Preliminary Hydrogeologic Evaluation
Brunner Island Steam Electric Station
York Haven, York County, Pennsylvania

Groundwater Management Associates, Inc.

2205 Candun Drive, Suite A
Apex, North Carolina 27523
Telephone: 919.363.6310
Fax: 919.363.6203

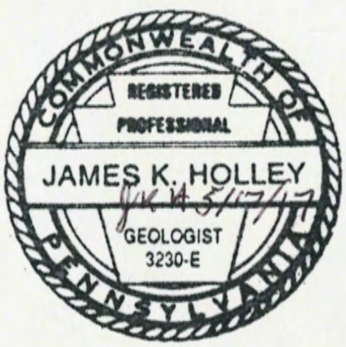
4300 Sapphire Court, Suite 100
Greenville, North Carolina 27834
Telephone: 252.758.3310
Fax: 252.758.8835

Preliminary Hydrogeologic Evaluation
Brunner Island Steam Electric Station
York Haven, York County, Pennsylvania

Prepared For:

Sierra Club Environmental Law Program
Attn: Zachary Fabish
50 F Street, NW, Eighth Floor
Washington, DC 20001

Prepared By:



Groundwater Management Associates, Inc.
4300 Sapphire Court, Suite 100
Greenville, North Carolina 27834
Telephone 252-758-3310

May 17, 2017

Table of Contents

Page

Figures

Tables

Appendices

Executive Summary

Groundwater Management Associates, Inc. (GMA) was contracted by the Sierra Club to provide hydrogeologic consulting on the groundwater conditions beneath and surrounding the Brunner Island Steam Electric Station. Based upon GMA's review and interpretations of data and reports, GMA makes the following major conclusions about groundwater contaminants at Brunner Island:

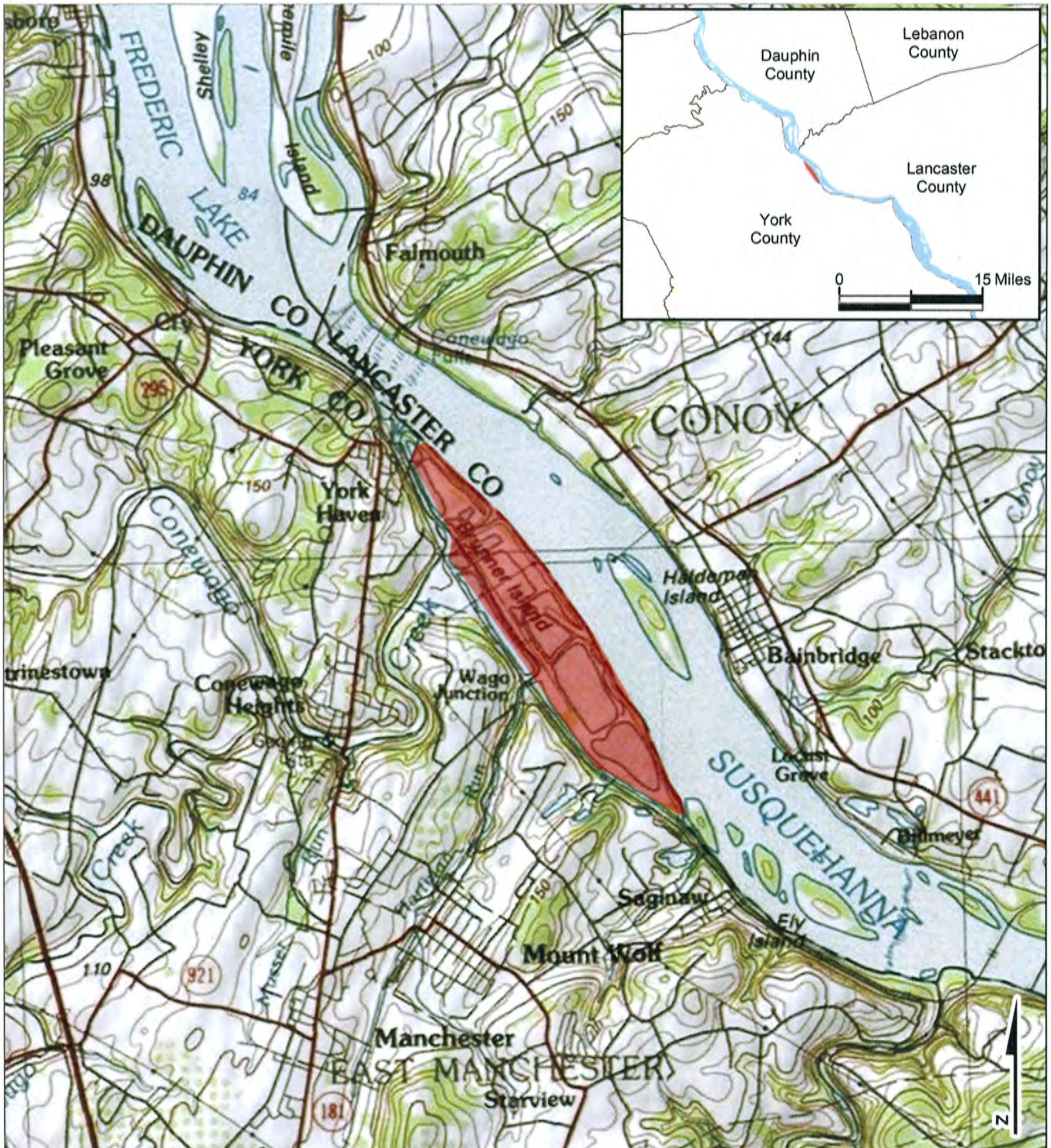
- The Brunner Island facility has numerous disposal areas and other industrial activities that have impacted groundwater quality.
- Most of the contaminants identified in the groundwater beneath Brunner Island are consistent with coal combustion residuals.
- Groundwater impacts have affected the unconsolidated sediments and the underlying bedrock aquifer units.
- Surface water has been impacted by discharge of contaminants from the groundwater system. This is clearly documented by direct observation and monitoring of seeps.
- The water table elevations within and surrounding ash basins and other contaminant source areas at Brunner Island are higher than the base level elevations of the Susquehanna River and nearby tributaries. Groundwater flows from areas of high head (recharge areas) to areas of lower head (discharge areas). Thus, groundwater flows away from high water table areas at Brunner Island and toward local surface water discharge areas.
- Most of the groundwater discharge to adjacent surface water bodies would occur through base flow discharge to the stream channels, rather than the small discharge quantities that have been observed at local seeps and springs. Base flow is discharge of groundwater directly to the stream channel below the water level in the stream.
- Because the groundwater beneath the Brunner Island facility is contaminated, and groundwater from Brunner Island discharges into local surface water bodies, groundwater discharge adds uncontrolled pollutants from the groundwater system into the Susquehanna River and its local tributaries.

1.0 Introduction

The Brunner Island Steam Electric Station (Brunner Island) is an electric power generation facility that has been in operation since 1961 (https://www.talenenergy.com/generation/fossil-fuels/brunner-island). Figure 1 illustrates the location of the Brunner Island facility. Talen Energy currently owns and operates the facility. Coal combustion residuals (CCRs) from coal burned at the plant have been managed and disposed of through a variety of practices, including storage and/or disposal in on site basins. Appendix I includes a copy of the "Overall Map" of the Brunner Island facility taken from the November 7, 2016 "Quarterly Groundwater Report: 3rd Quarter 2016 – Equalization Basin". There is a long history of assessment and monitoring of groundwater quality at Brunner Island.

Talen Energy has applied for renewal of the National Pollution Discharge Elimination System (NPDES) permit. The Sierra Club plans to provide formal comments to the Pennsylvania Department of Environmental Protection (PADEP) regarding concerns about PADEP's April 2017 draft NPDES permit for Brunner Island. These concerns include the potential entry of pollutants into local surface water bodies as a result of contaminated groundwater discharge. Discharge of contaminated groundwater into the surface water bodies may present an existing contaminant load to the surface water that is not accounted for in the draft NPDES permit.

The Sierra Club contracted Groundwater Management Associates, Inc. (GMA) to provide hydrogeologic consulting on the groundwater conditions beneath and surrounding the Brunner Island facility. GMA was asked to perform a focused review of documents provided by the Sierra Club and documents acquired by GMA, including groundwater monitoring and assessment reports. Section 7 of this report lists the documents that GMA reviewed in detail and relied upon for preparation of this report. GMA was asked to provide opinions about the evidence of groundwater contamination associated with handling and disposal of CCRs and other activities at Brunner Island. This report presents GMA's findings and opinions.



LEGEND

BRUNNER ISLAND

SUSQUEHANNA RIVER

0 5000 '

	LOCATION OF BRUNNER ISLAND STEAM ELECTRIC STATION	DATE: 5/11/2017
	BRUNNER ISLAND, PENNSYLVANIA	FIGURE 1

2.0 Summary of Ash Basins, Disposal Areas, and Other Identified Potential Contaminant Sources

Talen Energy conducts ongoing routine groundwater monitoring programs at Brunner Island that focus on 10 areas of concern for impacts to groundwater. These include the following areas:

- Active and Former Coal Ash/CCR Basins:
  - Basin 4 North
  - Basin 4 South
  - Basin 5
  - Basin 6
  - Basin 7
- Ash Landfill (Disposal Area 8)
- Industrial Waste Treatment Basin (IWTB)
- Equalization Basin (EQ Basin)
- Royal Manchester Golf Course
- Residential “Monitoring” Wells

Figure 2 presents a map of the Brunner Island facility showing general locations of CCR basins, disposal areas, and other areas of interest. In addition, the “Overall Map” in Appendix I presents the layout of areas of concern and the associated monitoring stations. Each of these areas is further discussed in the following sections.

LEGEND

- GROUNDWATER MONITORING LOCATION
- OUTFALL LOCATION

0 1800 '

GMA

	LOCATIONS OF ASH BASINS, DISPOSAL AREAS, NPDES OUTFALLS, AND IDENTIFIED POTENTIAL CONTAMINANT SOURCES	DATE: 5/12/2017
	BRUNNER ISLAND, PENNSYLVANIA	FIGURE 2

2.1 Active and Former Coal Ash Basins

Coal ash has been managed and disposed of at the Brunner Island facility predominantly through storage in basins. Today, there is one active coal ash basin (Basin 6) at the facility. According to Talen Energy (April 28, 2016, "Quarterly Groundwater Report: 1st Quarter 2016, Basin No. 6") operation of Basin 6 is to be discontinued, and a "Clean Closure (ash removal)" process began in July of 2015. Basins 4, 5, and 7 represent former coal ash basins at the facility that have ongoing monitoring programs. A cursory review of historical documents of the facility indicate the prior operation of additional basins (e.g., Ash Basin 3). The ash basins are bermed areas where coal ash is, or has previously been, deposited. GMA has not reviewed detailed documentation about the coal ash handling and disposal practices at the Brunner Island facility. However, based upon GMA's experience at other coal ash facilities, we believe that placement of coal ash into basins was performed by pumping a slurry of ash and water into the basins. The solid ash particles settle into the basin, and the water is discharged from the basin as a surface water outfall. The draft NPDES permit for Brunner Island includes an outfall from Ash Basin 6 to the Susquehanna River.

2.2 Ash Landfill (Disposal Area 8)

According to Geosyntec (2016), "*Ash Landfill 8, also called Disposal Area 8, is a CCR landfill constructed in 2008 to accept coal combustion residuals and other wastes produced by the Brunner Island SES…*" The landfill was built in the middle of Ash Basin 5, which was closed in 1987. Geosyntec has submitted a written closure plan to permanently close the landfill. The plan is to leave CCRs in place.

2.3 Industrial Waste Treatment Basin (IWTB)

Brunner Island operates a residual waste storage impoundment referred to as the Industrial Waste Treatment Basin (IWTB). According to PPL Generation, LLC (March 26, 2009), "*The IWTB collects coal pile sediment and water treatment plant sediment (silt from the river) along with some sediment from storm drains…*". Talen Energy performs groundwater monitoring at the IWTB on a quarterly basis.

2.4 Equalization Basin (EQ Basin)

According to PPL Generation, LLC (March 26, 2009), the Equalization Basin (AKA Equalization Pond) "*…operates as a residual waste storage impoundment under the Pennsylvania Residual*

Waste Regulations." The basin was constructed in 1993, and it "*…collects runoff and incidental plant waste flows that may contain sediment and fly ash*". Talen Energy conducts quarterly groundwater monitoring in the vicinity of the Equalization Basin.

2.5 Royal Manchester Golf Course

In 2008 (Geosyntec, 2016), CCRs from Brunner Island were used as fill in the construction of the Royal Manchester Golf Course. The golf course was built southwest of the Brunner Island facility. The CCR wastes applied to the golf course were blended with Stabil-Fill, a soil amendment that includes lime to attempt to stabilize constituents of CCR wastes and prevent leaching of contaminants into the groundwater system. Three monitoring wells were installed at the golf course, and routine groundwater monitoring is performed by Talen Energy and is reported to PADEP on a quarterly basis.

2.6 Residential "Monitoring" Wells

Residential areas adjacent to the Royal Manchester Golf Course include residences with active potable water-supply wells. Talen Energy monitors 7 residential wells on a regular basis to evaluate possible impacts associated with waste disposal on the golf course. The locations of residential wells are shown on the "Overall Map" in Appendix I.

3.0 Hydrogeologic Setting

3.1 Geologic Setting, Structure, and Lithology

The Brunner Island site lies along the boundary of the Gettysburg-Newark Lowland and the Piedmont Lowland sections of the Piedmont Province (DNRC, 2000). The Gettysburg-Newark Lowland is a Triassic age (approximately 252 to 200 ma) depositional basin bounded by a northeast-striking normal fault on the northwestern side of the basin. The basin represents a half-graben structure that formed during the rifting and break-up of the supercontinent Pangea (Figures 3 and 4). Extensional forces associated with rifting formed normal faults that allowed blocks of older continental crust to drop down, creating deep, narrow basins that rapidly filled with sediments eroded from the adjacent upland areas. The total thickness of basin fill in the Gettysburg-Newark Lowland basin near the Susquehanna River was estimated to be 5900 feet (Stose and Jonas, 1939). Thick complex sequences of mostly clastic sediments (mudstones, sandstones, and conglomerates) dominate the rock types within the basin (Wood and Johnston, 1964, PaDER, 1980).

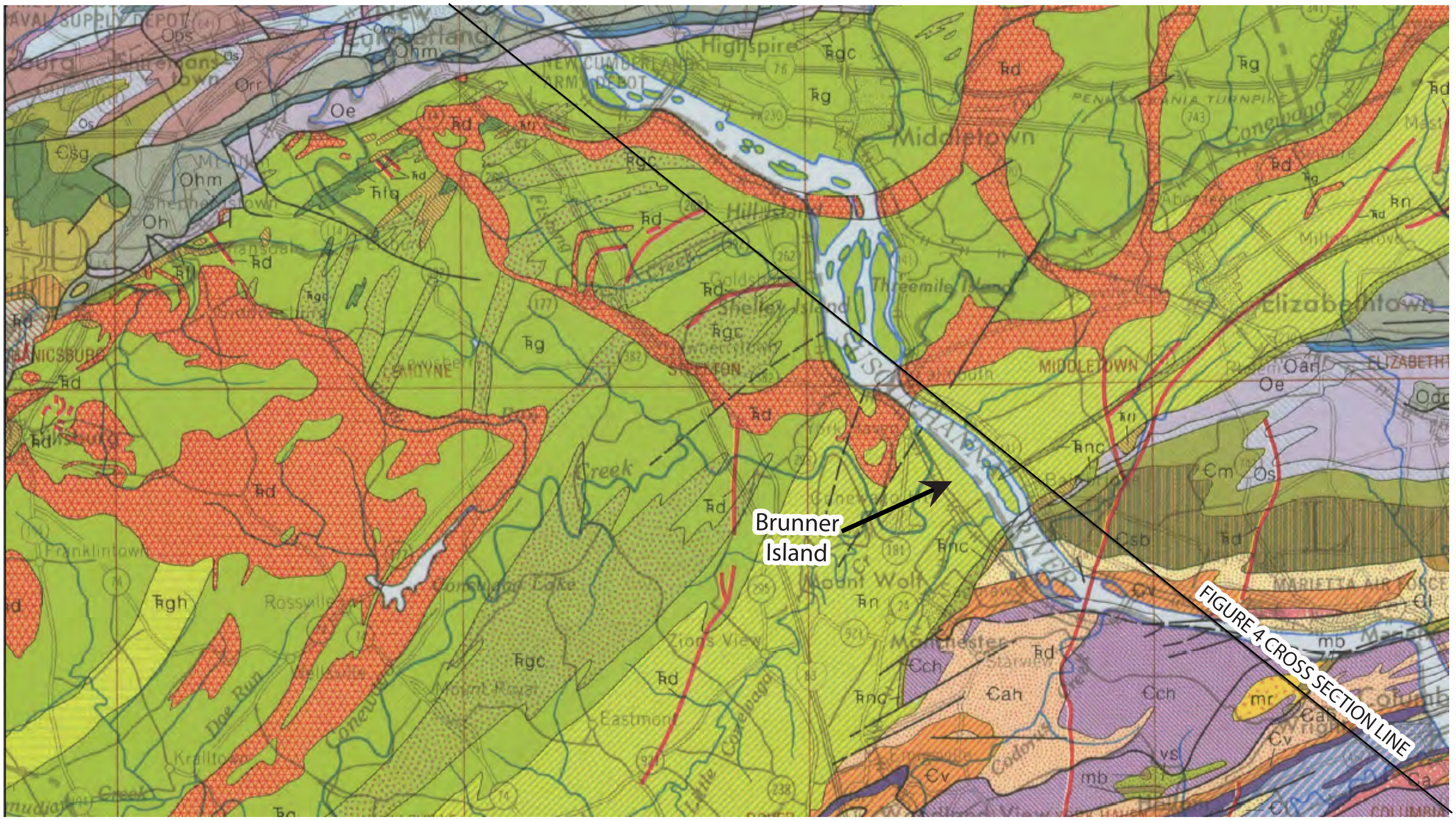


IMAGE SOURCE:
Pennsylvania Department of Environmental Resources, 1
1980, "Geologic Map of Pennsylvania", Commonwealth of
Pennsylvania Topographic and Geologic Survey, 3 sheets.

-LEGEND-

Ʀd - Diabase

Ʀn - New Oxford Formation

Ꞓ - Cambrian aged rocks

GMA
GROUNDWATER MANAGEMENT ASSOCIATES, INC.

	GEOLOGIC MAP OF THE BRUNNER ISLAND VICINITY	DATE: 05/12/2016
	BRUNNER ISLAND, PENNSYLVANIA	FIGURE 3

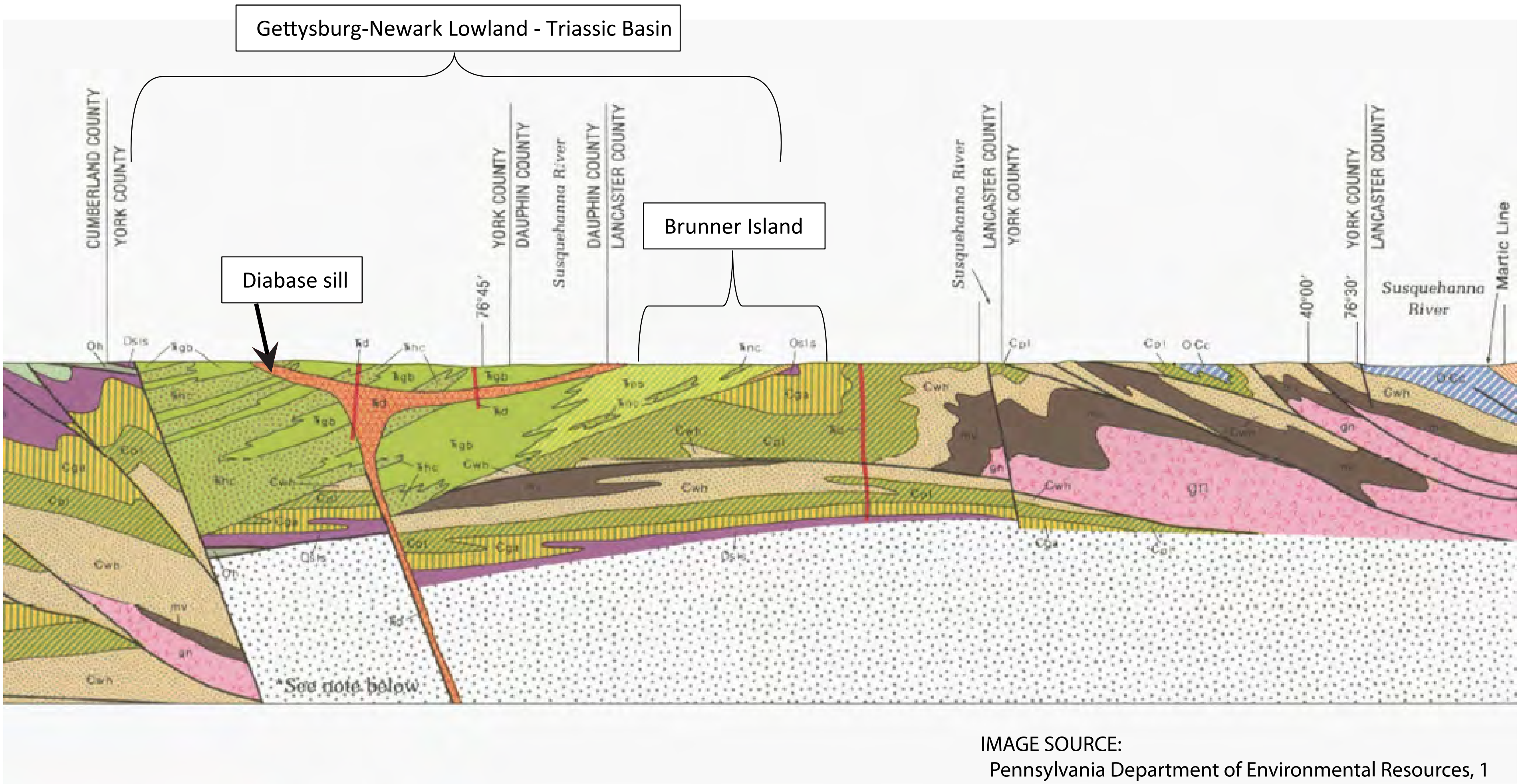


IMAGE SOURCE:
Pennsylvania Department of Environmental Resources, 1 1980, "Geologic Map of Pennsylvania", Commonwealth of Pennsylvania Topographic and Geologic Survey, 3 sheets.

-LEGEND-		GROUNDWATER MANAGEMENT ASSOCIATES, INC.
	GEOLOGIC CROSS SECTION OF THE BRUNNER ISLAND VICINITY	DATE: 05/11/2016
	BRUNNER ISLAND, PENNSYLVANIA	FIGURE 4

3.2 Groundwater Occurrence, Local Aquifer Units, and Preferential Groundwater Flow Pathways

Triassic Sedimentary Rocks

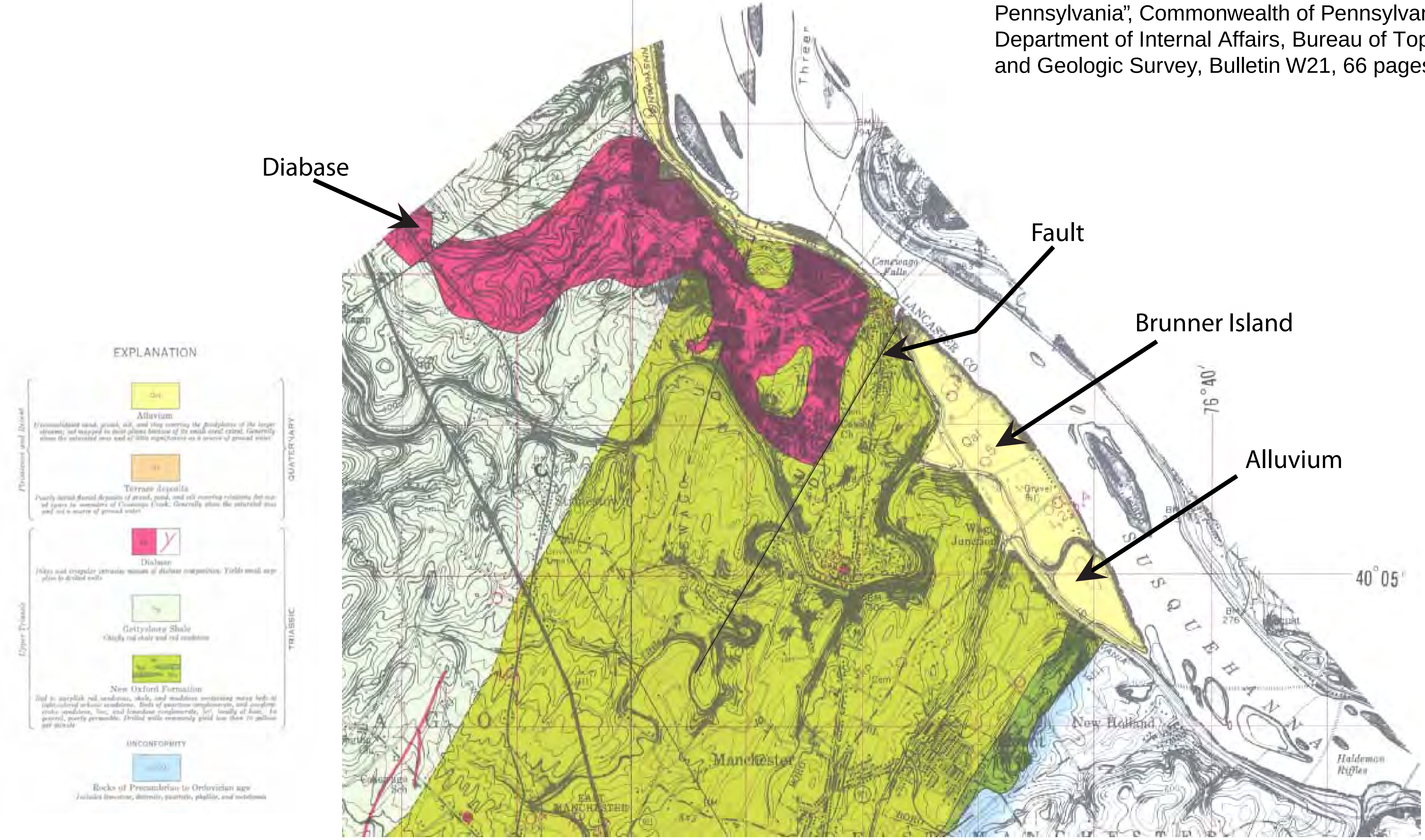
The Triassic sediments that directly underlie most of Brunner Island are mapped as the New Oxford Formation, which include red sandstone, shale, and mudstone containing beds of arkosic sandstone. Beds of conglomerate and conglomeratic sandstone locally occur at the base of the New Oxford Formation. The Triassic sediments of the New Oxford Formation dip to the northwest at an average of 25 degrees (Wood and Johnston, 1964). Much of the sediments in the basin are well indurated and have very low matrix permeability. Weathering of the near-surface Triassic sediments may result in higher permeability (Wood and Johnston, 1964).

