		0.07200			0.43830		0.00157	0.00122				0.01600	0.36030	6.00000		0.00408		0.01170	20.89156	0.00174	0.04648	0.77615	0.27028
		0.27			4.07		0.65	2.93				0.19	0.15	0.34		3.48		4.52	2.41	0.18	0.06	4.84	1.86
6/9/15	TB15B-GW-lsco	28.5	<0.059	<0.13	5.96	<0.086	0.378	0.00441	<0.017	<0.047	<0.0097	8.16	198	1885	<3.0	0.102	<0.03	0.24	956	0.71	78.1	11.9	10.5
6/9/15	TB15B-GW-lsco-dupe	27.4	<0.059	<0.13	5.74	<0.086	0.363	0.00448	<0.017	<0.047	<0.0097	8.08	199	1867	NA	0.102	<0.03	0.23	959	0.70	78.2	11.9	10.2
		1.08180			0.22410		0.01460	0.00006				0.07800	0.44220	18.00000		0.00031		0.00619	2.61415	0.00364	0.01882	0.00885	0.26438
		3.80			3.76		3.86	1.38				0.96	0.22	0.95		0.30		2.60	0.27	0.51	0.02	0.07	2.53
6/22/15	TB19-GW-grab	27.1	<0.059	<0.13	9.04	<0.086	0.225	0.0128	<0.017	<0.047	<0.0097	8.36	302	1179	<3.0	0.119	<0.03	0.25	434	1.61	74.5	12.7	12.2
6/22/15	TB19-GW-grab-dupe	27.8	<0.059	<0.13	9.18	<0.086	0.227	0.0130	<0.017	<0.047	<0.0097	8.35	302	1190	NA	0.125	<0.03	0.25	436	1.61	74.5	11.8	12.2
		0.68390			0.13763		0.00230	0.00019				0.00200	0.15260	11.00000		0.00610		0.00030	2.05288	0.00645	0.01628	0.94275	0.01609
		2.53			1.52		1.02	1.50				0.02	0.05	0.93		5.12		0.12	0.47	0.40	0.02	7.41	0.13
7/7/15	TB19-GW-lsco	23.4	<0.059	<0.13	9.56	<0.086	0.232	0.0283	<0.017	<0.047	<0.0097	8.13	299	1123	5.2	0.110	<0.03	0.22	414	1.20	65.4	14.7	14.0
7/7/15	TB19-GW-lsco-dupe	23.2	<0.059	<0.13	9.30	<0.086	0.228	0.0248	<0.017	<0.047	<0.0097	8.14	298	1121	NA	0.109	<0.03	0.25	415	1.20	65.4	15.4	14.0
		0.15580			0.26125		0.00369	0.00345				0.00200	0.54990	2.00000		0.00017		0.02208	0.71964	0.00606	0.03019	0.67842	0.01864
		0.67			2.73		1.59	12.19				0.02	0.18	0.18		0.15		9.86	0.17	0.50	0.05	4.60	0.13
7/20/15	TB19-GW-grab	21.4	<0.059	<0.13	8.41	<0.086	0.187	0.00936	<0.017	<0.047	<0.0097	7.94	248	796	<3.0	0.117	<0.03	0.29	245	1.04	58.3	13.6	12.7
7/20/15	TB19-GW-grab-dupe	20.5	<0.059	<0.13	7.66	<0.086	0.177	0.00491	<0.017	<0.047	<0.0097	7.97	248	795	NA	0.119	<0.03	0.30	245	1.05	58.1	13.8	12.7
		0.92480			0.74766		0.00978	0.00446				0.02600	0.07690	1.00000		0.00217		0.01365	0.13006	0.01032	0.14253	0.23070	0.00576
		4.31			8.89		5.22	47.61				0.33	0.03	0.13		1.85		4.73	0.05	0.99	0.24	1.70	0.05
							47.61																
8/4/15	TB19-GW-grab	25.9	<0.059	<0.13	8.24	<0.086	0.283	0.0132	<0.017	<0.047	0.0121	7.69	257	1089	<3.0	0.103	<0.03	0.20	421	2.06	70.6	12.1	11.7
8/4/15	TB19-GW-grab-dupe	25.7	<0.059	<0.13	8.11	<0.086	0.284	0.0114	<0.017	<0.047	0.0125	7.61	259	1092	NA	0.103	<0.03	0.22	420	2.06	70.4	12.2	11.4
		0.15340			0.12982		0.00167	0.00180				0.000366	0.08400	1.58510	3.00000		0.00008		0.01775	0.92415	0.00239	0.13291	0.07178
		0.59			1.58		0.59	13.69				3.02	1.09	0.62	0.28		0.08		8.81	0.22	0.12	0.19	0.59
8/19/15	TB9A-C2N-lsco	7.66	<0.059	<0.13	1.44	<0.086	0.121	0.00088	<0.017	<0.047	0.0804	6.89	44	279	129	0.005	0.04	1.01	103	1.04	19.6	36.3	22.0
8/19/15	TB9A-C2N-lsco-dupe	7.67	<0.059	<0.13	1.42	<0.086	0.119	0.00092	<0.017	<0.047	0.0800	6.80	44	271	NA	0.005	0.04	1.00	104	1.04	19.5	38.2	22.1
		0.00741			0.01679		0.00173	0.00004				0.000368	0.09100	0.40590	8.00000		0.00011	0.00633	0.01481	1.46477	0.00342	0.10885	1.87742
		0.10			1.17		1.43	4.08				0.46	1.32	0.93	2.87		2.27	14.79	1.46	1.43	0.33	0.55	5.17
																							0.42