Based upon evidence of faulting that cuts across some Triassic strata, the basin experienced continued extension during and after sediment deposition. These faults add a structural complexity to the rocks that can affect the direction and velocity of groundwater movement. One of these faults is mapped as occurring beneath the northern end of Brunner Island in the vicinity of Basin 7 (see Figure 5). Joints and bedding plane fractures are also common within the Triassic sediments, and these fractures enhance the permeability of the rocks (Wood and Johnston, 1964). The majority of groundwater flow through the Triassic sediments is expected to occur along bedding plane fractures, local joints, and through open fault zones.

Diabase Intrusive Bodies

The Triassic basin sediments in the Gettysburg-Newark Basin were also intruded by mafic magmas that cut across the sedimentary strata. These magmas cooled to form a dark colored iron-rich igneous rock called diabase. Most of the diabase near the Brunner Island site occurs as sills, although some nearly vertical tabular dikes have also been mapped in the region. Local geologic maps (PaDER, 1980, and Wood and Johnston, 1964) do not indicate the occurrence of diabase intrusions beneath Brunner Island. However, small dikes could occur that were not large enough to be mapped regionally. Identification of possible smaller diabase intrusions would require geophysical evaluations (such as magnetometry) followed by an exploratory drilling program. Figure 4 illustrates the nature of diabase intrusions within the Gettysburg-Newark Basin.

IMAGE SOURCE:
Wood, P.R., and H.E. Johnston, 1964, “Hydrology of the New Oxford Formation in Adams and York Counties, Pennsylvania”, Commonwealth of Pennsylvania Department of Internal Affairs, Bureau of Topographic and Geologic Survey, Bulletin W21, 66 pages.



-LEGEND-

GROUNDWATER MANAGEMENT ASSOCIATES, INC.

	GEOLOGIC MAP SHOWING LOCAL FAULTING AND QUATERNARY ALLUVIUM NEAR BRUNNER ISLAND	DATE: 05/15/2016
	BRUNNER ISLAND, PENNSYLVANIA	FIGURE 5

Understanding local diabase occurrence can be very important for understanding preferential groundwater flow patterns in Triassic basin rocks. Magma intrusions will cause contact metamorphism of adjacent rocks, resulting in thermal alteration of the intruded rock. Thermal alteration may involve expansion and contraction of the rocks, resulting in local fracturing of the intruded rock, thereby locally increasing the permeability of the rocks. Diabase may also contain frequent joints associated with cooling of the thin intrusive bodies. Diabase is composed of minerals that are unstable under surface temperatures, pressures, and weathering conditions, and it will tend to weather faster than adjacent, more siliceous, sedimentary rocks. As a result, diabase that occurs close to the land surface will commonly have significantly higher permeability than the surrounding unaltered Triassic sediments. Thus, preferential groundwater migration pathways are commonly associated with diabase.

Cambrian Carbonate Rock Units

The southeastern end of Brunner Island extends outside the Gettysburg-Newark Triassic basin (See Figures 3, 4, and 5). The southeastern tip of Basin 6 overlies Cambrian aged dolostones and limestones of the Snitz Creek, Buffalo Springs, and Ledger Formations. These older carbonate rocks have been extensively faulted and folded as a result of multiple Paleozoic orogenies and extensional faulting during the Triassic. The dolostones and limestones of these Cambrian rocks have limited primary porosity and permeability. However, fractures in the rocks can exhibit significantly higher permeability, and fractures may serve as preferred groundwater flow pathways. Dolostone is a sedimentary rock composed of the mineral dolomite, which is a calcium-magnesium carbonate ($CaMg(CO_3)_2$), and limestone is made of calcite ($CaCO_3$). These sedimentary rocks are susceptible to chemical weathering, especially in response to contact with acidic rain water. Dolostone is more resistant to weathering than limestone. These carbonate rocks can develop dissolution voids (caverns) in the subsurface, and chemical weathering of carbonates is often accelerated along open fractures that may occur. Dissolution voids can transmit significant quantities of groundwater and can serve as preferred groundwater flow pathways.

Unconsolidated Alluvium and Regolith

In addition to the indurated rocks of Triassic and Cambrian age beneath and surrounding the Brunner Island facility, there are recent unconsolidated sedimentary deposits and weathered rock (termed regolith) that overlie the indurated rocks. The water table commonly occurs in the unconsolidated sediments or regolith. The water table is the level in the saturated zone of the subsurface at which pore spaces are full of water and the hydraulic pressure (head) is equal to atmospheric pressure (Heath, 1983).

Geologic maps of the area that predate the development of the Brunner Island Steam Electric Station indicate that the island was underlain by Quaternary age (<2.5 Ma) alluvium (Wood and Johnston, 1964). A gravel pit mine was previously operated in the center of the island (See Figure 5), providing evidence of the coarse-grained sediments that naturally occurred beneath the island. The alluvium mapped beneath the island is consistent with fluvial channel deposits associated with the Susquehanna River system and its associated tributaries. Unconsolidated sands and gravels associated with fluvial deposition would be expected to have relatively high permeability. These sediments would also contiguously extend from beneath Brunner Island into the current channel of the Susquehanna River. It is reasonable to expect direct hydraulic connections between the alluvial sediments beneath the island and nearby surface water bodies (e.g., the Susquehanna River, Conewago Creek, Hartman Run, and Black Gut). Prior assessment of seeps that have been conducted at the Brunner Island facility confirm the connection between the shallow groundwater system and the adjacent surface water bodies (see Appendix II).

4.0 Identified Impacts to Groundwater

4.1 Detection of Contaminants

Groundwater contamination has been detected beneath Brunner Island in the water table aquifer (unconsolidated alluvium and regolith) as well as the underlying bedrock (Triassic sedimentary rocks). Monitoring at Basin 6 also indicates that groundwater quality of the Cambrian Carbonate rocks exhibit some drinking water-quality standard exceedances.

The majority of the groundwater-quality impacts reported at Brunner Island are commonly associated with CCRs. Some of the most notable contaminants reported include arsenic, manganese, iron, and boron. There have also been local drinking water-quality standard exceedances of halogenated organic compounds (e.g., trichloroethene) that would not be expected to be associated with CCRs. The halogenated organic compounds would likely be associated with industrial activities (e.g., vehicle maintenance, service areas for the steam plant equipment, etc.) at Brunner Island.

GMA compiled a summary of water-quality standard exceedances at Brunner Island that were reported in the 1st, 2nd, and 3rd quarters of 2016. The summary is presented in Table 1 and lists monitoring results by basin or monitoring program. At least 15 parameters have been reported in 2016 at concentrations exceeding applicable drinking water-quality standards at Brunner Island.

Table 1. Summary of 2016 Water-Quality Standard Exceedances from Brunner Island

BASIN	Number of Exceedances* 1Q 2016	2Q 2016	3Q 2016	Parameters detected above the Regulatory Criteria Limit during 2016
5	9	10	12	pH, TDS, sulfate (as SO4), aluminum, arsenic, beryllium, cadmium, iron, lithium, manganese, molybdenum, nickel
4N	7	7	6	pH, sulfate (as SO4), aluminum, beryllium, iron, manganese, nickel
4S	10	11	10	pH, TDS, sulfate (as SO4), aluminum, arsenic, iron, lead, lithium, manganese, molybdenum, nickel
6	7	6	6	pH, TDS, arsenic, iron, lithium, manganese, molybdenum
7	7	-	-	TDS, sulfate (as SO4), arsenic, boron, iron, manganese, molybdenum
EB	5	-	6	pH, TDS, sulfate (as SO4), iron, lead, manganese. See Note below.
IWTB	6	-	9	pH, TDS, sulfate (as SO4), aluminum, iron, lead, lithium, manganese, strontium
GOLF (Background)	1	0	1	pH, fecal coliform
MW-19 (Background)	0	0	0	

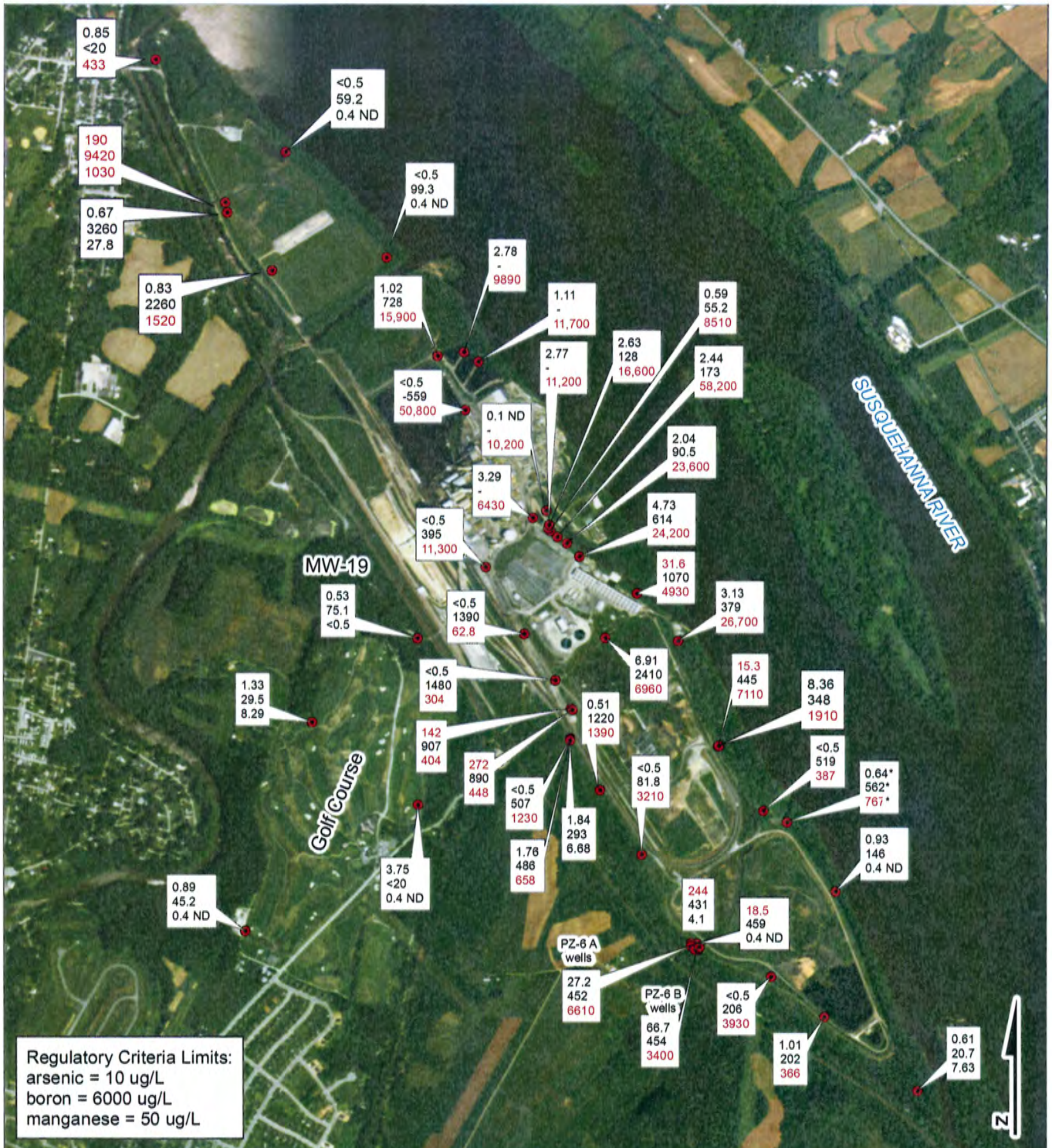
*Counts include field parameters; pH frequently lower than standard in wells with other contaminants. Species only counted once (e.g., exceedances for both Al, total and Al, dissolved only counted once)

Note: According to the Third Quarter Groundwater Monitoring Report, several halogenated organic compounds were identified in the EB monitoring wells, and two compounds (trichloroethene and cis-1,2-dichloroethene) exceeded applicable standards in 2nd quarter of 2016.

Evidence of groundwater contamination occurs beneath the entire island. There are widespread occurrences of contaminants associated with coal ash. Figure 6 presents a facility map that illustrates the concentrations of three selected groundwater contaminants of concern (arsenic, manganese, and boron) reported in 2016. These three contaminants of concern were selected because they are widespread across Brunner Island and they are common constituents of CCRs. This figure was developed for illustrative purposes only, and it is not intended to represent the full extent of groundwater contamination beneath the Brunner Island facility.

The map also includes data from shallow and deeper wells on the same illustration, and GMA has not attempted to discriminate vertical distribution of contaminants depicted on Figure 6.

Talen Energy's practice of monitoring and presenting groundwater results in separate individual reports by monitoring program does not provide an integrated depiction of the groundwater-quality characteristics across the entire facility. Because ash basins and other monitoring areas are closely placed across the facility, each basin does not have a clearly definable contaminant plume associated with a particular activity. Rather, contaminant plumes appear to commingle across much of the island.



LEGEND

● GROUNDWATER MONITORING LOCATION

3.74	arsenic, dissolved (ug/L)
406	boron, dissolved (ug/L)
7110	manganese, dissolved (ug/L)

0 1800 '

Concentrations shown in red exceed their regulatory criteria limit:

*concentrations represent total metals not dissolved

GMA

MAXIMUM CONCENTRATIONS OF SELECTED CONSTITUENTS OF CONCERN IN GROUNDWATER MONITORING WELLS, 2016

DATE: 5/15/2017

BRUNNER ISLAND, PENNSYLVANIA

FIGURE 6

Recent monitoring of the Royal Manchester Golf Course well network does not indicate obvious groundwater impacts associated with CCRs. Some low pH values could be related to CCRs, but other CCR indicators appear to be lacking. Conditions reported at the Royal Manchester Golf Course wells appear to exhibit background or near-background groundwater-quality conditions.

Talen Energy also regularly monitors well MW-19 as a "background" well associated with monitoring at Basin 4 (Talen Energy, November 7, 2016, "Quarterly Groundwater Report: 3rd Quarter 2016, Basin No. 4 North"). Well MW19 is located west of the Brunner Island site on property along the northeastern margin of the Royal Manchester Golf Course. Monitoring of MW-19 during 2016 did not reveal exceedance of drinking water-quality standards for any of the targeted constituents. MW-19 has been considered by Talen as a "background" monitoring well, implying that the well may represent natural groundwater quality unaffected by contaminants associated with CCRs. The lack of water-quality standard exceedances in well MW-19 does suggest that well MW-19 is upgradient of the known contaminant sources at the Brunner Island facility. However, some metals are present at MW-19 (e.g., arsenic and boron) that could be related to CCRs but are below applicable water-quality standards. The reported concentrations of common CCR target metals in well MW-19 may not represent true natural background concentrations. Determination of natural background may require more extensive evaluations (including statistical analyses and possibly additional monitoring well construction farther away from the facility). Nonetheless, the significantly lower concentrations of constituents of concern in well MW-19 indicate that the elevated contaminant concentrations reported from monitoring wells at Brunner Island are related to releases of contaminants from activities at Brunner Island rather than being contributed from off-site conditions or natural background concentrations in the groundwater system.

4.2 Groundwater Flow Patterns and Discharge Areas

Groundwater flows from Brunner Island toward adjacent surface water bodies (e.g., Susquehanna River, Conewego Creek, Hartman Run, Black Gut, etc.). Data that GMA reviewed of the Brunner Island facility did not include a facility-wide map of the groundwater equipotential surface. Groundwater flow patterns were not comprehensively depicted for the site. The most comprehensive facility-wide depiction of groundwater flow that GMA reviewed was Figure 1 from the Hartman Run-Black Gut seep investigation (AGES, Inc., 2008), included in Appendix II. The figure illustrates groundwater flow paths depicted as arrows that point away from the center of Brunner Island and toward the surrounding surface water bodies. Seepage areas depicted on the map are illustrative of areas where visible discharge of groundwater to the land surface was occurring. Prior seep monitoring has confirmed the discharge of common

CCR contaminants into local seeps (e.g., arsenic, iron, boron, aluminum, etc.) (Furjanic, 2007), and seep monitoring has been conducted at the facility since the 1980's (PPL, July 27, 2007).

Local assessment data from Basin 5 (Ish, Inc., 2006), Basin 7 (Ish, Inc., 2005), and the IWTB (Ish, Inc. and AGES, Inc., 2008) that GMA reviewed provided further documentation about groundwater occurrence and flow patterns. Appendix III includes two example equipotential maps from the Basin 5 and Basin 7 arsenic investigations. These maps, and other data reviewed, indicate that groundwater levels are elevated beneath Brunner Island as compared to the elevations of the average water levels in the adjacent surface water features. The equipotential maps depict higher head (i.e., groundwater recharge conditions) associated with the interior of Basins 5 and 7 and lower heads at adjacent surface waters (i.e., discharge areas). These maps present clear indications that groundwater moves toward and discharges into the Susquehanna River and the local tributaries. Reports from Basins 5 and 7 also depict contamination occurring in the alluvium, shallow bedrock, and deeper bedrock portions of the groundwater system. The vertical and horizontal extents of the groundwater contaminants were undefined by these prior assessments. In addition, the assessment reports of Basins 5 and 7 do not address the occurrence, orientation, and significance of preferred contaminant migration pathways (e.g., fractures) in the bedrock system.

Because groundwater contamination is evident beneath Brunner Island, and local discharge of contaminants has been confirmed through seep sampling, it is evident that groundwater contamination at Brunner Island discharges into the Susquehanna River and associated tributaries in an uncontrolled manner. Quarterly groundwater monitoring reports from Brunner Island demonstrate that impacts to groundwater quality persist at the site. In addition, the monitoring programs indicate to GMA that the full vertical and horizontal extents of groundwater contamination at Brunner Island remain undefined.

5.0 Conclusions Regarding Contaminant Discharge to the Susquehanna River System

GMA has completed a preliminary hydrogeologic evaluation of the Brunner Island Steam Electric Station. Our services included the following: review of documents provided to GMA by the Sierra Club, review of selected publications acquired by GMA, synthesis of available groundwater-quality data from 2016, interpretation of hydrogeologic and water-quality data, and preparation of a preliminary report. Our findings from this evaluation include the following:

- The Brunner Island facility has numerous disposal areas and other industrial activities that have impacted groundwater quality.
- Groundwater impacts have affected the unconsolidated sediments and the underlying bedrock aquifer units.
- Surface water has been impacted by discharge of contaminants from the groundwater system. This is clearly documented by direct observation and monitoring of seeps.
- The water table elevations within and surrounding ash basins and other contaminant source areas at Brunner Island are higher than the base level elevations of the Susquehanna River and nearby tributaries. Groundwater flows from areas of high head (recharge areas) to areas of lower head (discharge areas). Thus, groundwater flows away from high water table areas at Brunner Island and toward local surface water discharge areas.
- Most of the groundwater discharge to adjacent surface water bodies would occur through base flow discharge to the stream channels, rather than the small discharge quantities that have been observed at local seeps and springs. Base flow is discharge of groundwater directly to the stream channel below the water level in the stream.
- Monitoring well systems at Brunner Island do not adequately define the vertical and horizontal extents of all groundwater contaminants emanating from the site.
- Talen Energy’s routine reporting of groundwater monitoring data in separate reports subdivided by basin or activity area does not adequately consider the fate, transport pathways, and risks associated with uncontrolled migration of contaminants through the groundwater system.
- Because the groundwater beneath the Brunner Island facility is contaminated, and groundwater from Brunner Island discharges into local surface water bodies, groundwater discharge adds uncontrolled pollutants from the groundwater system into the Susquehanna River and its local tributaries.

6.0 Report Certification

This Preliminary Hydrogeologic Evaluation report was prepared by Groundwater Management Associates, Inc., a professional corporation employing staff licensed to practice geology in Pennsylvania. I, James K. Holley, do certify that the information contained in this report is correct and accurate to the best of my knowledge.

James K. Holley

James K. Holley, P.G. (PG003230E)
Senior Hydrogeologist

COMMONWEALTH OF PENNSYLVANIA
REGISTERED PROFESSIONAL
JAMES K. HOLLEY
JKH 5/17/17
GEOLOGIST
3230-E

7.0 References

AGES, Inc., July 22, 2008, "Work Plan for Hydrological and Water Quality Investigations to Determine the Source of Seeps to Hartman Run-Black Gut Stream Area and for Examining Arsenic in Groundwater in Shallow Bedrock at Brunner Island Steam Electric Station", 63 pages.

Furjanic, Sean, May 15, 2007, E-mail correspondence to Lee MacDonnell, 4 pages printed.

Geosyntec, October 2016, "Closure Plan, Per Requirements of 40 CFR §257.102, Brunner Island SES Ash Landfill 8, East Manchester Township, Pennsylvania", 173 pages.

Heath, R.C., 1983, "Basic Ground-Water Hydrology", United States Geological Survey Water-Supply Paper 2220, p. 85.

Ish, Inc., 2005, "Report on the Brunner Island Groundwater Investigations for Elevated Arsenic Levels in Monitoring Well MW7-5 Near Retired Ash Basin 7", 145 pages.

Ish, Inc., 2006, "Report on the Assessment of Arsenic in Groundwater near Monitoring Wells MW8-5A/MW8-5B at the Brunner Island Steam Electric Station", 227 pages.

Lloyd, O.B., and D.J. Growitz, 1977, “Ground-Water Resources of Central and Southern York County, Pennsylvania”, Commonwealth of Pennsylvania Department of Environmental Resources, Topographic and Geologic Survey, Water Resource Report 42, 93 pages.

Pennsylvania Department of Environmental Protection (PADEP), April 5, 2017, “Draft NPDES Permit – Industrial Waste – 3F, Brunner Island, Application No. PA0008281”, 64 pages.

Pennsylvania Department of Environmental Protection (PADEP), April 5, 2017, “NPDES Permit Fact Sheet– Individual Industrial Waste (IW), Application No. PA0008281”, 64 pages.

Pennsylvania Department of Environmental Resources (PaDER), 1980, “Geologic Map of Pennsylvania”, Commonwealth of Pennsylvania Topographic and Geologic Survey, 3 sheets.

Pennsylvania Department of Natural Resources and Conservation (DNRC), 2000, “Map 13: Physiographic Provinces of Pennsylvania”, Compiled by W. D. Sevon. Fourth Edition, 2000, 2 sheets.

PPL Service Corporation, July 27, 2007, Letter report to Sean Furjanic of PaDEP titled “PPL Brunner Island SES – Stormwater Evaluation Report”, 9 pages.

PPL Generation, LLC, March 26, 2009, Letter to Richard Kinch of the US Environmental Protection Agency titled “RE: Request for Information Under Section 104 (e) of the Comprehensive Environmental Response, Compensation, and Liability Act, 42 U.S.C. 9604(e)”, 12 pages.

Stose, G. W., and Jonas, A. I., 1939, “Geology and Mineral Resources of York County, Pennsylvania” Pennsylvania Geol. Survey, 4th ser., Bull. C-67, 199 p.