Appendix F. Exceedances of Water-Quality Standards in Surface-Water Grab Samples

Note: only analytes that recorded exceedances are shown

Illinois General-Use Water-Quality Standards (Section 302.204)

LOCATION		NUMERICAL Standards								DERIVED standards											
		min 6.5		500		1.0		0.05		acute		acute		chronic		chronic		chronic		chronic	
		max 9.0		mg/L		mg/L		mg/L		(calculated)		(calculated)		(calculated)		(calculated)		(calculated)		(calculated)	
tot samples	pH exceedances	% exceedances	Cl exceedances	% exceedances	Fe exceedances	% exceedances	P exceedances	% exceedances	NH3 -N exceedances	% exceedances	Cu exceedances	% exceedances	Cu exceedances	% exceedances	Ni exceedances	% exceedances	Pb exceedances	% exceedances	Zn exceedances	% exceedances	
PRECON	TB7Bin	5	1	20	1	20	-	-	-	-	2	40	2	40	2	40	-	-	1	20	
YEAR 1	TB7Bin	3	1	33	3	100	-	3	100	1	33	-	-	-	-	-	-	-	-	-	
YEAR 2	TB7Bin	15	1	7	13	87	-	12	80	-	-	2	13	2	13	-	-	-	2	13	
YEAR 3	TB7Bin	7	-	-	5	71	-	5	71	-	-	2	29	2	29	-	-	-	2	29	
YEAR 4	TB7Bin	10	-	-	10	100	-	5	50	-	-	-	-	-	-	-	-	-	1	10	
YEAR 5	TB7Bin	6	-	-	4	67	-	2	33	-	-	1	17	2	33	-	-	-	3	50	
total post-construction samples		41																			
exceedances after construction			2		35		0		27	1		5		6		0		0		8	
% exceedances before construction			20		20		0		0	0		40		40		40		0		20	
% after construction			5		85		0		66	2		12		15		0		0		20	
PRECON	TB7Bout	6	1	17	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
YEAR 1	TB7Bout	2	-	-	1	50	-	1	50	-	-	-	-	-	-	-	-	-	-	-	
YEAR 2	TB7Bout	3	-	-	2	67	-	3	100	-	-	-	-	-	-	-	-	-	-	-	
YEAR 3	TB7Bout	1	-	-	-	-	-	1	100	-	-	1	100	-	-	-	-	-	-	-	
YEAR 4	TB7Bout	4	-	-	3	75	-	2	50	-	-	-	-	-	-	-	-	-	-	-	
YEAR 5	TB7Bout	3	-	-	2	67	-	2	67	-	-	-	-	-	-	-	-	-	-	-	
total post-construction samples		13																			
exceedances after construction			0		8		0		9	0		0		1		0		0		0	
% exceedances before construction			17		0		0		0	0		0		0		0		0		0	
% after construction			0		62		0		69	0		0		8		0		0		0	
PRECON	TB9A	20	16	80	19	95	-	5	25	6	30	-	5	25	16	80	-	-	-	-	