Talen Energy Web Site, Accessed 5/10/17, https://www.talenenergy.com/generation/fossil-fuels/brunner-island

Talen Energy, November 7, 2016, “Quarterly Groundwater Report: 3rd Quarter 2016, Basin No. 4 North, (Post-Closure Groundwater Monitoring File 79-00-01C)”, 14 pages.

Talen Energy, November 7, 2016, “Quarterly Groundwater Report: 3rd Quarter 2016, Basin No. 4 South”, 54 pages.

Talen Energy, April 28, 2016, “Quarterly Groundwater Report: 1st Quarter 2016, Basin No. 5, Closure and Disposal Area 8”, 93 pages.

Talen Energy, April 28, 2016, “Quarterly Groundwater Report: 1st Quarter 2016, Basin No. 6”, 115 pages.

Talen Energy, April 28, 2016, “Quarterly Groundwater Report: 1st Quarter 2016, Basin No. 7”, 57 pages.

Talen Energy, November 7, 2016, “Quarterly Groundwater Report: 3rd Quarter 2016, Equalization Basin”, 33 pages.

Talen Energy, November 7, 2016, “Quarterly Groundwater Report: 3rd Quarter 2016, Industrial Waste Treatment Basin”, 39 pages.

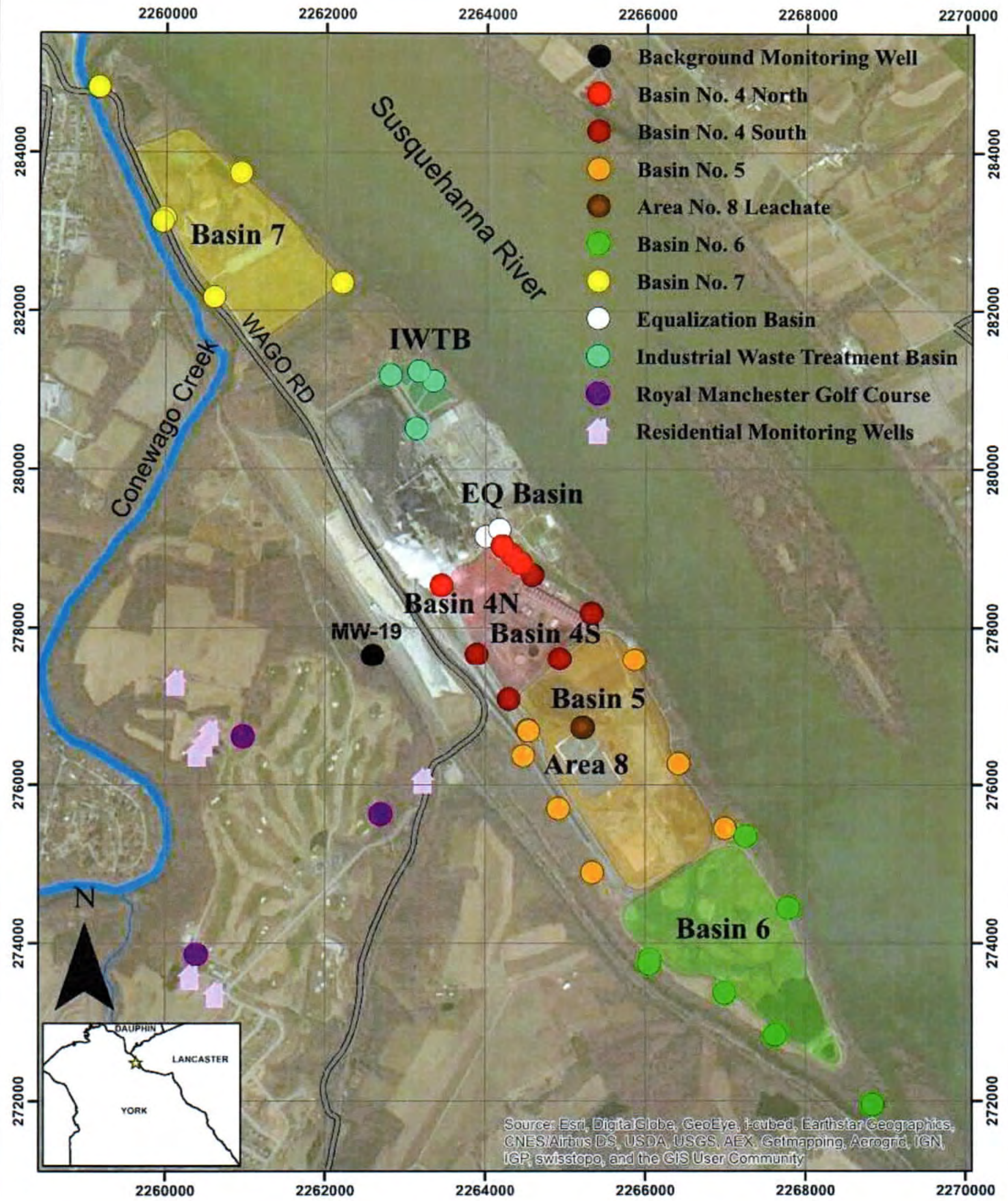
Talen Energy, November 7, 2016, “Quarterly Groundwater Report: 3rd Quarter 2016, Equalization Basin”, 33 pages.

Talen Energy, November 7, 2016, “Quarterly Groundwater Report: 3rd Quarter 2016, Equalization Basin”, 33 pages.

Wood, P.R., and H.E. Johnston, 1964, “Hydrology of the New Oxford Formation in Adams and York Counties, Pennsylvania”, Commonwealth of Pennsylvania Department of Internal Affairs, Bureau of Topographic and Geologic Survey, Bulletin W21, 66 pages.

Appendix I

"Overall Map" of the Brunner Island from the November 7, 2016 "Quarterly Groundwater Report: 3rd Quarter 2016 – Equalization Basin"



Talen Energy
Brunner Island SES

OVERALL MAP

North American Datum of 1983 (NAD83)
State Plane Pennsylvania South

0 0.125 0.25 0.5 Miles

Appendix II

Seepage Area Map from the April 11, 2008 PPL report
"Additional Groundwater Assessments – Hartman Run/Black Gut Creek Area"

DRAWN BY	JM
DATE	
CHECKED BY	
JOB NO.	P200833-04-BRU
DWG FILE	BRU IS Fig 1 b04.dwg
DRAWING SCALE	AS SHOWN

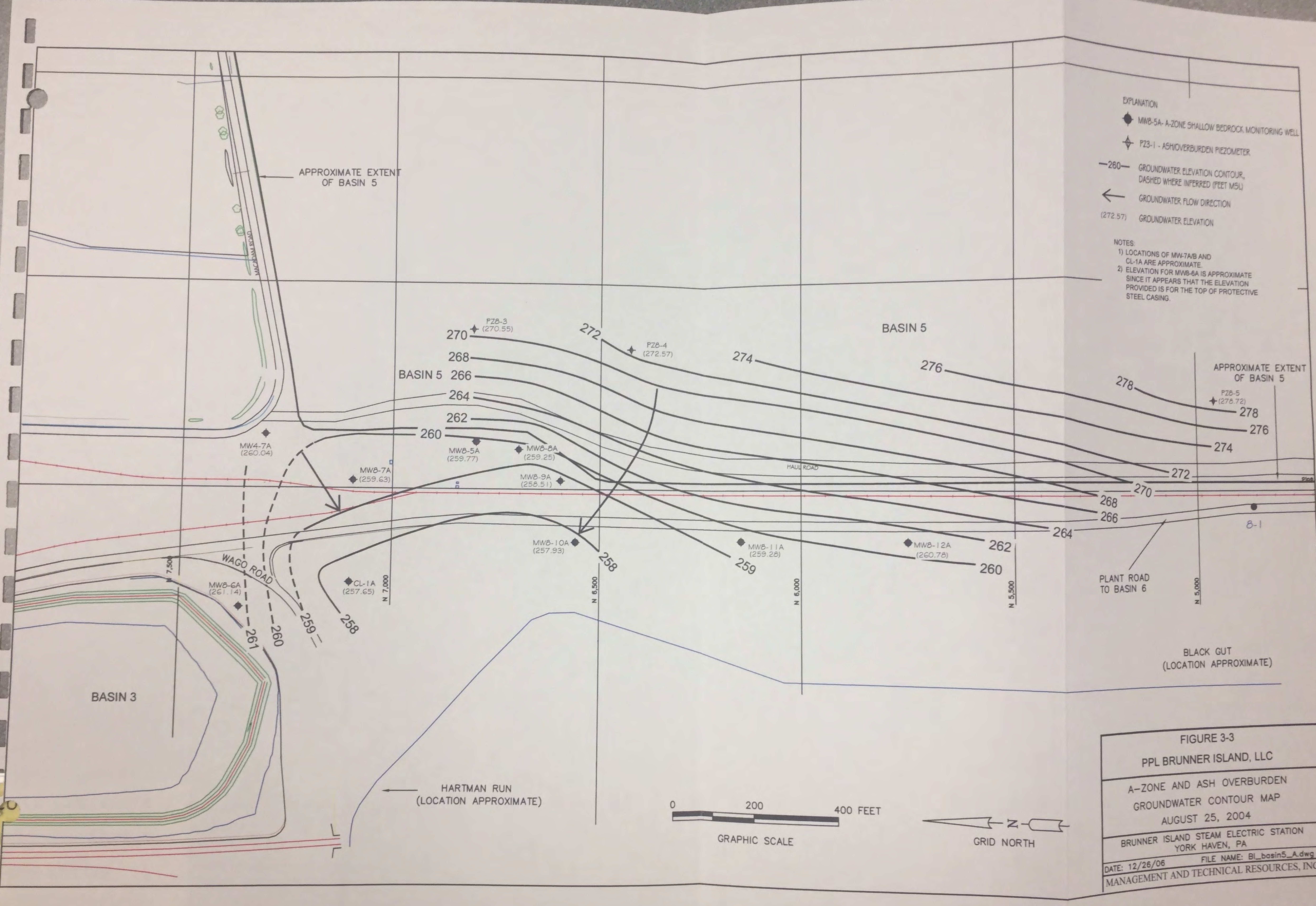
AGES
Applied Geology And Environmental Science, Inc.
800 Old Pond Road, Suite 703
Bridgeville, PA 15017
412.221.1296

ISH, INC.
BRUNNER ISLAND
STEAM ELECTRIC STATION
YORK HAVEN, PENNSYLVANIA
HISTORICAL SEEP AREAS

DRAWING NAME
FIGURE 1

Appendix III

Selected Groundwater Equipotential Maps Showing Local Groundwater Flow Patterns.



lo so may result in
at a time at your

FIGURE 5
PPL GENERATION, LLC
GENERALIZED & APPROXIMATE ASH OR OVERBURDEN GROUNDWATER CONTOURS-MARCH 2004 FOR BISES FORMER ASH BASIN 7 AREA
BRUNNER ISLAND STEAM ELECTRIC STATION
YORK HAVEN, PA
DATE: 11/10/04
FILE NAME: 008C1
ISH INC./MANAGEMENT AND TECHNICAL RESOURCES, INC.
NOTE:
GROUNDWATER LEVEL MEASUREMENTS WERE MADE OVER A MULTIPLE DAY PERIOD. THEREFORE THE GROUNDWATER CONTOUR PATTERN SHOWN IS APPROXIMATE AND THE CONTOUR PATTERN IS PROVIDED SO A GENERALIZED UNDERSTANDING OF GROUNDWATER FLOW CAN BE DETERMINED.
EXPLANATION
MW7-4 - BEDROCK MONITORING WELL
PZ7-11 - BEDROCK PIEZOMETER
PZ7-1 - ASH OR OVERBURDEN PIEZOMETER
(261.01) GROUNDWATER ELEVATION (FEET MSL)
260 GROUNDWATER CONTOUR (FEET MSL) & DASHED WHERE INFERRED
GROUNDWATER FLOW DIRECTION & DASHED WHERE INFERRED
0
120
240 FEET
GRAPHIC SCALE
N
CONEWAGO CREEK
FLOW
ACCESS ROAD
PUBLIC ROAD
N 15,000
N 14,500
N 14,000
N 13,500
E -2,000
PZ7-1 (266.20)
PZ7-2 (267.45)
PZ7-3 (268.27)
PZ7-4 (269.66)
PZ7-6 (269.60)
PZ7-13 (265.57)
PZ7-14
PZ7-8
PZ7-15
PZ7-12 (261.75)
PZ7-9
PZ7-10
PZ7-11
PZ7-5
MW7-7
MW7-5
MW7-6
MW7-4
262
263
264
265
266
267
268
269
270
275
285

\)-3B

Glenn P. Amey, P.G.
Sr. Environmental Professional
Environmental Management Department
Tel. 610-774-6316 Fax 610-774-5930
E-mail: gpamey@pplweb.com

PPL Services Corp
Two North Ninth Street, GENTW-17
Allentown, PA 18101-1179
http://www.pplweb.com/

April 11, 2008

Pennsylvania Department of Environmental Protection
Southeast Regional Office
Attn: Kurt Fritz, Geologic Specialist
909 Elmerton Avenue
Harrisburg, PA 17110-8200

Re: PPL Brunner Island, LLC
Additional Groundwater Assessments – Hartman Run/Black Gut Creek Area

Dear Kurt:

Attached, please find PPL's Phase II workplan to address the groundwater seeps in Hartman Run/Black Gut Creek. The workplan details the installation of approximately 18 piezometers and four shallow monitoring wells. Also included in the workplan is the development of the piezometers/wells, the sampling of the piezometers/wells, and analysis of the data.

The fieldwork is scheduled to begin on April 28, 2008.

If you have any questions regarding this workplan, please call me at the above referenced number.

Sincerely,

Glenn P. Amey

Glenn P. Amey, P.G.

Work Plan for Hydrological and Water Quality Investigations to Determine the Source of Seeps to Hartman Run-Black Gut Stream Area and for Examining Arsenic in Groundwater in Shallow Bedrock at Brunner Island Steam Electric Station

April, 2008

Prepared by

Ish Inc.
Raleigh, NC

Prepared for

PPL Generation, LLC
Allentown, PA

Work Plan for Hydrological and Water Quality Investigations to Determine the Source of Seeps to Hartman Run-Black Gut Stream Area and for Examining Arsenic in Groundwater in Shallow Bedrock at Brunner Island Steam Electric Station

April, 2008

Prepared by

Ish Inc.
Raleigh, NC

Prepared for

PPL Generation, LLC
Allentown, PA

Work Plan for Hydrological and Water Quality Investigations to Determine the Source of Seeps to Hartman Run-Black Gut Stream Area and for Examining Arsenic in Groundwater in Shallow Bedrock at Brunner Island Steam Electric Station

April, 2008

Prepared By:

COMMONWEALTH OF PENNSYLVANIA
REGISTERED
PROFESSIONAL
ROBERT W. KING
GEOLOGIST
PG-000899-G

Robert W. King, P.G.
PG000899G
Applied Geology and Environmental Science, Inc.
Chief Hydrogeologist

Work Plan for Hydrological and Water Quality Investigations to Determine the Source of Seeps to Hartman Run-Black Gut Stream Area and for Examining Arsenic in Groundwater in Shallow Bedrock at Brunner Island Steam Electric Station

TABLEOF CONTENTS

LIST OF FIGURES

LIST OF TABLES

LIST OF APPENDICES

Work Plan for Hydrological and Water Quality Investigations to Determine the Source of Seeps to Hartman Run-Black Gut Stream Area and for Examining Arsenic in Groundwater in Shallow Bedrock at Brunner Island Steam Electric Station

INTRODUCTION

As part of the monitoring activities at the Brunner Island Steam Electric Station (BISES), PPL staff has noted groundwater seeps to Hartman Run and Black Gut Creek. Five seeps have been sampled and analyzed for water quality parameters since 1995. In 2007, the PaDEP also collected and analyzed a few samples of the seep water and noted elevated levels of iron suggesting an acid mine drainage condition although the pH of the seep water was not acidic. Results of the PaDEP sampling are shown in Table 1.

PPL retained Ish Inc. in 2007 to review and evaluate the seep water quality data and then to design and conduct hydrological and water quality investigations, as needed, to identify the source(s) of the seepage water. In August 2007, a letter work plan was prepared and submitted to PaDEP by PPL, which included a proposed geophysical survey of the area. The geophysical survey was completed in December 2007 and an evaluation of the water quality data from the sampling of the seeps has been completed in developing this work plan for the installation of piezometers for hydrological and water quality investigations.

SUMMARY OF EVALUATIONS COMPLETED IN 2007-2008

The recent geophysical survey (Enviroscan, 2007), completed in accordance with the August 2007 letter work plan (PPL, 2007), implied that the terrain conductivity contours are generally consistent with shallow bedrock beneath much of the site. Elevated conductivities along the stream are presumed to be due to saturated soils particularly in the vicinity of the seeps. The geophysical survey further indicated the absence of a buried channel or preferred groundwater flow paths. The geophysical survey also indicated that there is groundwater with high conductivity in the study area.

Figure 1 shows the historical (approximately 1990 time frame) observations on seeps in the Black Gut/Hartman Run area. In 1985, PPL installed a limestone trench to neutralize and in-situ treat what was suspected as an acid mine drainage water that contained elevated levels of iron. The limestone trench is still operating in place and has possibly altered the nature and extent of the seepage of acid mine groundwater.

Water Quality Data Evaluation

Following the PPL letter work plan (2007), Ish Inc. has assembled and evaluated the water quality data for the locations H1, B3, B4, B6, and B7. Figures 2 and 3 show the five sampling locations that have been monitored for water quality parameters from 1995 onwards. Locations B-6 and B-7 were monitored through 2002. Appendix A contains the data set collected from 1995 through early 2007 for these sampling locations. Ish Inc. selected sulfate, iron, calcium and pH as the key parameters for evaluation. Time series scatter plots and regression analysis results have been completed for each of the five locations for the selected parameters and are shown in the figures in Appendix B.

Table 2 shows the summary statistics for pH, iron, calcium and sulfate for H-1, B-3, and B-4 sampling locations.

For the H-1 and B-3 locations, iron, calcium and sulfate are similar in concentrations with pH in the neutral to alkaline range. For both of these locations, some outliers involving iron concentrations are seen in the time series plots. Based on the similarity of the concentration data, these two locations represent ambient conditions with respect to water quality.

For the B-4 location, iron concentrations show increases and the overall average concentration is higher than locations H-1 and B-3. Both calcium and sulfate levels are also higher at this location compared to the other two locations. The pH of water at the B-4 location, while still neutral to alkaline, shows a lower value than at locations H-1 and B-3. The time series plots for the B-4 location for calcium, iron, sulfate and pH show variability but no systematic increasing trend for the period 1995 through 2008. However, the iron concentration and pH show a linear correlation indicating that at lower pH, iron concentrations in the water samples are relatively higher. Similarly the scatter plot of iron versus sulfate concentrations suggests that there may be oxidation of pyrite mineral to some extent that is contributing both iron and sulfate to the water samples and may be decreasing the pH somewhat in the process. Further the scatter plot of calcium versus sulfate concentrations shows strong correlation at this location. The strong correlation between calcium and sulfate suggests that gypsum is controlling the solubility of calcium and sulfate and the concentrations in the water samples are reflecting the dissolution of the gypsum solid phase. The scatter plot of calcium plus iron versus sulfate provides the best correlation between the three parameters measured in the water samples. This correlation provides the possible interpretation that the water quality is reflecting contributions of iron, calcium and sulfate from pyrite oxidation as well as from dissolution of gypsum.

Water quality data for locations B-6 and B-7 were collected from 1995 through 2002 and the time series plots for the key parameters have been examined in the evaluation of the data. For the location B-6, the time series data shows a mildly acidic pH with occasional alkaline pH values. The time series data also shows an increasing time trend. Iron concentration data shows large variability but has a decreasing time trend as seen in the scatter plot. Calcium and sulfate concentrations at location B-6 show an increasing time trend as depicted in the time series plots.

In contrast, the pH values at location B-7 increased consistently over time from an acidic condition to an alkaline range. Calcium, iron and sulfate concentrations also steadily decreased over time at this monitoring location.

As a result of the data evaluation, Ish Inc. recommended that a field investigation work plan for hydrological and water quality investigations be prepared and implemented as the next step to determine the source(s) of seeps and possible abatement measures, if needed.

The objectives for this project are listed below:

- Design and install piezometers in the overburden material to define the groundwater flow field and to obtain water quality data for identifying potential sources of generation and migration of iron containing groundwater,
- Design and install monitoring wells in the shallow bedrock material to examine groundwater quality with respect to potential migration of arsenic from retired Ash Basin #5,

- Analyze and evaluate the data obtained from sampling and analysis work to delineate the source(s) and migration pathways for the seeps, and
- Obtain sufficient amount of field data to be helpful in designing and implementing an abatement approach, if needed.

PROPOSED WORK

After review of the existing data and discussions between PPL and Ish Inc. staff, we have developed the following proposed scope of work for the installation of new piezometers, slug testing, groundwater level measurements and water quality sampling along with evaluation of the resulting data to prepare and submit and assessment report. PPL, PaDEP staff and Ish Inc. personnel visited the site on March 25th and established the sampling locations for the shallow overburden piezometers, the surface water and seep locations. During the meeting, the PaDEP project manager requested that PPL also install four shallow bedrock wells to examine if arsenic from Ash Basin #5 has migrated in groundwater into the area of investigation. PPL has therefore added installation and monitoring plans for these four additional bedrock wells into this proposed assessment effort.

Monitoring Piezometers and Shallow Bedrock Wells Installation and Development

Approximately eighteen piezometers will be installed in the study area (Figure 3) in the overburden material. If the field conditions and equipment access constrains do not allow installation of some of the proposed piezometers, PPL will not install those piezometers. The piezometers will be installed using 2" PVC material with 5-foot 0.020 slotted screens with Geoprobe equipment. The piezometers will provide spatial points to define the groundwater flow field and water quality measurements to delineate the source(s) and migration pathways for the seepage water. The following discusses installation methods for the piezometers and shallow bedrock wells.

Piezometers

Piezometers will be installed with a Geoprobe and the depth will vary depending on the amount of overburden material present above the bedrock. Each piezometer will be two-inch inner diameter (ID) and will be constructed of schedule 40 PVC. The screen will be 5 foot long, will have 0.02-inch slot openings, and set over a depth interval starting from 6" to 1' above the bedrock.

The screen length of 5-foot may need to be adjusted in the field depending on the thickness of the overburden material and the saturated conditions. A sand pack will be placed around the screen to a height of two feet above the screen. A bentonite seal, a minimum of two-feet thick, will be placed above the sand pack and permitted to hydrate. A cement-bentonite grout will be tremied to ground surface. Each piezometer will be completed as a stick-up and a protective steel casing will be placed over the well. An approximate two-foot diameter concrete pad will be placed around the protective casing.

Shallow Bedrock Monitoring Wells

Air rotary drilling equipment will be used to install the shallow bedrock monitoring wells (Figure 3). The targeted boring depth for the proposed wells is about 25 feet bgs. The borehole through the unconsolidated soils/materials will be nominally 10-inch outside diameter and will be advanced into the approximate top two feet of the competent bedrock. Eight inch ID temporary steel casing will be installed through the overlying unconsolidated material and placed two feet into the bedrock. Once the temporary casing is set, a 7-7/8 inch borehole will be advanced to the target depth of 25 feet in the bedrock. The monitoring wells will be four-inch ID and will be constructed of schedule-40 PVC. The well screen will be 10-foot long and will have 0.02-inch slot openings. The well screen interval in the shallow bedrock is anticipated to be set approximately 15 to 25-feet bgs. A sand pack will be placed around the screen to a height of two feet about the screen. A bentonite seal, a minimum of two-feet thick, will be placed above the sandpack and permitted to hydrate. A cement-bentonite grout will be then tremied to the ground surface and the temporary casing will be withdrawn. The monitoring well will be completed as a stick-up and a protective steel casing will be placed over the well. An approximate two-foot diameter concrete pad will be placed around the protective casing.

Development

Development will be initiated approximately 48 hours after installation of the piezometers and the monitoring wells. Development will consist of alternating surging and pumping with a submersible pump. Development will proceed until a sediment free condition occurs or a minimum of 10 well volumes are removed. If recharge is poor, less than 10 well volumes may be removed. During development of the monitoring wells field parameters of temperature, specific conductance, ORP, turbidity and pH will be maintained and recorded for each well volume removed.

Decontamination

Downhole drilling equipment and casing will be decontaminated between each piezometer and monitoring well using a high pressure and temperature cleaner. Pumps used for development will be decontaminated with a detergent wash, tap water rinse followed by a distilled water rinse. Dedicated tubing will be used for each pump.

Sampling of Overburden Soils

Soil samples will be collected for laboratory analysis by using four-foot macro core inserts. Approximately one pound of soil will be collected for each sample to be analyzed. More soil samples will be collected than actually analyzed in the laboratory. Soil samples may be analyzed for iron, pH, arsenic, sulfide and possibly other parameters as necessary. Soil samples for lab analysis will be selected based on field observations.