YEAR 1	TB9A	3	1	33	3	100	-	3	100	-	-	-	-	-	-	-	-	-	-	-	
YEAR 2	TB9A	14	1	7	12	86	-	13	93	-	-	-	-	1	7	-	-	-	-	-	
YEAR 3	TB9A	13	-	-	12	92	-	11	85	-	-	-	-	-	-	-	-	-	-	-	
YEAR 4	TB9A	17	-	-	16	94	-	10	59	-	1	6	1	6	-	-	-	-	-	-	
YEAR 5	TB9A	11	-	-	10	91	-	5	45	-	-	-	-	-	-	-	-	-	-	-	
total post-construction samples		58																			
exceedances after construction			2		53		0		42	0		1		1		1		0		0	
% exceedances before construction			80		95		0		25	30		0		25		80		0		0	
% after construction			3		91		0		72	0		2		2		2		0		0	
PRECON	TB15Bsw	29	27	93	25	86	-	8	28	9	31	22	76	26	90	9	31	-	-	-	
YEAR 1	TB15Bsw	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
YEAR 2	TB15Bsw	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
YEAR 3	TB15Bsw	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
YEAR 4	TB15Bsw	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
YEAR 5	TB15Bsw	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	
total post-construction samples		0																			
exceedances after construction			N/A		N/A		N/A		N/A	N/A		N/A		N/A		N/A		N/A		N/A	
% exceedances before construction			93		86		0		28	31		76		90		31		0		0	
% after construction			N/A		N/A		N/A		N/A	N/A		N/A		N/A		N/A		N/A		N/A	
PRECON	TB15Bsw	29	27	93	25	86	-	8	28	9	31	22	76	26	90	9	31	-	-	-	
YEAR 2	TB15Bsw	25	1	4	19	76	1	4	24	96	-	-	1	4	-	-	-	-	-	-	
YEAR 3	TB15Bsw	26	4	15	23	88	1	4	26	100	-	-	1	4	-	-	-	-	-	-	
YEAR 4	TB15Bsw	22	1	5	19	86	1	5	22	100	-	1	5	4	18	-	1	5	-	-	
YEAR 5	TB15Bsw	21	-	-	18	86	-	17	81	-	-	-	-	-	-	-	-	-	-	-	
total post-construction samples		123																			
exceedances after construction			33		104		3		97	9		23		32		9		1		0	
% exceedances before construction			93		86		0		28	31		76		90		31		0		0	
% after construction			27		85		2		79	7		19		26		7		1		0	

NS= no sample collected, N/A=not applicable

Appendix F. Exceedances of Water-Quality Standards in Surface-Water Grab Samples (con't.)

Note: only analytes that recorded exceedances are shown
Illinois General-Use Water-Quality Standards (Section 302.204)

		NUMERICAL Standards								DERIVED standards											
		min 6.5		500		1.0		0.05		acute (calculated)		acute (calculated)		chronic (calculated)		chronic (calculated)		chronic (calculated)		chronic (calculated)	
		max 9.0		mg/L		mg/L		mg/L		NH3 -N		Cu		Cu		Ni		Pb		Zn	
LOCATION	tot samples	exceedances	%	exceedances	%	exceedances	%	exceedances	%	exceedances	%	exceedances	%	exceedances	%	exceedances	%	exceedances	%	exceedances	%
PRECON	TB19sw	33	16	48	29	88	-	7	21	-	2	6	3	9	20	61	1	3	-	-	-
YEAR 1	TB19sw	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
YEAR 2	TB19sw	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
YEAR 3	TB19sw	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
YEAR 4	TB19sw	1	-	1	100	-	1	100	-	-	-	-	-	-	-	-	-	-	1	100	-
YEAR 5	TB19sw	1	-	-	-	-	1	100	-	-	-	1	100	-	-	-	-	-	-	-	-
total post-construction samples		2	0	1	N/A	2	0	0	0	0	0	1	0	0	0	1	0	1	0	1	0
exceedances after construction		0	48	88	N/A	21	0	6	9	0	0	61	3	0	0	3	0	0	0	0	0
% exceedances before construction		0	0	50	N/A	100	0	0	50	0	0	0	0	0	0	0	0	0	50	0	50
% after construction		0	48	88	N/A	21	0	6	9	0	0	61	3	0	0	3	0	0	0	0	0
PRECON	TB19sw	33	16	48	29	88	-	7	21	-	2	6	3	9	20	61	1	3	-	-	-
YEAR 2	TB19gw	25	-	14	56	1	4	24	96	-	-	-	-	-	-	-	-	-	-	-	-
YEAR 3	TB19gw	26	1	4	16	62	1	4	23	88	-	-	-	-	-	-	-	-	-	-	-
YEAR 4	TB19gw	22	-	13	59	2	9	19	86	-	-	3	14	-	-	-	-	-	-	-	-
YEAR 5	TB19gw	22	-	14	64	2	9	14	64	-	-	1	5	-	-	-	-	-	-	-	-
total post-construction samples		95	1	57	6	80	0	21	0	0	0	4	0	0	0	0	0	0	0	0	0
exceedances after construction		1	48	88	0	21	0	6	9	0	0	61	3	0	0	3	0	0	0	0	0
% exceedances before construction		1	1	60	6	84	0	6	84	0	0	4	0	0	0	0	0	0	0	0	0
% after construction		1	1	20	1	20	-	-	-	0	2	40	2	40	2	40	-	-	1	20	20
PRECON	TB7Bin	5	1	20	1	20	-	-	-	-	0	2	40	2	40	2	40	-	-	1	20
YEAR 3	TB9Ac2N	9	7	78	7	78	-	7	78	5	56	1	11	4	44	-	-	-	1	11	11
YEAR 4	TB9Ac2N	19	16	84	18	95	-	8	42	10	53	4	21	9	47	1	5	1	5	2	11
YEAR 5	TB9Ac2N	20	17	85	18	90	-	5	25	6	30	5	25	6	30	-	-	-	2	10	10
total post-construction samples		48	40	43	N/A	20	21	10	21	0	10	19	1	1	1	1	1	1	5	5	5
exceedances after construction		20	20	20	N/A	0	0	40	40	0	40	40	40	40	40	0	0	0	20	20	20
% exceedances before construction		83	83	90	N/A	42	44	21	40	44	40	40	2	2	2	2	2	2	10	10	10
% after construction		83	83	90	N/A	42	44	21	40	44	40	40	2	2	2	2	2	2	10	10	10
PRECON	TB7Bin	5	1	20	1	20	-	-	-	-	0	2	40	2	40	2	40	-	-	1	20
YEAR 4	TB15Bc1N	3	3	100	3	100	-	1	33	2	67	-	-	-	-	-	-	-	-	-	-
YEAR 5	TB15Bc1N	0	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS	NS
total post-construction samples		3	3	3	N/A	1	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0
exceedances after construction		20	20	20	N/A	0	0	40	40	0	40	40	40	40	40	0	0	0	20	20	20
% exceedances before construction		100	100	100	N/A	33	67	0	0	67	0	0	0	0	0	0	0	0	0	0	0
% after construction		100	100	100	N/A	33	67	0	0	67	0	0	0	0	0	0	0	0	0	0	0

NS= no sample collected, N/A=not applicable