Slug Testing

Slug testing will be performed to assess the hydraulic conductivity (K) at 8 to 10 of the newly installed piezometers and at 2 of the 4 installed monitoring wells. Rising and falling head tests will be performed. The falling head test will be performed by lowering a solid slug into the water column and recording the drop of head with time. The rising head test will be performed by removing the solid slug and recording the rise of head with time. The change of head with time will be recorded with a data logger and pressure transducer. Dedicated rope will be used on each well and the slug will be decontaminated using the same procedures discussed above for the pumps. Slug testing will be performed after development and prior to sampling groundwater.

Groundwater Sampling and Groundwater Level Measurements

Three rounds of measurements of groundwater levels will be made on a monthly basis in the newly installed piezometers and monitoring wells in the study area. The groundwater level measurement data will be used to define the flow field in the study area. Groundwater levels may also be monitored for well CL-1A, MW8-10A and MW8-11A. The groundwater elevations will be measured over the course of one-day period.

Groundwater will be sampled for all of the newly installed piezometers and monitoring wells during the first round of monitoring about two weeks after installation and development. Samples will be collected using a low-flow sampling method with a submersible pump and dedicated tubing. Between locations, the pump will be decontaminated with a detergent wash and tap water rinse followed by a distilled water rinse.

During sampling, field parameters of pH, ORP, specific conductivity, dissolved oxygen, turbidity, and temperature will be collected. Groundwater samples will be filtered by using in-line 45 um filters in the field and appropriately preserved for shipment to the laboratory for chemical analysis. The groundwater samples will be analyzed for at least pH, alkalinity, acidity, iron, manganese, calcium, TDS, arsenic and sulfate.

The second round of groundwater sampling and analysis will be performed after reviewing the water chemistry data for the first round. Sampling will only be performed for the piezometers that would provide additional information for identifying the source(s) and migration pathways. The second round of groundwater sampling for all four newly installed monitoring wells will be conducted approximately two months following the first round of sampling and analysis work.

Surface Water Sampling and Analysis

During the first and second rounds of groundwater sampling events, several surface water samples (seeps and the streams) will also be collected and analyzed for the same parameters as groundwater samples. The sampling locations were determined during the field visit on March 25 in consultation with the PaDEP project manager and PPL geologist (Figure 1).

DATA ANALYSIS AND EVALUATION

The new and the existing hydrological and water quality monitoring data will be analyzed graphically and mathematically as needed to identify correlations between source(s) and the seeps. The slug test data will be evaluated using commercially available software, as appropriate. A report will be prepared to present the evaluations, findings, and conclusions.

SCHEDULE

A field visit with the PaDEP project manager and PPL was undertaken on March 25, 2008 to stake out the locations for the piezometers and the surface water sampling locations. As a result of the field visit, the shallow bedrock monitoring wells have been added to this work plan. Assuming prompt approval of this work plan by the PaDEP, Ish Inc. will mobilize to the site towards the end of April/early May 2008 to install and develop the piezometers. The installation of the piezometers can be completed within one week unless unknown difficulties are encountered in the field. The shallow bedrock monitoring wells installation is expected to take a maximum of two days effort. Development and slug testing of the piezometers will be completed during the following week after installation.

The first round of sampling will occur about two weeks following development. Lab analysis will occur over a six week period following submission of the samples to the laboratory. Validation and evaluation of the data from first round of sampling will require about four weeks of time before the number of piezometers are identified for second round of sampling and analysis.

Data analysis, evaluations and draft report will be completed over a two month time period after the data from second round of sampling and analysis has been received.

One or more meetings between PPL staff and Ish Inc. staff will occur during the course of this work to provide updates and to discuss the results, as they become available. The PaDEP project manager will be kept fully informed of the progress and status of the project throughout the course of the project work and will be asked for input on any changes/revisions to the project scope, as needed.

REFERENCES

Glenn P. Amey, P.G. August 1, 2007. PPL Brunner Island, LLC Additional Groundwater Assessments – Hartman/Black Gut Area & IWTB.

Environscan, Inc. December 13, 2007. Final report Geophysical Survey Detection and Delineation of Suspected preferred flow paths seep area Brunner Island, PA.

FIGURES

TABLES

PPL BISES 5/1/07 Sampling Results(ug/l)
***7/03/07Sampling Results (ug/l)**

PA DEP SEEP SAMPLING RESULTS

	FE	NI	CU	B	CR	HG	SE	CD	PB	MO	ZN	AS	AL
0305188--Off Wago Rd. near #006 (040-05-15.0000/-076-41-37.3000) Hartman	3850	<50	<10	270	<50	<1	<7	<10	<1.0	<70	<10.0	8.2	<200
	*6020	<50	<10	240	<50	<1	<7	<10	2.5	<70	13	16.6	932
0305189--E. bank Hartman Run (040-05-13.0000/-076-41-35.5000) 175 yd. S. Wago Rd. intersect.	2510	<50	<10	940	<50	<1	<7	<10	<1.0	104	<10	<3.0	<200
	*3550	<50	<10	1090	<50	<1	<7	<10	<1.0	<70	<10	<3.0	<200
0305190--Swale N. Main Entrance Coal Pile (040-06-04.3000/-076-41-53.6000 Conewago	2520	233	46	730	<50	<1	<7	<10	5	<70	455	<3.0	18700
	*48700	725	134	640	<50	<1	11.6	12	2.6	<70	1650	<3.0	66800
0305191--Swale/Side Str. off S. Access Road Hartman (040-05-0.9000/-076-41-21.6000	2510	<50	<10	300	<50	<1	<7	<10	<1.0	<70	<10	<3	<200

Table 1: Analysis Results of Seep Samples By PADEP and PPL - 2007

For H-1 Location	**Fe (mg/L)**	**pH**	**Ca (mg/L)**	**SO4 (mg/L)**	**Ca+Fe (mg/L)**
Average	0.14	7.77	31.52	23.75	31.66
Minimum	0	6	18	13.9	18
Maximum	1.7	9	44.6	31.4	46.3
For B-3 Location					
Average	0.15	7.74	32.59	25.45	32.74
Minimum	0.04	6.8	18.3	12.3	18.34
Maximum	1.61	8.52	48.3	34.2	49.91
For B-4 Location					
Average	0.50	7.37	41.63	55.67	42.13
Minimum	0.08	5.7	18.5	14.4	20.15
Maximum	1.78	8.6	88.9	163	89.86

Table 2: Summary Statistics for Water Quality Data From Seep Samples H1, B3 and B4

APPENDIX A

SEEP ANALYTICAL DATA:

1995 - 2008

SEEP B3
1995 - 2007

Parameter	Date	Result
Al, tot., mg/l	2/22/1995	0.057
	5/17/1995	<0.0500
	8/23/1995	<0.0500
	12/6/1995	<0.0500
	12/6/1995	<0.0500
	2/28/1996	0.077
	6/5/1996	0.276
	8/14/1996	<0.0500
	12/11/1996	<0.0500
	2/12/1997	<0.0400
	5/14/1997	<0.0400
	8/27/1997	0.04
	11/12/1997	<0.0400
	2/11/1998	<0.040
	5/6/1998	0.242
	9/16/1998	<0.040
	12/9/1998	<0.040
	12/9/1998	<0.040
	2/10/1999	<0.040
	11/2/1999	<0.040
	2/9/2000	<0.040
	2/9/2000	<0.040
	5/11/2000	<0.040
	9/13/2000	1.29
	12/4/2000	<0.040
	2/7/2001	<0.040
	5/14/2001	0.065
	8/8/2001	ND
	8/8/2001	ND
	12/3/2001	ND
	2/27/2002	ND
	6/5/2002	<0.050
	8/28/2002	<0.050
	12/4/2002	<0.050
	3/5/2003	0.072
	6/11/2003	0.201
	9/17/2003	<0.050
	9/17/2003	<0.050
	12/4/2003	<0.100
	3/10/2004	<0.100
	6/7/2004	<0.100
	9/1/2004	ND
	9/1/2004	ND
	11/30/2004	ND
	2/28/2005	ND
	6/8/2005	<0.100
	8/24/2005	<0.100
	11/15/2005	ND
	3/8/2006	ND
	6/5/2006	<0.100
	6/5/2006	<0.100
	8/23/2006	<0.100
	11/14/2006	<0.100
	3/8/2007	<0.100
Alk., tot., mg/l	2/22/1995	52
	5/17/1995	80
	8/23/1995	81
	12/6/1995	60
	12/6/1995	60
	2/28/1996	49
	6/5/1996	55
	8/14/1996	76
	12/11/1996	49
	2/12/1997	50
	5/14/1997	74
	8/27/1997	94
	11/12/1997	79
	2/11/1998	50
	5/6/1998	55
	9/16/1998	108
	12/9/1998	95
	12/9/1998	95
	2/10/1999	60
	11/2/1999	86
	2/9/2000	75
	2/9/2000	75
	5/11/2000	76
	9/13/2000	45
	12/4/2000	96
	2/7/2001	54.5
	5/14/2001	79
	8/8/2001	113
	8/8/2001	113
	12/3/2001	118
	2/27/2002	95
	6/5/2002	96
	8/28/2002	124
	12/4/2002	72.5
	3/5/2003	53
	6/11/2003	59.5
	9/17/2003	93
	9/17/2003	93
	12/4/2003	63
	3/10/2004	54
	6/7/2004	80
	9/1/2004	78
	9/1/2004	78.5
	11/30/2004	61
	2/28/2005	59
	6/8/2005	85
	8/24/2005	115
	11/15/2005	90
	3/8/2006	64
	6/5/2006	94
	6/5/2006	94
	8/23/2006	115
	11/14/2006	67
	3/8/2007	56

SEEP B3
1995 - 2007

Parameter	Date	Result
Ca, tot., mg/l	2/22/1995	28
	5/17/1995	33.5
	8/23/1995	35.3
	12/6/1995	27.9
	12/6/1995	27.5
	2/28/1996	26.7
	6/5/1996	23.9
	8/14/1996	32.5
	12/11/1996	25.9
	2/12/1997	26.3
	5/14/1997	30.6
	8/27/1997	33.6
	11/12/1997	35.5
	2/11/1998	25.91
	5/6/1998	22.58
	9/16/1998	39.36
	12/9/1998	34.8
	12/9/1998	35.2
	2/10/1999	29.8
	11/2/1999	35.6
	2/9/2000	39.6
	2/9/2000	39.6
	5/11/2000	29.82
	9/13/2000	18.3
	12/4/2000	37.8
	2/7/2001	28
	5/14/2001	32.1
	8/8/2001	40.1
	8/8/2001	39.8
	12/3/2001	39.5
	2/27/2002	37.9
	6/5/2002	35.6
	8/28/2002	48.3
	12/4/2002	34
	3/5/2003	28.7
	6/11/2003	31.3
	9/17/2003	35.6
	9/17/2003	35.5
	12/4/2003	27
	3/10/2004	25
	6/7/2004	31.3
	9/1/2004	31.5
	9/1/2004	31.1
	11/30/2004	27.3
	2/28/2005	28.2
	6/8/2005	34.2
	8/24/2005	42.1
	11/15/2005	36.1
	3/8/2006	28.5
	6/5/2006	35.8
	6/5/2006	36.1
	8/23/2006	43.1
	11/14/2006	29.9
	3/8/2007	30.5
Cd, tot., mg/l	2/22/1995	<0.0010
	5/17/1995	<0.0010
	8/23/1995	<0.0010
	12/6/1995	<0.0010
	12/6/1995	<0.0010
	2/28/1996	<0.0010
	6/5/1996	<0.0010
	8/14/1996	<0.0010
	12/11/1996	<0.0010
	2/12/1997	<0.0010
	5/14/1997	<0.0010
	8/27/1997	<0.0010
	11/12/1997	<0.0010
	2/11/1998	<0.001
	5/6/1998	<0.001
	9/16/1998	<0.001
	12/9/1998	<0.001
	12/9/1998	<0.001
	2/10/1999	<0.001
	11/2/1999	<0.001
	2/9/2000	<0.001
	2/9/2000	<0.001
	5/11/2000	<0.001
	9/13/2000	<0.001
	12/4/2000	<0.001
	2/7/2001	ND
	5/14/2001	ND
	8/8/2001	ND
	8/8/2001	ND
	12/3/2001	ND
	2/27/2002	<0.001
	6/5/2002	ND
	8/28/2002	ND
	12/4/2002	ND
	3/5/2003	ND
	6/11/2003	ND
	9/17/2003	ND
	9/17/2003	ND
	12/4/2003	ND
	3/10/2004	ND
	6/7/2004	ND
	9/1/2004	ND
	9/1/2004	ND
	11/30/2004	ND
	2/28/2005	ND
	6/8/2005	ND
	8/24/2005	ND
	11/15/2005	ND
	3/8/2006	ND
	6/5/2006	ND
	6/5/2006	ND
	8/23/2006	ND
	11/14/2006	ND
	3/8/2007	ND

SEEP B3
1995 - 2007

Parameter	Date	Result
Fe, tot., mg/l	2/22/1995	0.22
	5/17/1995	0.19
	8/23/1995	0.07
	12/6/1995	0.11
	12/6/1995	0.12
	2/28/1996	0.25
	6/5/1996	0.38
	8/14/1996	0.09
	12/11/1996	0.14
	2/12/1997	0.06
	5/14/1997	0.1
	8/27/1997	0.15
	11/12/1997	0.06
	2/11/1998	0.06
	5/6/1998	0.29
	9/16/1998	0.08
	12/9/1998	0.09
	12/9/1998	0.09
	2/10/1999	0.06
	11/2/1999	0.06
	2/9/2000	0.06
	2/9/2000	0.06
	5/11/2000	0.09
	9/13/2000	1.61
	12/4/2000	0.06
	2/7/2001	0.08
	5/14/2001	0.22
	8/8/2001	0.18
	8/8/2001	0.17
	12/3/2001	0.16
	2/27/2002	0.08
	6/5/2002	0.1
	8/28/2002	0.29
	12/4/2002	0.13
	3/5/2003	0.09
	6/11/2003	0.22
	9/17/2003	0.2
	9/17/2003	0.09
	12/4/2003	0.09
	3/10/2004	0.08
	6/7/2004	0.14
	9/1/2004	0.07
	9/1/2004	0.07
	11/30/2004	0.06
	2/28/2005	0.1
	6/8/2005	0.14
	8/24/2005	0.08
	11/15/2005	0.04
	3/8/2006	0.06
	6/5/2006	0.1
	6/5/2006	0.1
	8/23/2006	0.17
	11/14/2006	0.14
	3/8/2007	0.11
HCO3, mg/l	8/8/2001	138
	8/8/2001	138
Mn, tot., mg/l	2/22/1995	0.098
	5/17/1995	0.111
	8/23/1995	0.051
	12/6/1995	0.061
	12/6/1995	0.063
	2/28/1996	0.124
	6/5/1996	0.051
	8/14/1996	0.03
	12/11/1996	0.057
	2/12/1997	0.052
	5/14/1997	0.056
	8/27/1997	0.056
	11/12/1997	0.07
	2/11/1998	0.043
	5/6/1998	0.055
	9/16/1998	0.04
	12/9/1998	0.066
	12/9/1998	0.065
	2/10/1999	0.041
	11/2/1999	0.058
	2/9/2000	0.046
	2/9/2000	0.047
	5/11/2000	0.05
	9/13/2000	0.127
	12/4/2000	0.045
	2/7/2001	0.045
	5/14/2001	0.093
	8/8/2001	0.149
	8/8/2001	0.141
	12/3/2001	0.119
	2/27/2002	0.063
	6/5/2002	0.068
	8/28/2002	0.272
	12/4/2002	0.071
	3/5/2003	0.046
	6/11/2003	0.044
	9/17/2003	0.041
	9/17/2003	0.044
	12/4/2003	0.044
	3/10/2004	0.019
	6/7/2004	0.046
	9/1/2004	0.029
	9/1/2004	0.028
	11/30/2004	0.019
	2/28/2005	0.051
	6/8/2005	0.072
	8/24/2005	0.088
	11/15/2005	0.051
	3/8/2006	0.04
	6/5/2006	0.054
	6/5/2006	0.056
	8/23/2006	0.141
	11/14/2006	0.037
	3/8/2007	0.03

SEEP B3
1995 - 2007

Parameter	Date	Result
Ni, tot, mg/l	2/22/1995	<0.0700
	5/17/1995	<0.0700
	8/23/1995	<0.0700
	12/6/1995	<0.0700
	12/6/1995	<0.0700
	2/28/1996	<0.0700
	6/5/1996	<0.0700
	8/14/1996	<0.0700
	12/11/1996	<0.0700
	2/12/1997	<0.0600
	5/14/1997	<0.0600
	8/27/1997	<0.0600
	11/12/1997	<0.0600
	2/11/1998	<0.060
	5/6/1998	<0.060
	9/16/1998	<0.060
	12/9/1998	<0.060
	12/9/1998	<0.060
	2/10/1999	<0.060
	11/2/1999	<0.060
	2/9/2000	<0.060
	2/9/2000	<0.060
	5/11/2000	<0.060
	9/13/2000	<0.060
	12/4/2000	<0.060
	2/7/2001	ND
	5/14/2001	ND
	8/8/2001	<0.0080
	8/8/2001	<0.0080
	12/3/2001	ND
	2/27/2002	ND
	6/5/2002	ND
	8/28/2002	ND
	12/4/2002	ND
	3/5/2003	ND
	6/11/2003	ND
	9/17/2003	ND
	9/17/2003	ND
	12/4/2003	ND
	3/10/2004	ND
	6/7/2004	ND
	9/1/2004	ND
	9/1/2004	ND
	11/30/2004	ND
	2/28/2005	ND
	6/8/2005	ND
	8/24/2005	ND
	11/15/2005	ND
	3/8/2006	ND
	6/5/2006	ND
	6/5/2006	ND
	8/23/2006	ND
	11/14/2006	ND
	3/8/2007	ND
pH, fld, s.u.	2/22/1995	8.1
	5/17/1995	7
	8/23/1995	6.8
	12/6/1995	8.3
	12/6/1995	8.3
	2/28/1996	7.8
	6/5/1996	NR
	8/14/1996	NR
	12/11/1996	8.4
	2/12/1997	8.3
	5/14/1997	7.8
	8/27/1997	7.3
	11/12/1997	7.6
	2/11/1998	8.05
	5/6/1998	7.5
	9/16/1998	7.73
	12/9/1998	7.67
	12/9/1998	7.67
	2/10/1999	7.5
	11/2/1999	7.56
	2/9/2000	7.73
	2/9/2000	7.73
	5/11/2000	7.92
	9/13/2000	7.75
	12/4/2000	7.3
	2/7/2001	8.52
	5/14/2001	7.67
	8/8/2001	7.6
	8/8/2001	7.6
	12/3/2001	7.77
	2/27/2002	7.87
	6/5/2002	7.67
	8/28/2002	7.42
	12/4/2002	7.71
	3/5/2003	7.43
	6/11/2003	7.65
	9/17/2003	7.74
	9/17/2003	7.74
	12/4/2003	8.06
	3/10/2004	7.26
	6/7/2004	7.38
	9/1/2004	7.91
	9/1/2004	7.91
	11/30/2004	7.76
	2/28/2005	8.33
	6/8/2005	7.79
	8/24/2005	7.63
	11/15/2005	7.62
	3/8/2006	8.37
	6/5/2006	7.62
	6/5/2006	7.62
	8/23/2006	7.74
	11/14/2006	7.47
	3/8/2007	7.69

SEEP B3
1995 - 2007

Parameter	Date	Result
Se, tot., mg/l	2/22/1995	<0.001
	5/17/1995	<0.001
	8/23/1995	<0.001
	12/6/1995	<0.002
	12/6/1995	<0.002
	2/28/1996	<0.002
	6/5/1996	<0.002
	8/14/1996	<0.002
	12/11/1996	<0.002
	2/12/1997	<0.001
	5/14/1997	<0.001
	8/27/1997	<0.001
	11/12/1997	<0.001
	2/11/1998	<0.001
	5/6/1998	<0.001
	9/16/1998	<0.001
	12/9/1998	<0.001
	12/9/1998	<0.001
	2/10/1999	<0.001
	11/2/1999	<0.001
	2/9/2000	<0.001
	2/9/2000	<0.001
	5/11/2000	<0.001
	9/13/2000	<0.001
	12/4/2000	<0.001
	2/7/2001	<0.0010
	5/14/2001	<0.0010
	8/8/2001	<0.0010
	8/8/2001	<0.0010
	12/3/2001	ND
	2/27/2002	<0.0010
	6/5/2002	<0.0010
	8/28/2002	<0.0010
	12/4/2002	<0.0010
	3/5/2003	<0.0010
	6/11/2003	<0.0010
	9/17/2003	ND
	9/17/2003	ND
	12/4/2003	<0.0010
	3/10/2004	ND
	6/7/2004	<0.0010
	9/1/2004	<0.0010
	9/1/2004	<0.0010
	11/30/2004	<0.0010
	2/28/2005	<0.0010
	6/8/2005	<0.0010
	8/24/2005	ND
	11/15/2005	ND
	3/8/2006	ND
	6/5/2006	ND
	6/5/2006	ND
	8/23/2006	<0.0020
	11/14/2006	ND
	3/8/2007	<0.0020
SO4, as SO4, mg/l	2/22/1995	31
	5/17/1995	25.3
	8/23/1995	26.2
	12/6/1995	29.1
	12/6/1995	29.2
	2/28/1996	30.5
	6/5/1996	19.5
	8/14/1996	22.7
	12/11/1996	27.1
	2/12/1997	25.6
	5/14/1997	22.7
	8/27/1997	22.9
	11/12/1997	31.7
	2/11/1998	28.68
	5/6/1998	21.33
	9/16/1998	24.61
	12/9/1998	20.5
	12/9/1998	20.9
	2/10/1999	29.3
	11/2/1999	28
	2/9/2000	26.7
	2/9/2000	27
	5/11/2000	23.46
	9/13/2000	12.3
	12/4/2000	25.7
	2/7/2001	26.2
	5/14/2001	25.1
	8/8/2001	26
	8/8/2001	25.4
	12/3/2001	25.1
	2/27/2002	29.4
	6/5/2002	23.6
	8/28/2002	31.2
	12/4/2002	29.3
	3/5/2003	23.8
	6/11/2003	24.4
	9/17/2003	23
	9/17/2003	22.6
	12/4/2003	25.1
	3/10/2004	20.6
	6/7/2004	20.4
	9/1/2004	23.6
	9/1/2004	23.8
	11/30/2004	22.5
	2/28/2005	26.5
	6/8/2005	22.2
	8/24/2005	26.2
	11/15/2005	30.2
	3/8/2006	28.8
	6/5/2006	24.4
	6/5/2006	24.4
	8/23/2006	34.2
	11/14/2006	26.1
	3/8/2007	28

SEEP B3
1995 - 2007

Parameter	Date	Result
Sp. Cond., fld, umho	2/22/1995	258
	5/17/1995	268
	8/23/1995	294
	12/6/1995	244
	12/6/1995	244
	2/28/1996	253
	6/5/1996	205
	8/14/1996	259
	12/11/1996	235
	2/12/1997	232
	5/14/1997	245
	8/27/1997	291
	11/12/1997	304
	2/11/1998	221
	5/6/1998	210
	9/16/1998	362
	12/9/1998	238
	12/9/1998	238
	2/10/1999	309
	11/2/1999	311
	2/9/2000	183
	2/9/2000	183
	5/11/2000	251
	9/13/2000	160
	12/4/2000	281
	2/7/2001	304
	5/14/2001	283
	8/8/2001	332
	8/8/2001	332
	12/3/2001	329
	2/27/2002	340
	6/5/2002	315
	8/28/2002	349
	12/4/2002	302
	3/5/2003	285
	6/11/2003	250
	9/17/2003	298
	9/17/2003	298
	12/4/2003	244
	3/10/2004	228
	6/7/2004	266
	9/1/2004	283
	9/1/2004	283
	11/30/2004	222
	2/28/2005	262
	6/8/2005	295
	8/24/2005	361
	11/15/2005	310
	3/8/2006	260
	6/5/2006	284
	6/5/2006	284
	8/23/2006	362
	11/14/2006	252
	3/8/2007	339
Sr, tot., mg/l	6/5/1996	0.085
	8/14/1996	0.109
	12/11/1996	0.094
	2/12/1997	0.092
	5/14/1997	0.107
	8/27/1997	0.128
	11/12/1997	0.118
	2/11/1998	0.094
	5/6/1998	0.077
	9/16/1998	0.136
	12/9/1998	0.121
	12/9/1998	0.123
	2/10/1999	0.103
	11/2/1999	0.132
	2/9/2000	0.131
	2/9/2000	0.137
	5/11/2000	0.107
	9/13/2000	0.067
	12/4/2000	0.137
	2/7/2001	0.113
	5/14/2001	0.125
	8/8/2001	0.15
	8/8/2001	0.149
	12/3/2001	0.153
	2/27/2002	0.155
	6/5/2002	0.148
	8/28/2002	0.178
	12/4/2002	0.131
	3/5/2003	0.11
	6/11/2003	0.121
	9/17/2003	0.136
	9/17/2003	0.138
	12/4/2003	0.113
	3/10/2004	0.102
	6/7/2004	0.121
	9/1/2004	0.126
	9/1/2004	0.124
	11/30/2004	0.107
	2/28/2005	0.111
	6/8/2005	0.128
	8/24/2005	0.153
	11/15/2005	0.14
	3/8/2006	0.11
	6/5/2006	0.133
	6/5/2006	0.134
	8/23/2006	0.164
	11/14/2006	0.111
	3/8/2007	0.117

SEEP B3
1995 - 2007

Parameter	Date	Result
Water temp. (C)	2/22/1995	3.7
	5/17/1995	15.3
	8/23/1995	18
	12/6/1995	4.4
	12/6/1995	4.4
	2/28/1996	6.9
	6/5/1996	15.5
	8/14/1996	17.6
	12/11/1996	7.1
	2/12/1997	1.6
	5/14/1997	9
	8/27/1997	17.9
	11/12/1997	6.9
	2/10/1999	3
	11/2/1999	12.66
	2/9/2000	0
	2/9/2000	0
	5/11/2000	15.12
	9/13/2000	20
	12/4/2000	0.6
	2/7/2001	4.95
	5/14/2001	12.01
	8/8/2001	23.31
	8/8/2001	23.31
	12/3/2001	6.26
	2/27/2002	4.47
	6/5/2002	18.12
	8/28/2002	20.74
	12/4/2002	0.16
	3/5/2003	4.84
	6/11/2003	17.15
	9/17/2003	15.93
	9/17/2003	15.93
	12/4/2003	3.29
	3/10/2004	4.79
	6/7/2004	15.5
	9/1/2004	20.67
	9/1/2004	20.67
	11/30/2004	7.16
	2/28/2005	2.43
	6/8/2005	19.75
	8/24/2005	19.2
	11/15/2005	10.45
	3/8/2006	2.2
	6/5/2006	17.43
	6/5/2006	17.43
	8/23/2006	20.15
	11/14/2006	11.97
	3/8/2007	0.06
Zn, tot., mg/l	2/22/1995	<0.0400
	5/17/1995	<0.0400
	8/23/1995	<0.0400
	12/6/1995	<0.0400
	12/6/1995	<0.0400
	2/28/1996	<0.0400
	6/5/1996	<0.0400
	8/14/1996	<0.0400
	12/11/1996	<0.0400
	2/12/1997	<0.0200
	5/14/1997	<0.0200
	8/27/1997	<0.0200
	11/12/1997	<0.0200
	2/11/1998	<0.020
	5/6/1998	<0.020
	9/16/1998	<0.020
	12/9/1998	<0.020
	12/9/1998	<0.020
	2/10/1999	<0.020
	11/2/1999	<0.020
	2/9/2000	<0.020
	2/9/2000	<0.020
	5/11/2000	<0.020
	9/13/2000	0.024
	12/4/2000	<0.020
	2/7/2001	<0.020
	5/14/2001	<0.020
	8/8/2001	ND
	8/8/2001	<0.0100
	12/3/2001	<0.010
	2/27/2002	0.012
	6/5/2002	<0.010
	8/28/2002	0.013
	12/4/2002	ND
	3/5/2003	<0.010
	6/11/2003	<0.010
	9/17/2003	ND
	9/17/2003	0.018
	12/4/2003	ND
	3/10/2004	ND
	6/7/2004	<0.020
	9/1/2004	ND
	9/1/2004	ND
	11/30/2004	ND
	2/28/2005	ND
	6/8/2005	ND
	8/24/2005	<0.020
	11/15/2005	<0.020
	3/8/2006	ND
	6/5/2006	ND
	6/5/2006	ND
	8/23/2006	<0.020
	11/14/2006	<0.020
	3/8/2007	<0.020

SEEP B4
1995 - 2007

Parameter	Date	Result
Al, tot., mg/l	2/22/1995	<0.0500
	5/17/1995	<0.0500
	8/23/1995	<0.0500
	12/6/1995	<0.0500
	2/28/1996	0.114
	2/28/1996	0.117
	6/5/1996	0.414
	8/14/1996	<0.0500
	12/11/1996	<0.0500
	2/12/1997	<0.0400
	5/14/1997	<0.0400
	8/27/1997	0.045
	11/12/1997	<0.0400
	2/11/1998	<0.040
	5/6/1998	0.252
	9/16/1998	<0.040
	12/9/1998	<0.040
	2/10/1999	<0.040
	2/10/1999	<0.040
	11/2/1999	<0.040
	2/9/2000	<0.040
	5/11/2000	<0.040
	9/13/2000	1.23
	12/4/2000	<0.040
	2/7/2001	<0.040
	2/7/2001	<0.040
	5/14/2001	ND
	8/8/2001	ND
	12/3/2001	ND
	2/27/2002	ND
	6/5/2002	<0.050
	8/28/2002	ND
	12/4/2002	ND
	3/5/2003	0.072
	6/11/2003	0.175
	9/17/2003	0.056
	12/4/2003	<0.100
	6/7/2004	<0.100
	9/1/2004	<0.100
	11/30/2004	ND
	2/28/2005	ND
	6/8/2005	0.127
	8/24/2005	ND
	11/15/2005	ND
	3/8/2006	ND
	6/5/2006	<0.100
	8/23/2006	ND
	8/23/2006	<0.100
	11/14/2006	<0.100
	3/8/2007	<0.100
	3/8/2007	<0.100
Alk., tot., mg/l	2/22/1995	57
	5/17/1995	90
	8/23/1995	83
	12/6/1995	65
	2/28/1996	57
	2/28/1996	56
	6/5/1996	55
	8/14/1996	76
	12/11/1996	50
	2/12/1997	51
	5/14/1997	75
	8/27/1997	98
	11/12/1997	80
	2/11/1998	51
	5/6/1998	58
	9/16/1998	114
	12/9/1998	100
	2/10/1999	64
	2/10/1999	63
	11/2/1999	90
	2/9/2000	79
	5/11/2000	80
	9/13/2000	46
	12/4/2000	102
	2/7/2001	57
	2/7/2001	56.5
	5/14/2001	83
	8/8/2001	119
	12/3/2001	124
	2/27/2002	98
	6/5/2002	100
	8/28/2002	132
	12/4/2002	75
	3/5/2003	55
	6/11/2003	60.5
	9/17/2003	95
	12/4/2003	66
	6/7/2004	83
	9/1/2004	82
	11/30/2004	60
	2/28/2005	62
	6/8/2005	88
	8/24/2005	115
	11/15/2005	93
	3/8/2006	68
	6/5/2006	97
	8/23/2006	122
	8/23/2006	122
	11/14/2006	68
	3/8/2007	56
	3/8/2007	57

SEEP B4
1995 - 2007

Parameter	Date	Result
Ca, tot., mg/l	2/22/1995	33.9
	5/17/1995	49.6
	8/23/1995	42.1
	12/6/1995	33.5
	2/28/1996	42.8
	2/28/1996	42.4
	6/5/1996	25.1
	8/14/1996	33.1
	12/11/1996	26.3
	2/12/1997	28.5
	5/14/1997	38.2
	8/27/1997	57.7
	11/12/1997	36.6
	2/11/1998	26.36
	5/6/1998	23.69
	9/16/1998	71.78
	12/9/1998	55.8
	2/10/1999	34.9
	2/10/1999	34.1
	11/2/1999	43.8
	2/9/2000	55.5
	5/11/2000	35.76
	9/13/2000	18.5
	12/4/2000	51
	2/7/2001	32.8
	2/7/2001	32.8
	5/14/2001	40.4
	8/8/2001	65.6
	12/3/2001	57.7
	2/27/2002	47.8
	6/5/2002	40.9
	8/28/2002	88.9
	12/4/2002	38.7
	3/5/2003	31
	6/11/2003	27.4
	9/17/2003	48.4
	12/4/2003	30.9
	6/7/2004	35.4
	9/1/2004	37.8
	11/30/2004	27.6
	2/28/2005	32.8
	6/8/2005	43.7
	8/24/2005	62.6
	11/15/2005	44.8
	3/8/2006	34.4
	6/5/2006	45.2
	8/23/2006	69.3
	8/23/2006	69.7
	11/14/2006	31
	3/8/2007	32.2
	3/8/2007	32.1
Cd, tot., mg/l	2/22/1995	<0.0010
	5/17/1995	<0.0010
	8/23/1995	<0.0010
	12/6/1995	<0.0010
	2/28/1996	<0.0010
	2/28/1996	<0.0010
	6/5/1996	<0.0010
	8/14/1996	<0.0010
	12/11/1996	<0.0010
	2/12/1997	<0.0010
	5/14/1997	<0.0010
	8/27/1997	<0.0010
	11/12/1997	<0.0010
	2/11/1998	<0.001
	5/6/1998	<0.001
	9/16/1998	<0.001
	12/9/1998	<0.001
	2/10/1999	<0.001
	2/10/1999	<0.001
	11/2/1999	<0.001
	2/9/2000	<0.001
	5/11/2000	<0.001
	9/13/2000	<0.001
	12/4/2000	<0.001
	2/7/2001	ND
	2/7/2001	ND
	5/14/2001	ND
	8/8/2001	ND
	12/3/2001	ND
	2/27/2002	<0.001
	6/5/2002	ND
	8/28/2002	ND
	12/4/2002	ND
	3/5/2003	ND
	6/11/2003	ND
	9/17/2003	ND
	12/4/2003	ND
	6/7/2004	ND
	9/1/2004	ND
	11/30/2004	ND
	2/28/2005	ND
	6/8/2005	ND
	8/24/2005	ND
	11/15/2005	ND
	3/8/2006	ND
	6/5/2006	ND
	8/23/2006	ND
	8/23/2006	ND
	11/14/2006	ND
	3/8/2007	ND
	3/8/2007	<0.001

SEEP B4
1995 - 2007

Parameter	Date	Result
Fe, tot., mg/l	2/22/1995	0.5
	5/17/1995	1.02
	8/23/1995	0.48
	12/6/1995	0.34
	2/28/1996	0.56
	2/28/1996	0.53
	6/5/1996	0.61
	8/14/1996	0.14
	12/11/1996	0.11
	2/12/1997	0.14
	5/14/1997	0.49
	8/27/1997	1.78
	11/12/1997	0.13
	2/11/1998	0.08
	5/6/1998	0.33
	9/16/1998	1.46
	12/9/1998	0.89
	2/10/1999	0.16
	2/10/1999	0.15
	11/2/1999	0.39
	2/9/2000	0.41
	5/11/2000	0.2
	9/13/2000	1.65
	12/4/2000	0.55
	2/7/2001	0.14
	2/7/2001	0.16
	5/14/2001	0.26
	8/8/2001	0.65
	12/3/2001	0.78
	2/27/2002	0.34
	6/5/2002	0.26
	8/28/2002	0.96
	12/4/2002	0.22
	3/5/2003	0.13
	6/11/2003	0.2
	9/17/2003	0.34
	12/4/2003	0.21
	6/7/2004	0.31
	9/1/2004	0.34
	11/30/2004	0.12
	2/28/2005	0.27
	6/8/2005	0.67
	8/24/2005	1.1
	11/15/2005	0.55
	3/8/2006	0.29
	6/5/2006	0.6
	8/23/2006	1.58
	8/23/2006	1.58
	11/14/2006	0.2
	3/8/2007	0.14
	3/8/2007	0.15
HCO3, mg/l	8/8/2001	145
Mn, tot., mg/l	2/22/1995	0.547
	5/17/1995	1.13
	8/23/1995	0.427
	12/6/1995	0.358
	2/28/1996	1.09
	2/28/1996	1.08
	6/5/1996	0.096
	8/14/1996	0.082
	12/11/1996	0.066
	2/12/1997	0.163
	5/14/1997	0.498
	8/27/1997	1.74
	11/12/1997	0.145
	2/11/1998	0.08
	5/6/1998	0.11
	9/16/1998	2.252
	12/9/1998	1.34
	2/10/1999	0.307
	2/10/1999	0.298
	11/2/1999	0.647
	2/9/2000	0.817
	5/11/2000	0.369
	9/13/2000	0.171
	12/4/2000	0.895
	2/7/2001	0.181
	2/7/2001	0.18
	5/14/2001	0.522
	8/8/2001	1.51
	12/3/2001	1.25
	2/27/2002	0.591
	6/5/2002	0.369
	8/28/2002	2.31
	12/4/2002	0.302
	3/5/2003	0.176
	6/11/2003	0.047
	9/17/2003	0.665
	12/4/2003	0.294
	6/7/2004	0.323
	9/1/2004	0.41
	11/30/2004	0.059
	2/28/2005	0.336
	6/8/2005	0.712
	8/24/2005	1.45
	11/15/2005	0.59
	3/8/2006	0.366
	6/5/2006	0.619
	8/23/2006	1.8
	8/23/2006	1.81
	11/14/2006	0.123
	3/8/2007	0.111
	3/8/2007	0.111

SEEP B4
1995 - 2007

Parameter	Date	Result
Ni, tot, mg/l	2/22/1995	<0.0700
	5/17/1995	<0.0700
	8/23/1995	<0.0700
	12/6/1995	<0.0700
	2/28/1996	<0.0700
	2/28/1996	<0.0700
	6/5/1996	<0.0700
	8/14/1996	<0.0700
	12/11/1996	<0.0700
	2/12/1997	<0.0600
	5/14/1997	<0.0600
	8/27/1997	<0.0600
	11/12/1997	<0.0600
	2/11/1998	<0.060
	5/6/1998	<0.060
	9/16/1998	<0.060
	12/9/1998	<0.060
	2/10/1999	<0.060
	2/10/1999	<0.060
	11/2/1999	<0.060
	2/9/2000	<0.060
	5/11/2000	<0.060
	9/13/2000	<0.060
	12/4/2000	<0.060
	2/7/2001	ND
	2/7/2001	ND
	5/14/2001	ND
	8/8/2001	<0.0080
	12/3/2001	ND
	2/27/2002	ND
	6/5/2002	ND
	8/28/2002	ND
	12/4/2002	ND
	3/5/2003	ND
	6/11/2003	ND
	9/17/2003	ND
	12/4/2003	ND
	6/7/2004	ND
	9/1/2004	ND
	11/30/2004	ND
	2/28/2005	ND
	6/8/2005	ND
	8/24/2005	ND
	11/15/2005	ND
	3/8/2006	ND
	6/5/2006	ND
	8/23/2006	ND
	8/23/2006	ND
	11/14/2006	ND
	3/8/2007	ND
	3/8/2007	ND
pH, fld, s.u.	2/22/1995	7.8
	5/17/1995	5.7
	8/23/1995	6.6
	12/6/1995	7.6
	2/28/1996	7.7
	2/28/1996	7.7
	6/5/1996	7.1
	8/14/1996	NR
	12/11/1996	8.6
	2/12/1997	7.7
	5/14/1997	7.3
	8/27/1997	6.2
	11/12/1997	7.4
	2/11/1998	7.61
	5/6/1998	7.3
	9/16/1998	7
	12/9/1998	7.13
	2/10/1999	7.3
	2/10/1999	7.3
	11/2/1999	7.28
	2/9/2000	7.15
	5/11/2000	7.65
	9/13/2000	7.5
	12/4/2000	7.6
	2/7/2001	7.93
	2/7/2001	7.93
	5/14/2001	7.89
	8/8/2001	7.18
	12/3/2001	7.36
	2/27/2002	7.67
	6/5/2002	7.59
	8/28/2002	6.93
	12/4/2002	7.46
	3/5/2003	7.09
	6/11/2003	7.61
	9/17/2003	7.3
	12/4/2003	7.65
	6/7/2004	6.93
	9/1/2004	7.54
	11/30/2004	7.58
	2/28/2005	7.54
	6/8/2005	7.86
	8/24/2005	7
	11/15/2005	7.31
	3/8/2006	7.56
	6/5/2006	7.01
	8/23/2006	6.99
	8/23/2006	6.99
	11/14/2006	7.37
	3/8/2007	7.55
	3/8/2007	7.55

SEEP B4
1995 - 2007

Parameter	Date	Result
Se, tot., mg/l	2/22/1995	<0.001
	5/17/1995	<0.001
	8/23/1995	<0.001
	12/6/1995	<0.002
	2/28/1996	<0.002
	2/28/1996	<0.002
	6/5/1996	<0.002
	8/14/1996	<0.002
	12/11/1996	<0.002
	2/12/1997	<0.001
	5/14/1997	<0.001
	8/27/1997	<0.001
	11/12/1997	<0.001
	2/11/1998	<0.001
	5/6/1998	<0.001
	9/16/1998	<0.001
	12/9/1998	<0.001
	2/10/1999	<0.001
	2/10/1999	<0.001
	11/2/1999	<0.001
	2/9/2000	<0.001
	5/11/2000	<0.001
	9/13/2000	<0.001
	12/4/2000	<0.001
	2/7/2001	<0.0010
	2/7/2001	<0.0010
	5/14/2001	<0.0010
	8/8/2001	<0.0010
	12/3/2001	<0.0010
	2/27/2002	<0.0010
	6/5/2002	<0.0010
	8/28/2002	<0.0010
	12/4/2002	<0.0010
	3/5/2003	<0.0010
	6/11/2003	<0.0010
	9/17/2003	ND
	12/4/2003	<0.0010
	6/7/2004	ND
	9/1/2004	<0.0010
	11/30/2004	<0.0010
	2/28/2005	<0.0010
	6/8/2005	<0.0010
	8/24/2005	ND
	11/15/2005	ND
	3/8/2006	ND
	6/5/2006	ND
	8/23/2006	<0.0020
	8/23/2006	ND
	11/14/2006	ND
	3/8/2007	<0.0020
	3/8/2007	<0.0020
SO4, as SO4, mg/l	2/22/1995	51.5
	5/17/1995	78.7
	8/23/1995	45
	12/6/1995	41.6
	2/28/1996	74.4
	2/28/1996	73.8
	6/5/1996	21.2
	8/14/1996	25.2
	12/11/1996	27.9
	2/12/1997	30.6
	5/14/1997	43
	8/27/1997	100
	11/12/1997	35.4
	2/11/1998	29.4
	5/6/1998	23.64
	9/16/1998	145.33
	12/9/1998	90.1
	2/10/1999	43.9
	2/10/1999	44.9
	11/2/1999	56.5
	2/9/2000	62.9
	5/11/2000	38.6
	9/13/2000	14.4
	12/4/2000	67.5
	2/7/2001	33.2
	2/7/2001	33.2
	5/14/2001	50.2
	8/8/2001	110
	12/3/2001	81.6
	2/27/2002	59.9
	6/5/2002	52.2
	8/28/2002	163
	12/4/2002	45.4
	3/5/2003	31
	6/11/2003	24.8
	9/17/2003	48
	12/4/2003	35.4
	6/7/2004	33.2
	9/1/2004	41.8
	11/30/2004	20.6
	2/28/2005	38.5
	6/8/2005	54.6
	8/24/2005	99.4
	11/15/2005	60.5
	3/8/2006	46
	6/5/2006	56
	8/23/2006	129
	8/23/2006	129
	11/14/2006	31.2
	3/8/2007	33
	3/8/2007	33.2

SEEP B4
1995 - 2007

Parameter	Date	Result
Sp. Cond., fld, umho	2/22/1995	292
	5/17/1995	390
	8/23/1995	330
	12/6/1995	273
	2/28/1996	391
	2/28/1996	391
	6/5/1996	198
	8/14/1996	263
	12/11/1996	233
	2/12/1997	243
	5/14/1997	307
	8/27/1997	508
	11/12/1997	325
	2/11/1998	229
	5/6/1998	210
	9/16/1998	543
	12/9/1998	419
	2/10/1999	309
	2/10/1999	309
	11/2/1999	379
	2/9/2000	361
	5/11/2000	301
	9/13/2000	161
	12/4/2000	374
	2/7/2001	321
	2/7/2001	321
	5/14/2001	333
	8/8/2001	504
	12/3/2001	454
	2/27/2002	405
	6/5/2002	352
	8/28/2002	616
	12/4/2002	337
	3/5/2003	303
	6/11/2003	236
	9/17/2003	355
	12/4/2003	274
	6/7/2004	262
	9/1/2004	328
	11/30/2004	244
	2/28/2005	313
	6/8/2005	369
	8/24/2005	512
	11/15/2005	375
	3/8/2006	305
	6/5/2006	353
	8/23/2006	554
	8/23/2006	554
	11/14/2006	264
	3/8/2007	348
	3/8/2007	348
Sr, tot., mg/l	6/5/1996	0.091
	8/14/1996	0.111
	12/11/1996	0.095
	2/12/1997	0.101
	5/14/1997	0.137
	8/27/1997	0.237
	11/12/1997	0.122
	2/11/1998	0.096
	5/6/1998	0.081
	9/16/1998	0.283
	12/9/1998	0.216
	2/10/1999	0.125
	2/10/1999	0.122
	11/2/1999	0.171
	2/9/2000	0.19
	5/11/2000	0.131
	9/13/2000	0.068
	12/4/2000	0.194
	2/7/2001	0.136
	2/7/2001	0.125
	5/14/2001	0.163
	8/8/2001	0.26
	12/3/2001	0.229
	2/27/2002	0.196
	6/5/2002	0.171
	8/28/2002	0.352
	12/4/2002	0.15
	3/5/2003	0.12
	6/11/2003	0.108
	9/17/2003	0.175
	12/4/2003	0.128
	6/7/2004	0.14
	9/1/2004	0.152
	11/30/2004	0.109
	2/28/2005	0.134
	6/8/2005	0.172
	8/24/2005	0.252
	11/15/2005	0.181
	3/8/2006	0.137
	6/5/2006	0.176
	8/23/2006	0.292
	8/23/2006	0.293
	11/14/2006	0.117
	3/8/2007	0.124
	3/8/2007	0.124

SEEP B4
1995 - 2007

Parameter	Date	Result
Water temp. (C)	2/22/1995	3.5
	5/17/1995	15
	8/23/1995	18.1
	12/6/1995	4.4
	2/28/1996	7.8
	2/28/1996	7.8
	6/5/1996	15.8
	8/14/1996	17.5
	12/11/1996	7
	2/12/1997	1.4
	5/14/1997	9.1
	8/27/1997	17.7
	11/12/1997	6.9
	2/10/1999	2.9
	2/10/1999	2.9
	11/2/1999	12.71
	2/9/2000	0.5
	5/11/2000	14.99
	9/13/2000	20.1
	12/4/2000	2.3
	2/7/2001	4.57
	2/7/2001	4.57
	5/14/2001	11.74
	8/8/2001	22.42
	12/3/2001	7.09
	2/27/2002	4.63
	6/5/2002	17.9
	8/28/2002	20.01
	12/4/2002	0.4
	3/5/2003	4.79
	6/11/2003	17.05
	9/17/2003	15.92
	12/4/2003	3.29
	6/7/2004	15.31
	9/1/2004	19.83
	11/30/2004	6.96
	2/28/2005	2.51
	6/8/2005	19.35
	8/24/2005	18.85
	11/15/2005	10.63
	3/8/2006	2.43
	6/5/2006	17.36
	8/23/2006	19.28
	8/23/2006	19.28
	11/14/2006	11.93
	3/8/2007	0.16
	3/8/2007	0.16
Zn, tot., mg/l	2/22/1995	<0.0400
	5/17/1995	<0.0400
	8/23/1995	<0.0400
	12/6/1995	<0.0400
	2/28/1996	<0.0400
	2/28/1996	<0.0400
	6/5/1996	<0.0400
	8/14/1996	<0.0400
	12/11/1996	<0.0400
	2/12/1997	<0.0200
	5/14/1997	<0.0200
	8/27/1997	<0.0200
	11/12/1997	<0.0200
	2/11/1998	<0.020
	5/6/1998	<0.020
	9/16/1998	<0.020
	12/9/1998	<0.020
	2/10/1999	<0.020
	2/10/1999	<0.020
	11/2/1999	<0.020
	2/9/2000	<0.020
	5/11/2000	<0.020
	9/13/2000	0.021
	12/4/2000	<0.020
	2/7/2001	ND
	2/7/2001	<0.020
	5/14/2001	<0.020
	8/8/2001	ND
	12/3/2001	<0.010
	2/27/2002	0.015
	6/5/2002	ND
	8/28/2002	0.014
	12/4/2002	ND
	3/5/2003	<0.010
	6/11/2003	ND
	9/17/2003	0.053
	12/4/2003	ND
	6/7/2004	<0.020
	9/1/2004	<0.020
	11/30/2004	ND
	2/28/2005	ND
	6/8/2005	ND
	8/24/2005	ND
	11/15/2005	<0.020
	3/8/2006	ND
	6/5/2006	ND
	8/23/2006	ND
	8/23/2006	<0.020
	11/14/2006	<0.020
	3/8/2007	<0.020
	3/8/2007	<0.020

SEEP B6
1995 - 2007

Parameter	Date	Result
Al, tot., mg/l	2/22/1995	0.08
	5/17/1995	<0.0500
	8/23/1995	<0.0500
	12/6/1995	<0.0500
	2/28/1996	<0.0500
	6/5/1996	0.08
	6/5/1996	0.283
	8/14/1996	<0.0500
	12/11/1996	<0.0500
	2/12/1997	<0.0400
	5/14/1997	<0.0400
	8/27/1997	<0.0400
	11/12/1997	0.124
	2/11/1998	<0.040
	5/6/1998	0.102
	9/16/1998	<0.040
	12/9/1998	<0.040
	2/10/1999	0.119
	11/2/1999	0.076
	2/9/2000	0.053
	5/11/2000	<0.040
	9/13/2000	0.119
	12/4/2000	<0.040
	2/7/2001	<0.040
	5/14/2001	<0.040
	8/8/2001	0.0655
	12/3/2001	ND
	2/27/2002	ND
	6/5/2002	<0.050
Alk., tot., mg/l	2/22/1995	130
	5/17/1995	116
	8/23/1995	127
	12/6/1995	138
	2/28/1996	110
	6/5/1996	118
	6/5/1996	118
	8/14/1996	77
	12/11/1996	113
	2/12/1997	131
	5/14/1997	129
	8/27/1997	143
	11/12/1997	121
	2/11/1998	52
	5/6/1998	121
	9/16/1998	129
	12/9/1998	95
	2/10/1999	137
	11/2/1999	145
	2/9/2000	148
	5/11/2000	148
	9/13/2000	150
	12/4/2000	161
	2/7/2001	59
	5/14/2001	130
	8/8/2001	140
	12/3/2001	162
	2/27/2002	98
	6/5/2002	105
Ca, tot., mg/l	2/22/1995	160
	5/17/1995	148
	8/23/1995	163
	12/6/1995	155
	2/28/1996	125
	6/5/1996	174
	6/5/1996	175
	8/14/1996	32.6
	12/11/1996	154
	2/12/1997	174
	5/14/1997	144
	8/27/1997	183
	11/12/1997	174
	2/11/1998	26.07
	5/6/1998	174.18
	9/16/1998	200.9
	12/9/1998	40.9
	2/10/1999	188
	11/2/1999	182
	2/9/2000	238
	5/11/2000	195.46
	9/13/2000	210
	12/4/2000	216
	2/7/2001	38.2
	5/14/2001	168
	8/8/2001	172
	12/3/2001	210
	2/27/2002	48.2
	6/5/2002	76.9

SEEP B6
1995 - 2007

Parameter	Date	Result
Cd, tot., mg/l	2/22/1995	<0.0010
	5/17/1995	<0.0010
	8/23/1995	<0.0010
	12/6/1995	<0.0010
	2/28/1996	<0.0010
	6/5/1996	<0.0010
	6/5/1996	<0.0010
	8/14/1996	<0.0010
	12/11/1996	<0.0010
	2/12/1997	<0.0010
	5/14/1997	<0.0010
	8/27/1997	<0.0010
	11/12/1997	<0.0010
	2/11/1998	<0.001
	5/6/1998	<0.001
	9/16/1998	<0.001
	12/9/1998	<0.001
	2/10/1999	<0.001
	11/2/1999	<0.001
	2/9/2000	<0.001
	5/11/2000	<0.001
	9/13/2000	<0.001
	12/4/2000	<0.001
	2/7/2001	ND
	5/14/2001	<0.001
	8/8/2001	<0.001
	12/3/2001	<0.001
	2/27/2002	ND
	6/5/2002	ND
Fe, tot., mg/l	2/22/1995	13.5
	5/17/1995	6.43
	8/23/1995	11.8
	12/6/1995	11.2
	2/28/1996	0.77
	6/5/1996	0.89
	6/5/1996	1.24
	8/14/1996	0.12
	12/11/1996	1.63
	2/12/1997	9.62
	5/14/1997	9.42
	8/27/1997	16.2
	11/12/1997	7.49
	2/11/1998	0.08
	5/6/1998	1.38
	9/16/1998	3.09
	12/9/1998	0.45
	2/10/1999	6.56
	11/2/1999	6.45
	2/9/2000	8.94
	5/11/2000	3.65
	9/13/2000	6.02
	12/4/2000	12.4
	2/7/2001	0.29
	5/14/2001	1.68
	8/8/2001	2.48
	12/3/2001	8.2
	2/27/2002	0.4
	6/5/2002	0.74
HCO3, mg/l	8/8/2001	171
Mn, tot., mg/l	2/22/1995	8.99
	5/17/1995	8.2
	8/23/1995	9.04
	12/6/1995	8.32
	2/28/1996	6.14
	6/5/1996	8.51
	6/5/1996	8.73
	8/14/1996	0.062
	12/11/1996	8.64
	2/12/1997	9.59
	5/14/1997	7.58
	8/27/1997	9.94
	11/12/1997	8.92
	2/11/1998	0.06
	5/6/1998	7.761
	9/16/1998	10.881
	12/9/1998	0.478
	2/10/1999	8.83
	11/2/1999	9.71
	2/9/2000	11.2
	5/11/2000	8.34
	9/13/2000	10.8
	12/4/2000	11.8
	2/7/2001	0.045
	5/14/2001	6.82
	8/8/2001	8.21
	12/3/2001	10.6
	2/27/2002	0.613
	6/5/2002	1.95

SEEP B6
1995 - 2007

Parameter	Date	Result
Ni, tot, mg/l	2/22/1995	<0.0700
	5/17/1995	<0.0700
	8/23/1995	<0.0700
	12/6/1995	<0.0700
	2/28/1996	<0.0700
	6/5/1996	<0.0700
	6/5/1996	<0.0700
	8/14/1996	<0.0700
	12/11/1996	<0.0700
	2/12/1997	<0.0600
	5/14/1997	<0.0600
	8/27/1997	<0.0600
	11/12/1997	<0.0600
	2/11/1998	<0.060
	5/6/1998	<0.060
	9/16/1998	<0.060
	12/9/1998	<0.060
	2/10/1999	<0.060
	11/2/1999	<0.060
	2/9/2000	<0.060
	5/11/2000	<0.060
	9/13/2000	<0.060
	12/4/2000	<0.060
	2/7/2001	ND
	5/14/2001	ND
	8/8/2001	0.0155
	12/3/2001	<0.020
	2/27/2002	ND
	6/5/2002	ND
pH, fld, s.u.	2/22/1995	6.6
	5/17/1995	6.3
	8/23/1995	5.8
	12/6/1995	6.6
	2/28/1996	6.5
	6/5/1996	8.5
	6/5/1996	8.5
	8/14/1996	NR
	12/11/1996	7.6
	2/12/1997	6.1
	5/14/1997	6.5
	8/27/1997	6.4
	11/12/1997	6.6
	2/11/1998	7.81
	5/6/1998	6.4
	9/16/1998	6.48
	12/9/1998	7.07
	2/10/1999	6.5
	11/2/1999	6.41
	2/9/2000	6.4
	5/11/2000	6.61
	9/13/2000	6.44
	12/4/2000	6.5
	2/7/2001	8.13
	5/14/2001	6.63
	8/8/2001	6.48
	12/3/2001	6.46
	2/27/2002	7.33
	6/5/2002	7.49
Se, tot., mg/l	2/22/1995	<0.001
	5/17/1995	0.009
	8/23/1995	<0.001
	12/6/1995	<0.002
	2/28/1996	<0.002
	6/5/1996	<0.002
	6/5/1996	<0.002
	8/14/1996	<0.002
	12/11/1996	<0.002
	2/12/1997	<0.001
	5/14/1997	<0.001
	8/27/1997	<0.001
	11/12/1997	<0.001
	2/11/1998	<0.001
	5/6/1998	<0.001
	9/16/1998	<0.001
	12/9/1998	<0.001
	2/10/1999	<0.001
	11/2/1999	<0.001
	2/9/2000	<0.001
	5/11/2000	<0.001
	9/13/2000	<0.001
	12/4/2000	<0.001
	2/7/2001	<0.0010
	5/14/2001	<0.0010
	8/8/2001	ND
	12/3/2001	ND
	2/27/2002	<0.0010
	6/5/2002	<0.0010

SEEP B6
1995 - 2007

Parameter	Date	Result
SO4, as SO4, mg/l	2/22/1995	412
	5/17/1995	401
	8/23/1995	405
	12/6/1995	426
	2/28/1996	340
	6/5/1996	430
	6/5/1996	430
	8/14/1996	23.9
	12/11/1996	410
	2/12/1997	438
	5/14/1997	425
	8/27/1997	464
	11/12/1997	434
	2/11/1998	29.35
	5/6/1998	389
	9/16/1998	650.89
	12/9/1998	36.9
	2/10/1999	563
	11/2/1999	565
	2/9/2000	599
	5/11/2000	563.59
	9/13/2000	601
	12/4/2000	609
	2/7/2001	49.1
	5/14/2001	442
	8/8/2001	390
	12/3/2001	637
	2/27/2002	61.9
	6/5/2002	49.8
Sp. Cond., fld, umho	2/22/1995	1078
	5/17/1995	1020
	8/23/1995	1040
	12/6/1995	935
	2/28/1996	945
	6/5/1996	1005
	6/5/1996	1005
	8/14/1996	242
	12/11/1996	1000
	2/12/1997	1030
	5/14/1997	1010
	8/27/1997	1100
	11/12/1997	1160
	2/11/1998	144
	5/6/1998	1025
	9/16/1998	1318
	12/9/1998	348
	2/10/1999	1220
	11/2/1999	1380
	2/9/2000	1270
	5/11/2000	1250
	9/13/2000	1260
	12/4/2000	1325
	2/7/2001	340
	5/14/2001	971
	8/8/2001	1300
	12/3/2001	1410
	2/27/2002	600
	6/5/2002	340
Sr, tot., mg/l	6/5/1996	0.759
	6/5/1996	0.746
	8/14/1996	0.111
	12/11/1996	0.692
	2/12/1997	0.694
	5/14/1997	0.581
	8/27/1997	0.745
	11/12/1997	0.693
	2/11/1998	0.094
	5/6/1998	0.695
	9/16/1998	1.022
	12/9/1998	0.147
	2/10/1999	0.803
	11/2/1999	0.889
	2/9/2000	0.976
	5/11/2000	0.787
	9/13/2000	0.848
	12/4/2000	0.915
	2/7/2001	0.135
	5/14/2001	0.719
	8/8/2001	0.782
	12/3/2001	0.947
	2/27/2002	0.197
	6/5/2002	0.335

SEEP B6
1995 - 2007

Parameter	Date	Result
Water temp. (C)	2/22/1995	9.6
	5/17/1995	14.8
	8/23/1995	16.9
	12/6/1995	13.6
	2/28/1996	11.4
	6/5/1996	13.6
	6/5/1996	13.6
	8/14/1996	17.5
	12/11/1996	12
	2/12/1997	9.2
	5/14/1997	11.1
	8/27/1997	15.6
	11/12/1997	13.6
	2/10/1999	9.9
	11/2/1999	14.7
	2/9/2000	9.67
	5/11/2000	11.83
	9/13/2000	15.7
	12/4/2000	12.6
	2/7/2001	5
	5/14/2001	11.37
	8/8/2001	14.67
	12/3/2001	13.16
	2/27/2002	5.35
	6/5/2002	17.95
Zn, tot., mg/l	2/22/1995	<0.0400
	5/17/1995	<0.0400
	8/23/1995	<0.0400
	12/6/1995	<0.0400
	2/28/1996	<0.0400
	6/5/1996	<0.0400
	6/5/1996	<0.0400
	8/14/1996	<0.0400
	12/11/1996	<0.0400
	2/12/1997	<0.0200
	5/14/1997	<0.0200
	8/27/1997	<0.0200
	11/12/1997	<0.0200
	2/11/1998	<0.020
	5/6/1998	<0.020
	9/16/1998	<0.020
	12/9/1998	<0.020
	2/10/1999	<0.020
	11/2/1999	<0.020
	2/9/2000	<0.020
	5/11/2000	<0.020
	9/13/2000	<0.020
	12/4/2000	<0.020
	2/7/2001	ND
	5/14/2001	<0.020
	8/8/2001	ND
	12/3/2001	0.014
	2/27/2002	0.017
	6/5/2002	ND

SEEP B7
1995 - 2007

Parameter	Date	Result
Al, tot., mg/l	2/22/1995	0.343
	5/17/1995	1.53
	8/23/1995	0.228
	12/6/1995	<0.0500
	2/28/1996	<0.0500
	6/5/1996	0.105
	8/14/1996	<0.0500
	8/14/1996	0.057
	12/11/1996	<0.0500
	2/12/1997	<0.0400
	5/14/1997	<0.0400
	11/12/1997	0.065
	2/11/1998	<0.040
	5/6/1998	0.053
	9/16/1998	0.06
	12/9/1998	<0.040
	2/10/1999	<0.040
	11/2/1999	<0.040
	11/2/1999	<0.040
	5/11/2000	<0.040
	9/13/2000	1.25
	2/7/2001	<0.040
	5/14/2001	<0.040
	2/27/2002	ND
	6/5/2002	<0.050
Alk., tot., mg/l	2/22/1995	38
	5/17/1995	50
	8/23/1995	154
	12/6/1995	150
	2/28/1996	119
	6/5/1996	115
	8/14/1996	75
	8/14/1996	75
	12/11/1996	139
	2/12/1997	68
	5/14/1997	166
	11/12/1997	120
	2/11/1998	50
	5/6/1998	120
	9/16/1998	127
	12/9/1998	97
	2/10/1999	111
	11/2/1999	100
	11/2/1999	98
	5/11/2000	75
	9/13/2000	45
	2/7/2001	56
	5/14/2001	78
	2/27/2002	94
	6/5/2002	88
Ca, tot., mg/l	2/22/1995	126
	5/17/1995	180
	8/23/1995	282
	12/6/1995	171
	2/28/1996	143
	6/5/1996	111
	8/14/1996	31
	8/14/1996	31.4
	12/11/1996	133
	2/12/1997	39.9
	5/14/1997	167
	11/12/1997	132
	2/11/1998	24.39
	5/6/1998	74.37
	9/16/1998	51.4
	12/9/1998	34.8
	2/10/1999	91.8
	11/2/1999	42.8
	11/2/1999	50.4
	5/11/2000	29.58
	9/13/2000	18.5
	2/7/2001	29.7
	5/14/2001	31.9
	2/27/2002	38
	6/5/2002	34.6
Cd, tot., mg/l	2/22/1995	<0.0010
	5/17/1995	<0.0010
	8/23/1995	<0.0010
	12/6/1995	<0.0010
	2/28/1996	<0.0010
	6/5/1996	<0.0010
	8/14/1996	<0.0010
	8/14/1996	<0.0010
	12/11/1996	<0.0010
	2/12/1997	<0.0010
	5/14/1997	<0.0010
	11/12/1997	<0.0010
	2/11/1998	<0.001
	5/6/1998	<0.001
	9/16/1998	<0.001
	12/9/1998	<0.001
	2/10/1999	<0.001
	11/2/1999	<0.001
	11/2/1999	<0.001
	5/11/2000	<0.001
	9/13/2000	<0.001
	2/7/2001	ND
	5/14/2001	ND
	2/27/2002	<0.001
	6/5/2002	ND

SEEP B7
1995 - 2007

Parameter	Date	Result
Fe, tot., mg/l	2/22/1995	11.5
	5/17/1995	10.1
	8/23/1995	6.79
	12/6/1995	11.7
	2/28/1996	7.22
	6/5/1996	4.66
	8/14/1996	0.08
	8/14/1996	0.09
	12/11/1996	5.39
	2/12/1997	0.35
	5/14/1997	1.62
	11/12/1997	1.2
	2/11/1998	0.04
	5/6/1998	2.49
	9/16/1998	0.4
	12/9/1998	0.06
	2/10/1999	0.55
	11/2/1999	0.36
	11/2/1999	0.43
	5/11/2000	0.09
	9/13/2000	1.53
	2/7/2001	0.08
	5/14/2001	0.08
	2/27/2002	0.08
	6/5/2002	0.06
Mn, tot., mg/l	2/22/1995	4.5
	5/17/1995	9.53
	8/23/1995	4.33
	12/6/1995	5.48
	2/28/1996	4.51
	6/5/1996	3.5
	8/14/1996	0.01
	8/14/1996	0.011
	12/11/1996	3.16
	2/12/1997	0.5
	5/14/1997	3.78
	11/12/1997	5.91
	2/11/1998	0.014
	5/6/1998	2.631
	9/16/1998	0.163
	12/9/1998	0.024
	2/10/1999	1.9
	11/2/1999	0.484
	11/2/1999	0.816
	5/11/2000	0.029
	9/13/2000	0.12
	2/7/2001	0.07
	5/14/2001	0.034
	2/27/2002	0.045
	6/5/2002	0.022
Ni, tot, mg/l	2/22/1995	<0.0700
	5/17/1995	<0.0700
	8/23/1995	<0.0700
	12/6/1995	<0.0700
	2/28/1996	<0.0700
	6/5/1996	<0.0700
	8/14/1996	<0.0700
	8/14/1996	<0.0700
	12/11/1996	<0.0700
	2/12/1997	<0.0600
	5/14/1997	<0.0600
	11/12/1997	<0.0600
	2/11/1998	<0.060
	5/6/1998	<0.060
	9/16/1998	<0.060
	12/9/1998	<0.060
	2/10/1999	<0.060
	11/2/1999	<0.060
	11/2/1999	<0.060
	5/11/2000	<0.060
	9/13/2000	<0.060
	2/7/2001	ND
	5/14/2001	ND
	2/27/2002	ND
	6/5/2002	ND
pH, fld, s.u.	2/22/1995	7.1
	5/17/1995	5.9
	8/23/1995	6.2
	12/6/1995	7.4
	2/28/1996	7.5
	6/5/1996	NR
	8/14/1996	NR
	8/14/1996	NR
	12/11/1996	8.7
	2/12/1997	8.4
	5/14/1997	6.7
	11/12/1997	7.1
	2/11/1998	8.22
	5/6/1998	7.1
	9/16/1998	7.81
	12/9/1998	7.75
	2/10/1999	7.2
	11/2/1999	7.63
	11/2/1999	7.63
	5/11/2000	7.97
	9/13/2000	7.71
	2/7/2001	8.48
	5/14/2001	7.83
	12/3/2001	N.M
	2/27/2002	8.09
	6/5/2002	7.69

SEEP B7
1995 - 2007

Parameter	Date	Result
Se, tot., mg/l	2/22/1995	<0.001
	5/17/1995	<0.001
	8/23/1995	<0.001
	12/6/1995	<0.002
	2/28/1996	<0.002
	6/5/1996	<0.002
	8/14/1996	<0.002
	8/14/1996	<0.002
	12/11/1996	<0.002
	2/12/1997	<0.001
	5/14/1997	<0.001
	11/12/1997	<0.001
	2/11/1998	<0.001
	5/6/1998	<0.001
	9/16/1998	<0.001
	12/9/1998	<0.001
	2/10/1999	<0.001
	11/2/1999	<0.001
	11/2/1999	<0.001
	5/11/2000	<0.001
	9/13/2000	<0.001
	2/7/2001	<0.0010
	5/14/2001	<0.0010
	2/27/2002	<0.0010
	6/5/2002	<0.0010
SO4, as SO4, mg/l	2/22/1995	337
	5/17/1995	519
	8/23/1995	597
	12/6/1995	405
	2/28/1996	295
	6/5/1996	221
	8/14/1996	21.3
	8/14/1996	21.1
	12/11/1996	274
	2/12/1997	78.6
	5/14/1997	302
	11/12/1997	341
	2/11/1998	27.06
	5/6/1998	140.47
	9/16/1998	80.8
	12/9/1998	20
	2/10/1999	202
	11/2/1999	53.5
	11/2/1999	51
	5/11/2000	22.86
	9/13/2000	12.6
	2/7/2001	26.4
	5/14/2001	24.3
	2/27/2002	28.7
	6/5/2002	23.1
Sp. Cond., fld, umho	2/22/1995	755
	5/17/1995	975
	8/23/1995	1360
	12/6/1995	998
	2/28/1996	899
	6/5/1996	708
	8/14/1996	258
	8/14/1996	258
	12/11/1996	837
	2/12/1997	344
	5/14/1997	893
	11/12/1997	837
	2/11/1998	216
	5/6/1998	540
	9/16/1998	408
	12/9/1998	262
	2/10/1999	646
	11/2/1999	307
	11/2/1999	307
	5/11/2000	245
	9/13/2000	158
	2/7/2001	305
	5/14/2001	263
	12/3/2001	N.M
	2/27/2002	335
	6/5/2002	310
Sr, tot., mg/l	6/5/1996	0.533
	8/14/1996	0.103
	8/14/1996	0.104
	12/11/1996	0.628
	2/12/1997	0.146
	5/14/1997	0.839
	11/12/1997	0.499
	2/11/1998	0.087
	5/6/1998	0.285
	9/16/1998	0.225
	12/9/1998	0.122
	2/10/1999	0.33
	11/2/1999	0.178
	11/2/1999	0.218
	5/11/2000	0.103
	9/13/2000	0.066
	2/7/2001	0.122
	5/14/2001	0.122
	2/27/2002	0.153
	6/5/2002	0.143

SEEP B7
1995 - 2007

Parameter	Date	Result
Water temp. (C)	2/22/1995	6.3
	5/17/1995	16.2
	8/23/1995	18.6
	12/6/1995	4.8
	2/28/1996	7.4
	6/5/1996	17.6
	8/14/1996	18
	8/14/1996	18
	12/11/1996	6.4
	2/12/1997	1.9
	5/14/1997	9.9
	11/12/1997	7.3
	2/10/1999	3.3
	11/2/1999	12.74
	11/2/1999	12.74
	5/11/2000	15.08
	9/13/2000	20.1
	2/7/2001	5.25
	5/14/2001	11.93
	12/3/2001	N.M
	2/27/2002	4.36
	6/5/2002	18.16
Zn, tot., mg/l	2/22/1995	0.069
	5/17/1995	<0.0400
	8/23/1995	<0.0400
	12/6/1995	<0.0400
	2/28/1996	<0.0400
	6/5/1996	<0.0400
	8/14/1996	<0.0400
	8/14/1996	<0.0400
	12/11/1996	<0.0400
	2/12/1997	<0.0200
	5/14/1997	<0.0200
	11/12/1997	<0.0200
	2/11/1998	<0.020
	5/6/1998	<0.020
	9/16/1998	<0.020
	12/9/1998	<0.020
	2/10/1999	<0.020
	11/2/1999	<0.020
	11/2/1999	<0.020
	5/11/2000	<0.020
	9/13/2000	<0.020
	2/7/2001	<0.020
	5/14/2001	<0.020
	2/27/2002	0.01
	6/5/2002	<0.010

SEEP H1
1995 - 2007

Parameter	Date	Result
Al, tot., mg/l	5/17/1995	0.084
	8/23/1995	<0.0500
	8/23/1995	<0.0500
	12/6/1995	<0.0500
	2/28/1996	0.076
	6/5/1996	0.228
	8/14/1996	0.065
	12/11/1996	0.051
	2/12/1997	<0.0400
	5/14/1997	<0.0400
	8/27/1997	<0.0400
	11/12/1997	<0.0400
	2/11/1998	<0.040
	5/6/1998	0.259
	9/16/1998	<0.040
	9/16/1998	<0.040
	12/9/1998	<0.040
	2/10/1999	<0.040
	11/2/1999	<0.040
	2/9/2000	<0.040
	5/11/2000	<0.040
	9/13/2000	1.44
	12/4/2000	<0.040
	12/4/2000	<0.040
	2/7/2001	<0.040
	5/14/2001	<0.040
	5/14/2001	<0.040
	8/8/2001	ND
	12/3/2001	<0.050
	2/27/2002	ND
	6/5/2002	0.082
	8/28/2002	<0.050
	12/4/2002	ND
	12/4/2002	ND
	3/5/2003	0.081
	6/11/2003	0.178
	9/17/2003	<0.050
	3/10/2004	<0.100
	6/7/2004	<0.100
	9/1/2004	<0.100
	11/30/2004	ND
	2/28/2005	ND
	2/28/2005	ND
	6/8/2005	<0.100
	8/24/2005	<0.100
	11/15/2005	ND
	3/8/2006	ND
	6/5/2006	<0.100
	8/23/2006	ND
	11/14/2006	<0.100
	11/14/2006	<0.100
	3/8/2007	0.112
Alk., tot., mg/l	5/17/1995	80
	8/23/1995	79
	8/23/1995	80
	12/6/1995	57
	2/28/1996	45
	6/5/1996	56
	8/14/1996	75
	12/11/1996	48
	2/12/1997	48
	5/14/1997	70
	8/27/1997	93
	11/12/1997	79
	2/11/1998	50
	5/6/1998	54
	9/16/1998	106
	9/16/1998	106
	12/9/1998	94
	2/10/1999	58
	11/2/1999	85
	2/9/2000	75
	5/11/2000	75
	9/13/2000	45
	12/4/2000	94
	12/4/2000	94
	2/7/2001	54
	5/14/2001	77
	5/14/2001	77
	8/8/2001	111
	12/3/2001	117
	2/27/2002	95
	6/5/2002	95
	8/28/2002	121
	12/4/2002	70
	12/4/2002	71
	3/5/2003	52
	6/11/2003	58
	9/17/2003	90
	3/10/2004	53.5
	6/7/2004	80.5
	9/1/2004	76
	11/30/2004	60
	2/28/2005	57
	2/28/2005	57
	6/8/2005	85
	8/24/2005	110
	11/15/2005	87.5
	3/8/2006	61
	6/5/2006	91
	8/23/2006	110
	11/14/2006	65
	11/14/2006	65
	3/8/2007	54
B, tot., mg/l	6/5/2006	0.023

SEEP H1
1995 - 2007

Parameter	Date	Result
Ca, tot., mg/l	5/17/1995	32
	8/23/1995	34.5
	8/23/1995	34.2
	12/6/1995	25.8
	2/28/1996	23.3
	6/5/1996	23.8
	8/14/1996	31.6
	12/11/1996	24.7
	2/12/1997	25
	5/14/1997	29.3
	8/27/1997	31.3
	11/12/1997	34.3
	2/11/1998	24.16
	5/6/1998	22.19
	9/16/1998	38.98
	9/16/1998	38.38
	12/9/1998	34.5
	2/10/1999	28.2
	11/2/1999	33
	2/9/2000	37.9
	5/11/2000	28.44
	9/13/2000	18
	12/4/2000	37.5
	12/4/2000	36.8
	2/7/2001	29.1
	5/14/2001	31.1
	5/14/2001	30.6
	8/8/2001	38.2
	12/3/2001	39.3
	2/27/2002	39.3
	6/5/2002	34.4
	8/28/2002	44.6
	12/4/2002	33.4
	12/4/2002	33.4
	3/5/2003	27.8
	6/11/2003	26.2
	9/17/2003	34.3
	3/10/2004	24.8
	6/7/2004	30.6
	9/1/2004	30.3
	11/30/2004	26.9
	2/28/2005	27.1
	2/28/2005	27.5
	6/8/2005	33.5
	8/24/2005	41.3
	11/15/2005	34.7
	3/8/2006	27.8
	6/5/2006	35
	8/23/2006	41.5
	11/14/2006	29.4
	11/14/2006	28.9
	3/8/2007	30.4
Cd, tot., mg/l	5/17/1995	<0.0010
	8/23/1995	<0.0010
	8/23/1995	<0.0010
	12/6/1995	<0.0010
	2/28/1996	<0.0010
	6/5/1996	<0.0010
	8/14/1996	<0.0010
	12/11/1996	<0.0010
	2/12/1997	<0.0010
	5/14/1997	<0.0010
	8/27/1997	<0.0010
	11/12/1997	<0.0010
	2/11/1998	<0.001
	5/6/1998	<0.001
	9/16/1998	<0.001
	9/16/1998	<0.001
	12/9/1998	<0.001
	2/10/1999	<0.001
	11/2/1999	<0.001
	2/9/2000	<0.001
	5/11/2000	<0.001
	9/13/2000	<0.001
	12/4/2000	<0.001
	12/4/2000	<0.001
	2/7/2001	ND
	5/14/2001	ND
	5/14/2001	ND
	8/8/2001	ND
	12/3/2001	<0.001
	2/27/2002	<0.001
	6/5/2002	ND
	8/28/2002	ND
	12/4/2002	ND
	12/4/2002	ND
	3/5/2003	ND
	6/11/2003	ND
	9/17/2003	ND
	3/10/2004	ND
	6/7/2004	ND
	9/1/2004	ND
	11/30/2004	ND
	2/28/2005	ND
	2/28/2005	ND
	6/8/2005	ND
	8/24/2005	ND
	11/15/2005	ND
	3/8/2006	ND
	6/5/2006	ND
	8/23/2006	ND
	11/14/2006	ND
	11/14/2006	ND
	3/8/2007	ND

SEEP H1
1995 - 2007

Parameter	Date	Result
Fe, tot., mg/l	5/17/1995	0.21
	8/23/1995	0.08
	8/23/1995	0.07
	12/6/1995	<0.0700
	2/28/1996	0.1
	6/5/1996	0.31
	8/14/1996	0.11
	12/11/1996	0.11
	2/12/1997	0.09
	5/14/1997	0.07
	8/27/1997	0.13
	11/12/1997	0.04
	2/11/1998	0.03
	5/6/1998	0.29
	9/16/1998	0.8
	9/16/1998	0.09
	12/9/1998	0.06
	2/10/1999	0.05
	11/2/1999	0.05
	2/9/2000	0.05
	5/11/2000	0.07
	9/13/2000	1.7
	12/4/2000	0.05
	12/4/2000	0.05
	2/7/2001	0.05
	5/14/2001	0.07
	5/14/2001	0.08
	8/8/2001	0.16
	12/3/2001	0.14
	2/27/2002	0.06
	6/5/2002	0.14
	8/28/2002	0.19
	12/4/2002	0.06
	12/4/2002	0.06
	3/5/2003	0.1
	6/11/2003	0.18
	9/17/2003	0.06
	3/10/2004	0.06
	6/7/2004	0.14
	9/1/2004	0.05
	11/30/2004	0.04
	2/28/2005	0.05
	2/28/2005	0.05
	6/8/2005	0.12
	8/24/2005	0.07
	11/15/2005	0.03
	3/8/2006	0.03
	6/5/2006	0.09
	8/23/2006	0.11
	11/14/2006	0.09
	11/14/2006	0.09
	3/8/2007	0.12
HCO3, mg/l	8/8/2001	135
Li, tot., mg/l	6/5/2006	ND
Mn, tot., mg/l	5/17/1995	0.06
	8/23/1995	0.017
	8/23/1995	0.017
	12/6/1995	0.012
	2/28/1996	0.012
	6/5/1996	0.03
	8/14/1996	0.016
	12/11/1996	0.023
	2/12/1997	0.019
	5/14/1997	0.02
	8/27/1997	0.034
	11/12/1997	0.015
	2/11/1998	0.007
	5/6/1998	0.03
	9/16/1998	0.025
	9/16/1998	0.024
	12/9/1998	0.02
	2/10/1999	0.01
	11/2/1999	0.013
	2/9/2000	0.012
	5/11/2000	0.024
	9/13/2000	0.112
	12/4/2000	0.017
	12/4/2000	0.016
	2/7/2001	0.018
	5/14/2001	0.014
	5/14/2001	0.015
	8/8/2001	0.0511
	12/3/2001	0.047
	2/27/2002	0.037
	6/5/2002	0.028
	8/28/2002	0.062
	12/4/2002	0.018
	12/4/2002	0.018
	3/5/2003	0.018
	6/11/2003	0.018
	9/17/2003	0.013
	3/10/2004	0.015
	6/7/2004	0.015
	9/1/2004	0.008
	11/30/2004	0.005
	2/28/2005	0.01
	2/28/2005	0.011
	6/8/2005	0.018
	8/24/2005	0.023
	11/15/2005	0.008
	3/8/2006	0.007
	6/5/2006	0.019
	8/23/2006	0.038
	11/14/2006	0.008
	11/14/2006	0.008
	3/8/2007	0.012

Parameter	Date	Result
Ni, tot, mg/l	5/17/1995	<0.0700
	8/23/1995	<0.0700
	8/23/1995	<0.0700
	12/6/1995	<0.0700
	2/28/1996	<0.0700
	6/5/1996	<0.0700
	8/14/1996	<0.0700
	12/11/1996	<0.0700
	2/12/1997	<0.0600
	5/14/1997	<0.0600
	8/27/1997	<0.0600
	11/12/1997	<0.0600
	2/11/1998	<0.060
	5/6/1998	<0.060
	9/16/1998	<0.060
	9/16/1998	<0.060
	12/9/1998	<0.060
	2/10/1999	<0.060
	11/2/1999	<0.060
	2/9/2000	<0.060
	5/11/2000	<0.060
	9/13/2000	<0.060
	12/4/2000	<0.060
	12/4/2000	<0.060
	2/7/2001	ND
	5/14/2001	ND
	5/14/2001	ND
	8/8/2001	ND
	12/3/2001	ND
	2/27/2002	ND
	6/5/2002	ND
	8/28/2002	ND
	12/4/2002	ND
	12/4/2002	ND
	3/5/2003	ND
	6/11/2003	ND
	9/17/2003	ND
	3/10/2004	ND
	6/7/2004	ND
	9/1/2004	ND
	11/30/2004	ND
	2/28/2005	ND
	2/28/2005	ND
	6/8/2005	ND
	8/24/2005	ND
	11/15/2005	ND
	3/8/2006	ND
	6/5/2006	ND
	8/23/2006	ND
	11/14/2006	<0.010
	11/14/2006	ND
	3/8/2007	ND
pH, fld, s.u.	5/17/1995	6
	8/23/1995	6.7
	8/23/1995	6.7
	12/6/1995	7.7
	2/28/1996	8.4
	6/5/1996	NR
	8/14/1996	NR
	12/11/1996	9
	2/12/1997	8.8
	5/14/1997	7.4
	8/27/1997	7.4
	11/12/1997	7.7
	2/11/1998	8.31
	5/6/1998	7.4
	9/16/1998	7.81
	9/16/1998	7.81
	12/9/1998	7.76
	2/10/1999	7.4
	11/2/1999	7.71
	2/9/2000	7.62
	5/11/2000	8.04
	9/13/2000	7.71
	12/4/2000	7.85
	12/4/2000	7.85
	2/7/2001	8.69
	5/14/2001	7.89
	5/14/2001	7.39
	8/8/2001	7.78
	12/3/2001	7.76
	2/27/2002	8.13
	6/5/2002	7.67
	8/28/2002	7.53
	12/4/2002	7.79
	12/4/2002	7.79
	3/5/2003	7.61
	6/11/2003	7.7
	9/17/2003	7.85
	3/10/2004	7.44
	6/7/2004	7.46
	9/1/2004	8.17
	11/30/2004	7.94
	2/28/2005	8.55
	2/28/2005	8.55
	6/8/2005	7.77
	8/24/2005	7.67
	11/15/2005	7.74
	3/8/2006	8.45
	6/5/2006	7.72
	8/23/2006	7.68
	11/14/2006	7.62
	11/14/2006	7.62
	3/8/2007	7.69

SEEP H1
1995 - 2007

Parameter	Date	Result
Se, tot., mg/l	5/17/1995	0.006
	8/23/1995	<0.001
	8/23/1995	<0.001
	12/6/1995	<0.002
	2/28/1996	<0.002
	6/5/1996	<0.002
	8/14/1996	<0.002
	12/11/1996	<0.002
	2/12/1997	<0.001
	5/14/1997	<0.001
	8/27/1997	<0.001
	11/12/1997	<0.001
	2/11/1998	<0.001
	5/6/1998	<0.001
	9/16/1998	<0.001
	9/16/1998	<0.001
	12/9/1998	<0.001
	2/10/1999	<0.001
	11/2/1999	<0.001
	2/9/2000	<0.001
	5/11/2000	<0.001
	9/13/2000	<0.001
	12/4/2000	<0.001
	12/4/2000	<0.001
	2/7/2001	ND
	5/14/2001	<0.0010
	5/14/2001	<0.0010
	8/8/2001	<0.0010
	12/3/2001	<0.0010
	2/27/2002	<0.0010
	6/5/2002	<0.0010
	8/28/2002	<0.0010
	12/4/2002	<0.0010
	12/4/2002	<0.0010
	3/5/2003	<0.0010
	6/11/2003	<0.0010
	9/17/2003	ND
	3/10/2004	<0.0010
	6/7/2004	ND
	9/1/2004	<0.0010
	11/30/2004	<0.0010
	2/28/2005	<0.0010
	2/28/2005	<0.0010
	6/8/2005	<0.0010
	8/24/2005	ND
	11/15/2005	ND
	3/8/2006	<0.0020
	6/5/2006	ND
	8/23/2006	<0.0020
	11/14/2006	ND
	11/14/2006	ND
	3/8/2007	<0.0020
SO4, as SO4, mg/l	5/17/1995	22
	8/23/1995	23.4
	8/23/1995	23.3
	12/6/1995	26.7
	2/28/1996	22.3
	6/5/1996	13.9
	8/14/1996	22.6
	12/11/1996	24.8
	2/12/1997	23.8
	5/14/1997	20.9
	8/27/1997	21.7
	11/12/1997	28.9
	2/11/1998	26.37
	5/6/1998	20.52
	9/16/1998	24.35
	9/16/1998	24.18
	12/9/1998	20
	2/10/1999	27.6
	11/2/1999	26
	2/9/2000	25.8
	5/11/2000	23
	9/13/2000	14.8
	12/4/2000	25
	12/4/2000	25.5
	2/7/2001	24.4
	5/14/2001	23.2
	5/14/2001	23.2
	8/8/2001	23.6
	12/3/2001	24.3
	2/27/2002	28.5
	6/5/2002	23.6
	8/28/2002	23.3
	12/4/2002	27.6
	12/4/2002	28.1
	3/5/2003	22.6
	6/11/2003	23.5
	9/17/2003	21.3
	3/10/2004	20.6
	6/7/2004	19
	9/1/2004	22.6
	11/30/2004	21.3
	2/28/2005	22.8
	2/28/2005	22.2
	6/8/2005	20.9
	8/24/2005	24.8
	11/15/2005	28.4
	3/8/2006	27.2
	6/5/2006	22.7
	8/23/2006	31.4
	11/14/2006	24.9
	11/14/2006	24.9
	3/8/2007	26.8

SEEP H1
1995 - 2007

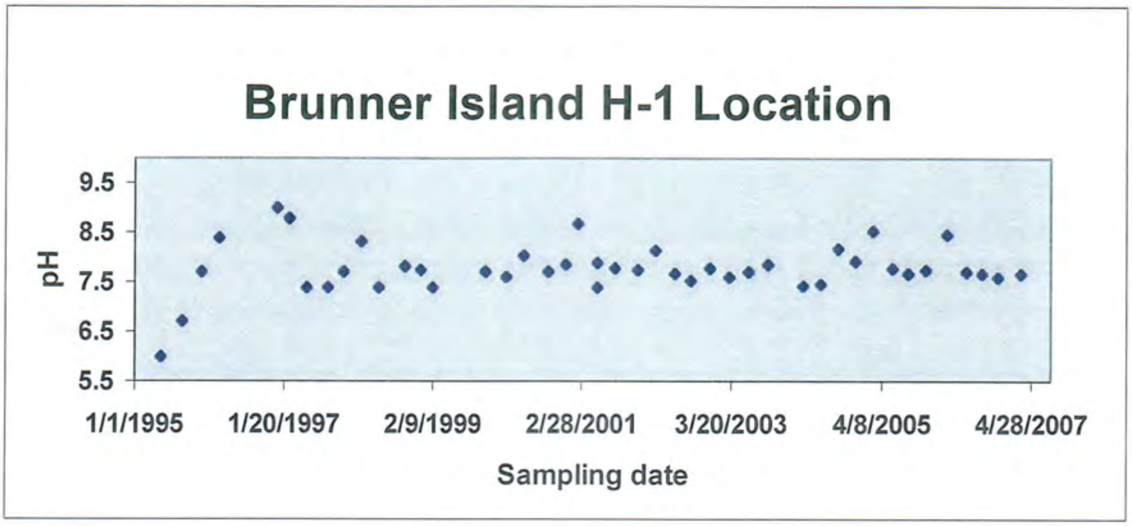
Parameter	Date	Result
Sp. Cond., fld, umho	5/17/1995	257
	8/23/1995	282
	8/23/1995	282
	12/6/1995	234
	2/28/1996	227
	6/5/1996	202
	8/14/1996	256
	12/11/1996	226
	2/12/1997	221
	5/14/1997	241
	8/27/1997	286
	11/12/1997	307
	2/11/1998	212
	5/6/1998	209
	9/16/1998	308
	9/16/1998	308
	12/9/1998	261
	2/10/1999	310
	11/2/1999	299
	2/9/2000	306
	5/11/2000	244
	9/13/2000	158
	12/4/2000	271
	12/4/2000	271
	2/7/2001	296
	5/14/2001	260
	5/14/2001	260
	8/8/2001	320
	12/3/2001	320
	2/27/2002	335
	6/5/2002	310
	8/28/2002	335
	12/4/2002	296
	12/4/2002	296
	3/5/2003	281
	6/11/2003	245
	9/17/2003	294
	3/10/2004	236
	6/7/2004	259
	9/1/2004	277
	11/30/2004	237
	2/28/2005	270
	2/28/2005	270
	6/8/2005	288
	8/24/2005	356
	11/15/2005	303
	3/8/2006	253
	6/5/2006	280
	8/23/2006	350
	11/14/2006	247
	11/14/2006	247
	3/8/2007	292
Sr, tot., mg/l	6/5/1996	0.084
	8/14/1996	0.104
	12/11/1996	0.089
	2/12/1997	0.088
	5/14/1997	0.103
	8/27/1997	0.117
	11/12/1997	0.114
	2/11/1998	0.086
	5/6/1998	0.075
	9/16/1998	0.136
	9/16/1998	0.134
	12/9/1998	0.122
	2/10/1999	0.099
	11/2/1999	0.125
	2/9/2000	0.13
	5/11/2000	0.1
	9/13/2000	0.066
	12/4/2000	0.136
	12/4/2000	0.135
	2/7/2001	0.111
	5/14/2001	0.119
	5/14/2001	0.119
	8/8/2001	0.145
	12/3/2001	0.154
	2/27/2002	0.154
	6/5/2002	0.142
	8/28/2002	0.169
	12/4/2002	0.128
	12/4/2002	0.128
	3/5/2003	0.107
	6/11/2003	0.103
	9/17/2003	0.131
	3/10/2004	0.1
	6/7/2004	0.118
	9/1/2004	0.12
	11/30/2004	0.106
	2/28/2005	0.108
	2/28/2005	0.109
	6/8/2005	0.124
	8/24/2005	0.149
	11/15/2005	0.135
	3/8/2006	0.107
	6/5/2006	0.129
	8/23/2006	0.156
	11/14/2006	0.109
	11/14/2006	0.108
	3/8/2007	0.114

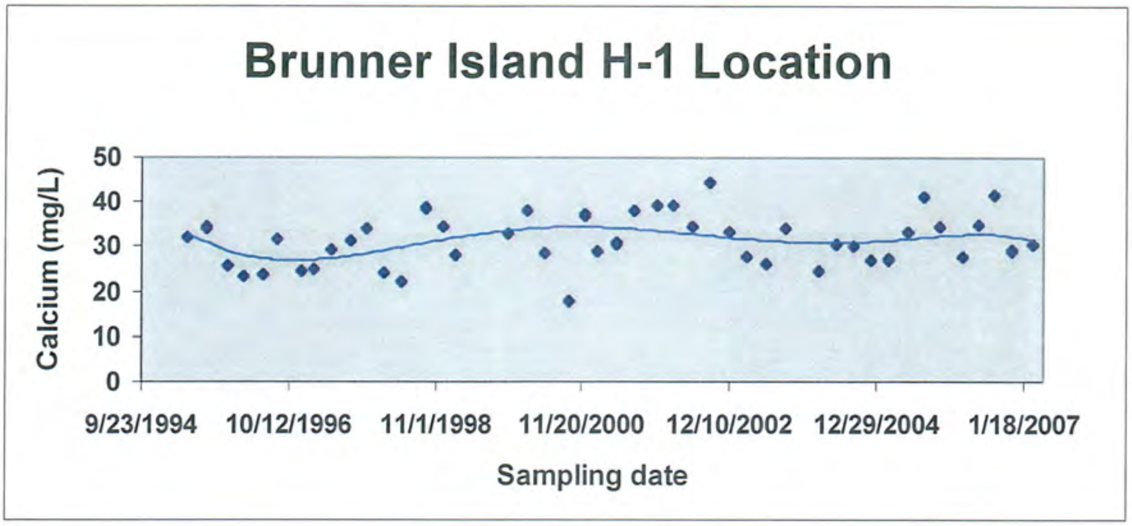
Parameter	Date	Result
Water temp. (C)	5/17/1995	15.5
	8/23/1995	17.8
	8/23/1995	17.8
	12/6/1995	4.2
	2/28/1996	7.1
	6/5/1996	15.8
	8/14/1996	18.1
	12/11/1996	7
	2/12/1997	1.8
	5/14/1997	9.4
	8/27/1997	17.9
	11/12/1997	7
	2/10/1999	3.6
	11/2/1999	12.77
	2/9/2000	0
	5/11/2000	15.15
	9/13/2000	20.1
	12/4/2000	0.9
	12/4/2000	0.9
	2/7/2001	5.47
	5/14/2001	11.97
	5/14/2001	11.97
	8/8/2001	23.52
	12/3/2001	6.33
	2/27/2002	4.46
	6/5/2002	18.18
	8/28/2002	20.79
	12/4/2002	0.2
	12/4/2002	0.2
	3/5/2003	5.17
	6/11/2003	17.35
	9/17/2003	16.17
	3/10/2004	4.88
	6/7/2004	15.5
	9/1/2004	21.29
	11/30/2004	7.34
	2/28/2005	2.58
	2/28/2005	2.58
	6/8/2005	19.66
	8/24/2005	19.07
	11/15/2005	10.47
	3/8/2006	2.38
	6/5/2006	17.52
	8/23/2006	20.1
	11/14/2006	12.06
	11/14/2006	12.06
	3/8/2007	0.09
Zn, tot., mg/l	5/17/1995	<0.0400
	8/23/1995	<0.0400
	8/23/1995	<0.0400
	12/6/1995	<0.0400
	2/28/1996	<0.0400
	6/5/1996	<0.0400
	8/14/1996	<0.0400
	12/11/1996	<0.0400
	2/12/1997	<0.0200
	5/14/1997	<0.0200
	8/27/1997	<0.0200
	11/12/1997	<0.0200
	2/11/1998	<0.020
	5/6/1998	<0.020
	9/16/1998	<0.020
	9/16/1998	<0.020
	12/9/1998	<0.020
	2/10/1999	<0.020
	11/2/1999	<0.020
	2/9/2000	<0.020
	5/11/2000	<0.020
	9/13/2000	<0.020
	12/4/2000	<0.020
	12/4/2000	<0.020
	2/7/2001	<0.020
	5/14/2001	<0.020
	5/14/2001	<0.020
	8/8/2001	ND
	12/3/2001	<0.010
	2/27/2002	<0.010
	6/5/2002	ND
	8/28/2002	<0.010
	12/4/2002	ND
	12/4/2002	ND
	3/5/2003	<0.010
	6/11/2003	ND
	9/17/2003	ND
	3/10/2004	<0.020
	6/7/2004	<0.020
	9/1/2004	<0.020
	11/30/2004	ND
	2/28/2005	ND
	2/28/2005	ND
	6/8/2005	ND
	8/24/2005	<0.020
	11/15/2005	<0.020
	3/8/2006	ND
	6/5/2006	<0.020
	8/23/2006	<0.020
	11/14/2006	<0.020
	11/14/2006	<0.020
	3/8/2007	<0.020

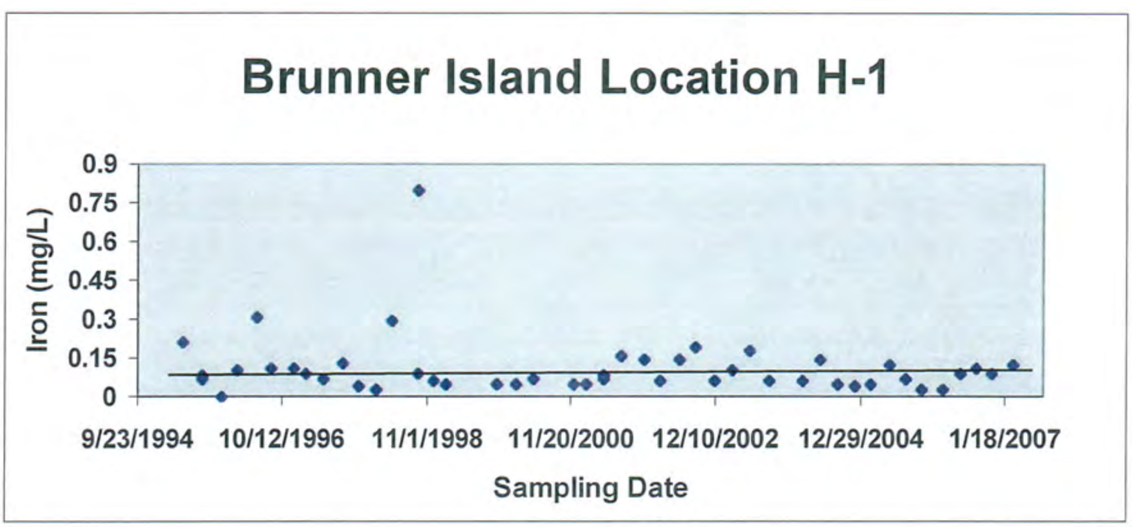
APPENDIX B

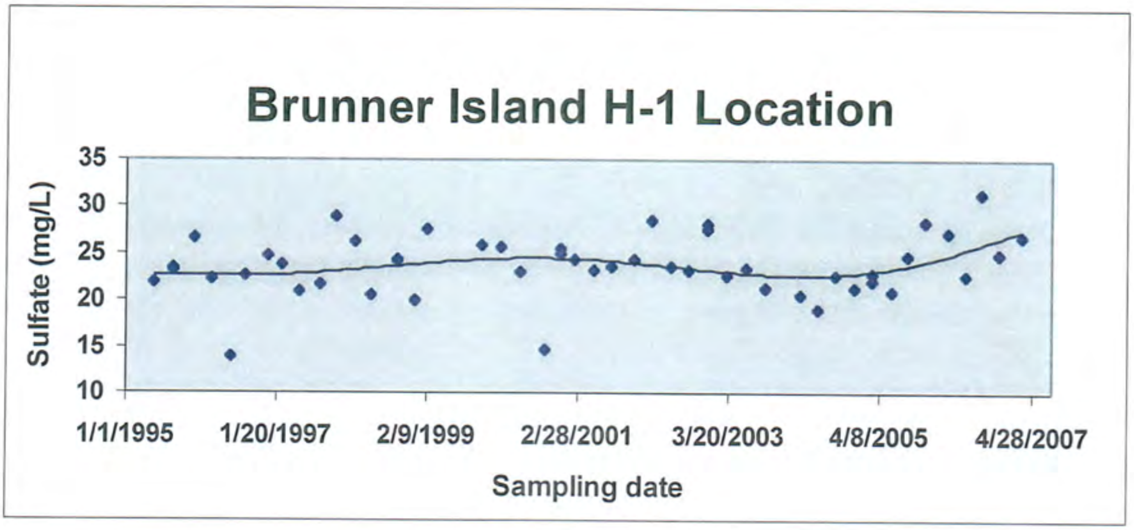
TIME SERIES SCATTER PLOTS AND

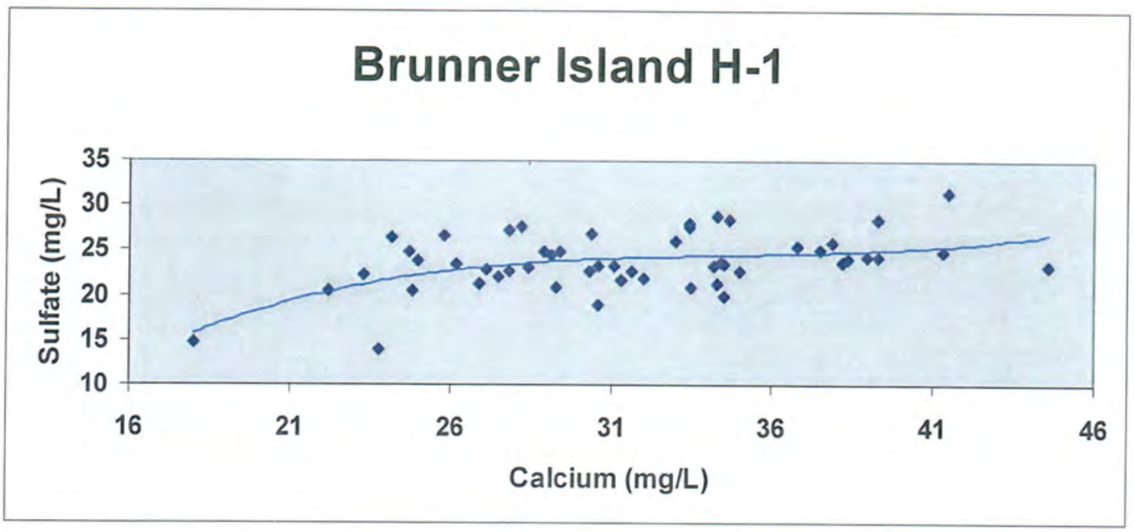
REGRESSION ANALYSIS

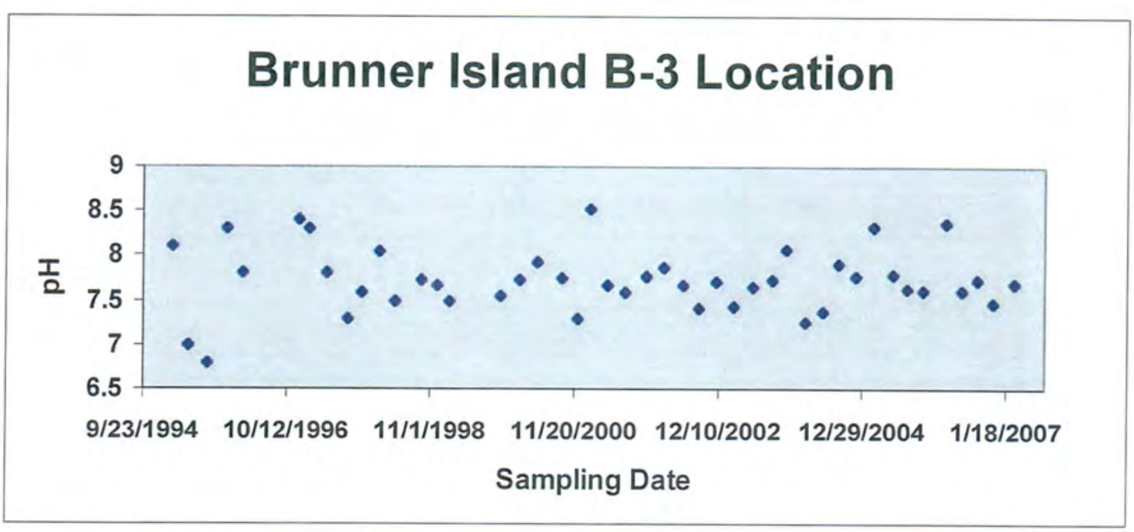

Brunner Island H-1 Location
pH
9.5
8.5
7.5
6.5
5.5
1/1/1995
1/20/1997
2/9/1999
2/28/2001
3/20/2003
4/8/2005
4/28/2007
Sampling date

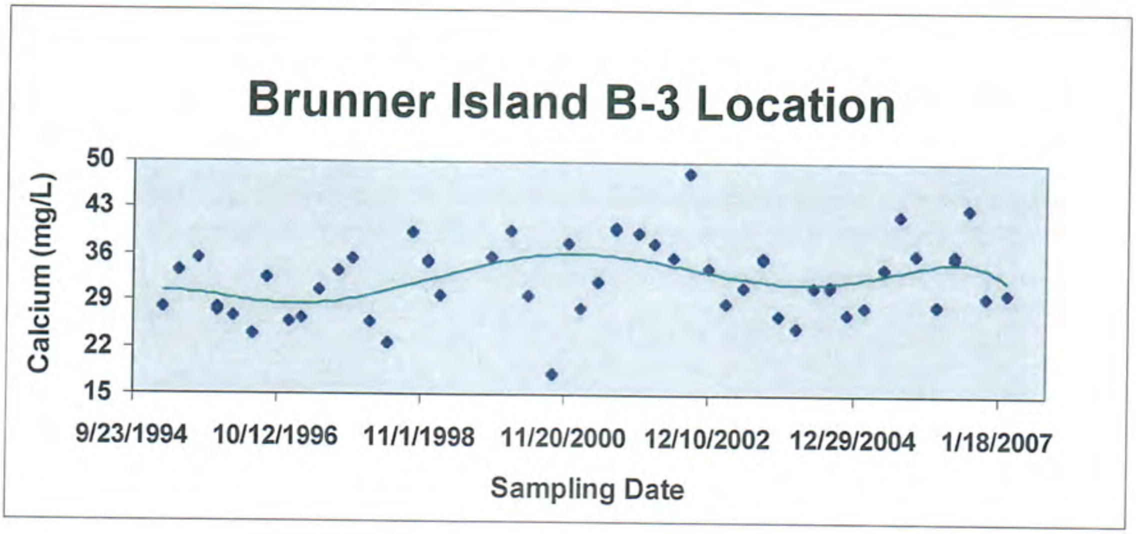

Brunner Island H-1 Location
Calcium (mg/L)
50
40
30
20
10
0
9/23/1994
10/12/1996
11/1/1998
11/20/2000
12/10/2002
12/29/2004
1/18/2007
Sampling date

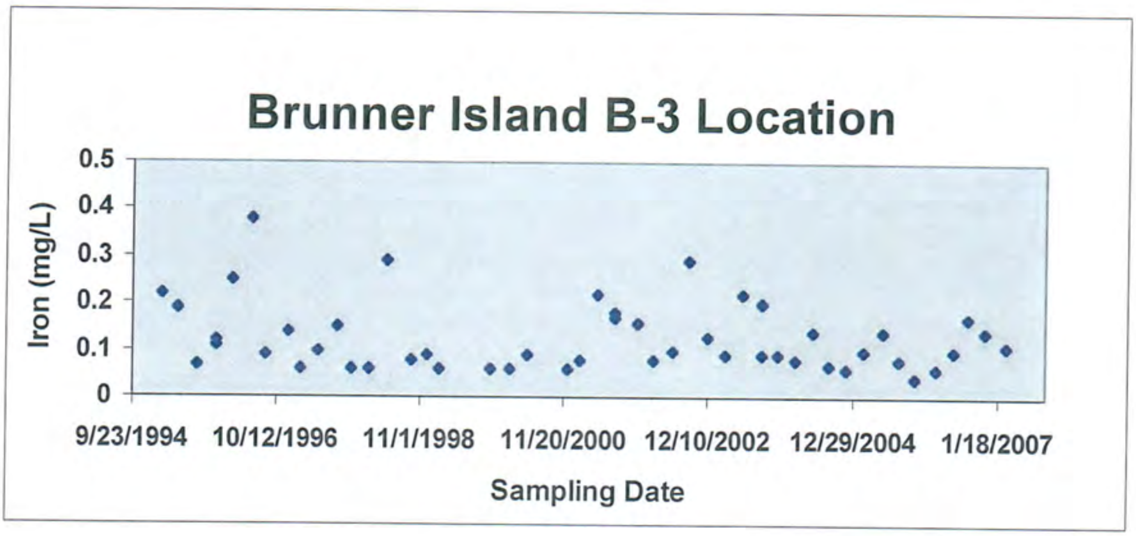

Brunner Island Location H-1
Iron (mg/L)
0.9
0.75
0.6
0.45
0.3
0.15
0
9/23/1994
10/12/1996
11/1/1998
11/20/2000
12/10/2002
12/29/2004
1/18/2007
Sampling Date

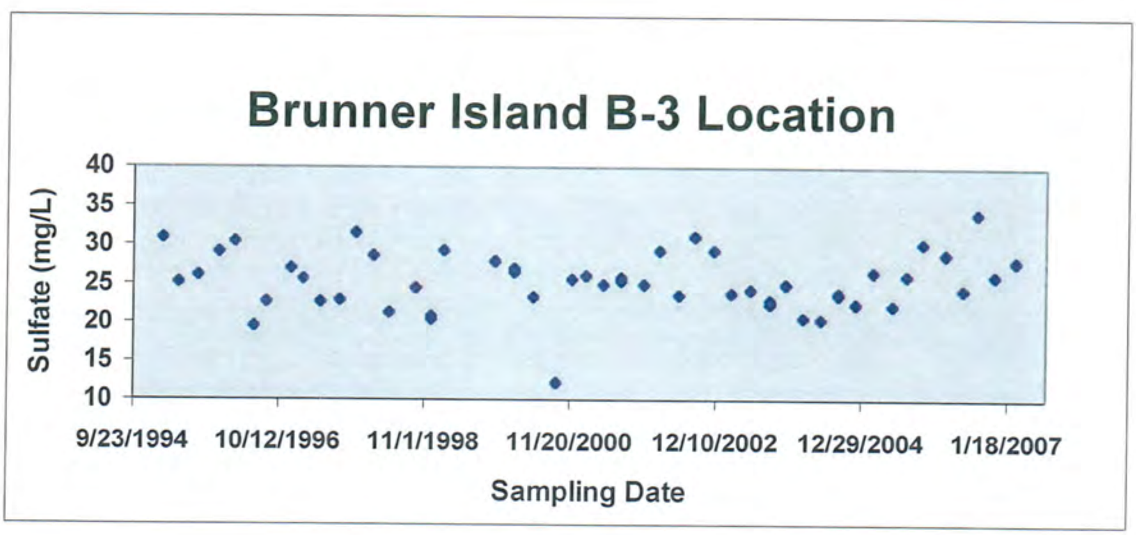

Brunner Island H-1 Location
Sulfate (mg/L)
35
30
25
20
15
10
1/1/1995
1/20/1997
2/9/1999
2/28/2001
3/20/2003
4/8/2005
4/28/2007
Sampling date

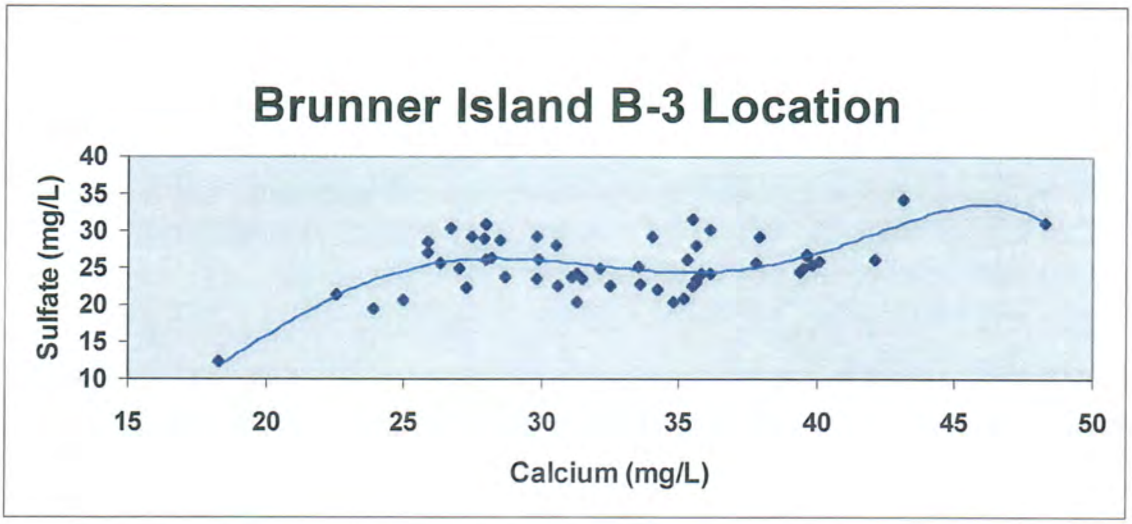

Brunner Island H-1
Sulfate (mg/L)
35
30
25
20
15
10
16
21
26
31
36
41
46
Calcium (mg/L)

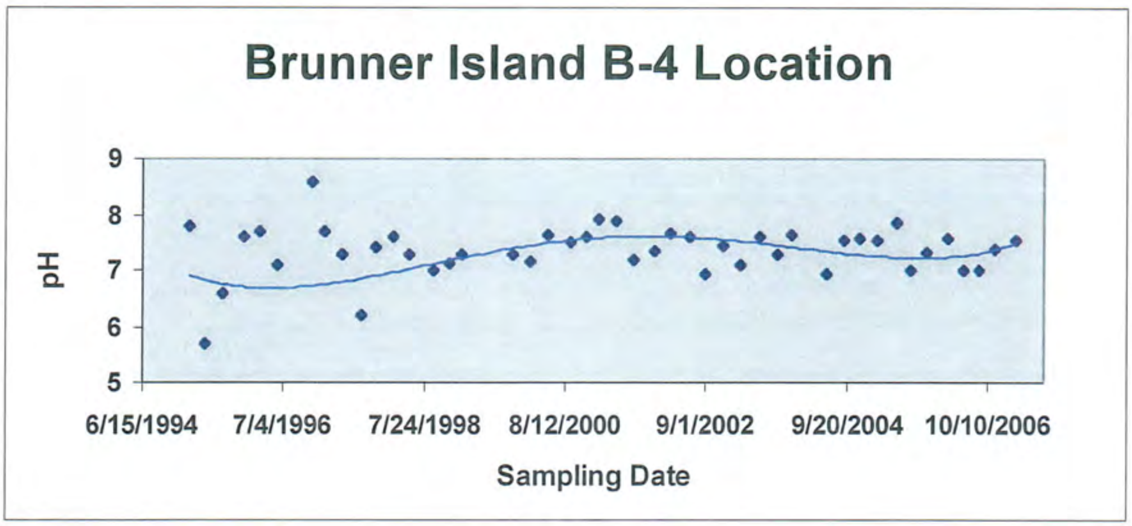

Brunner Island B-3 Location
pH
9
8.5
8
7.5
7
6.5
9/23/1994
10/12/1996
11/1/1998
11/20/2000
12/10/2002
12/29/2004
1/18/2007
Sampling Date

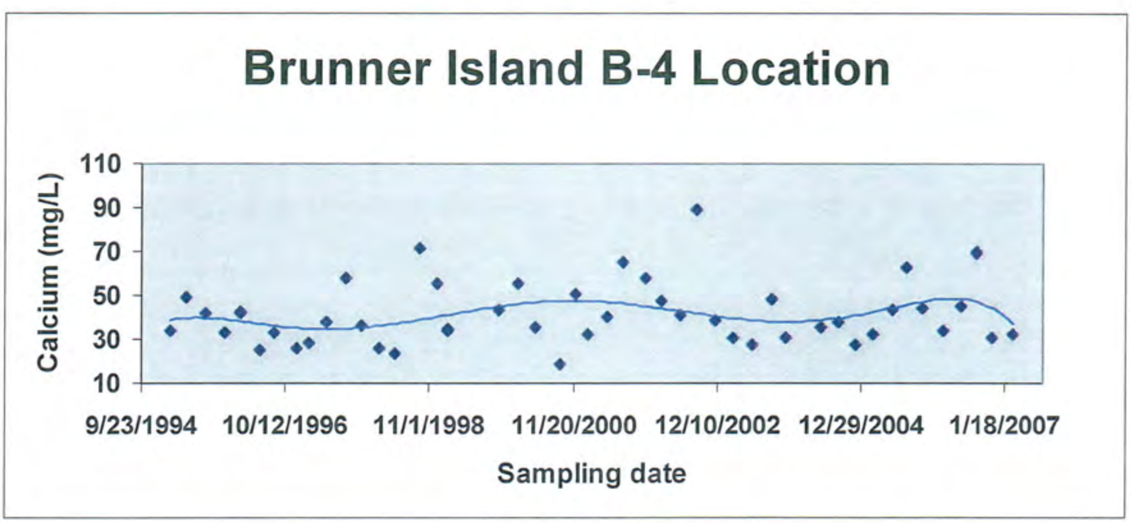

Brunner Island B-3 Location
Calcium (mg/L)
50
43
36
29
22
15
9/23/1994
10/12/1996
11/1/1998
11/20/2000
12/10/2002
12/29/2004
1/18/2007
Sampling Date

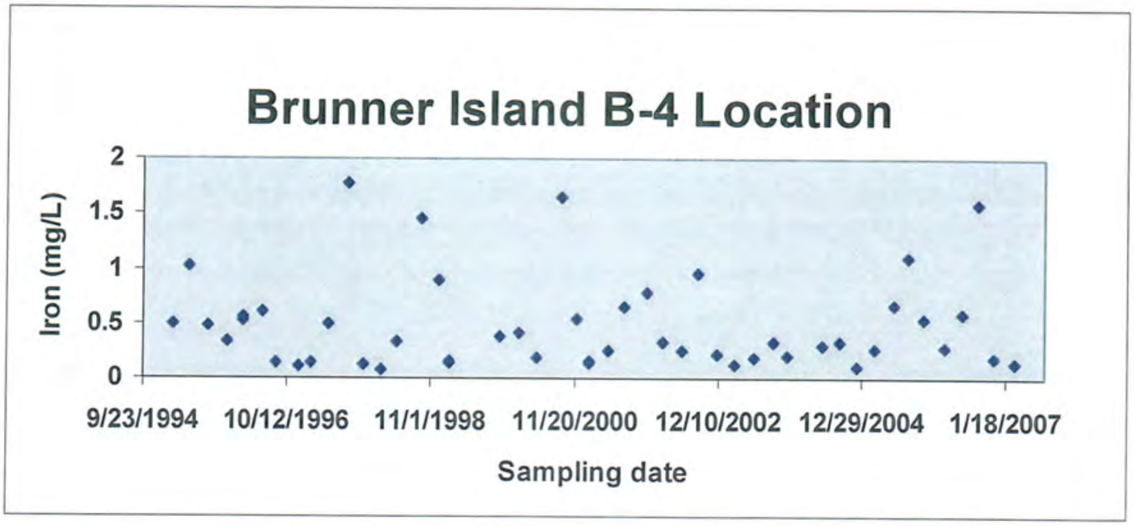

Brunner Island B-3 Location
Iron (mg/L)
0.5
0.4
0.3
0.2
0.1
0
9/23/1994
10/12/1996
11/1/1998
11/20/2000
12/10/2002
12/29/2004
1/18/2007
Sampling Date


Brunner Island B-3 Location
Sulfate (mg/L)
40
35
30
25
20
15
10
9/23/1994
10/12/1996
11/1/1998
11/20/2000
12/10/2002
12/29/2004
1/18/2007
Sampling Date

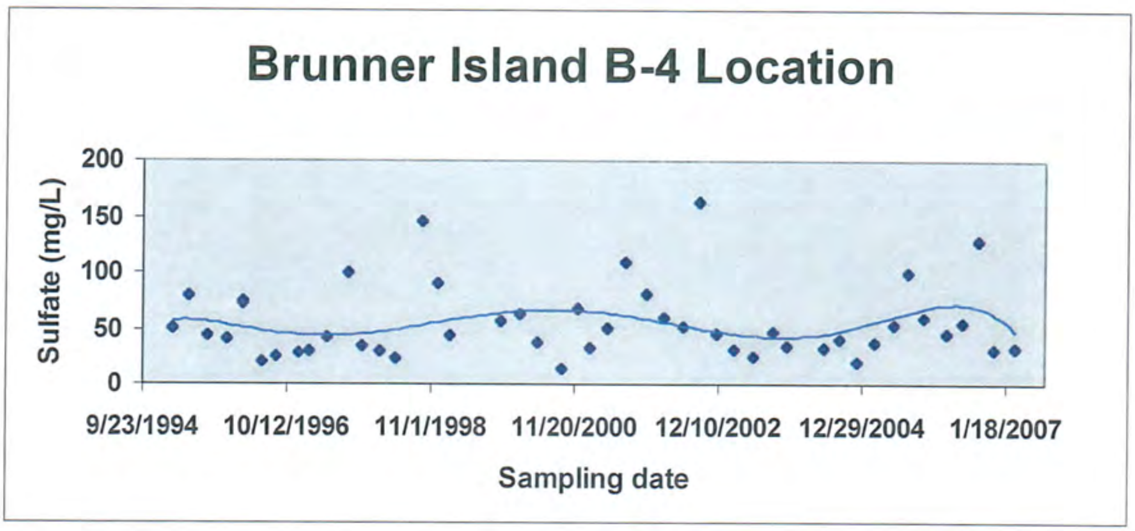

Brunner Island B-3 Location
Sulfate (mg/L)
40
35
30
25
20
15
10
15
20
25
30
35
40
45
50
Calcium (mg/L)


Brunner Island B-4 Location
pH
9
8
7
6
5
6/15/1994
7/4/1996
7/24/1998
8/12/2000
9/1/2002
9/20/2004
10/10/2006
Sampling Date

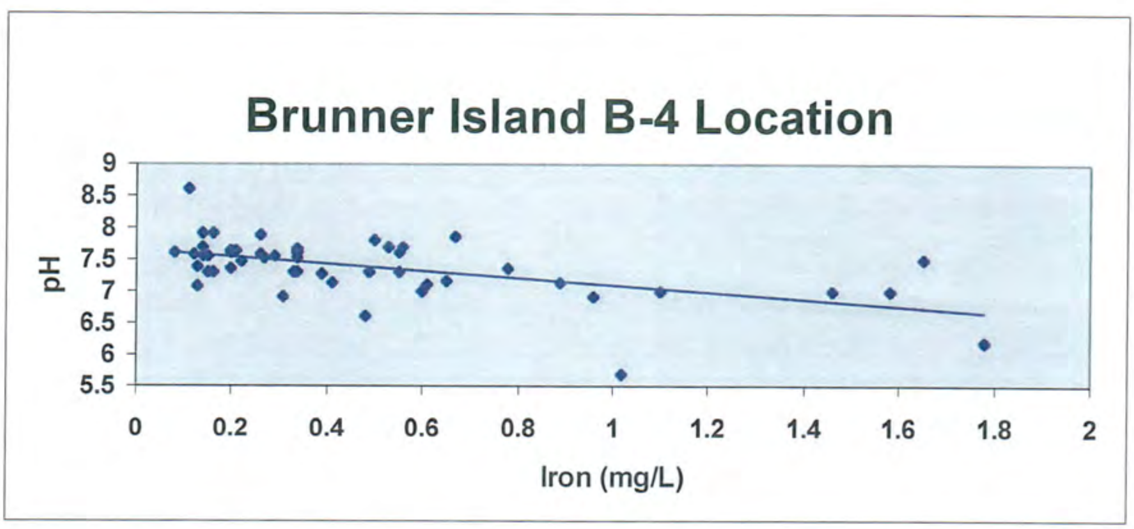

Brunner Island B-4 Location
Calcium (mg/L)
110
90
70
50
30
10
9/23/1994
10/12/1996
11/1/1998
11/20/2000
12/10/2002
12/29/2004
1/18/2007
Sampling date



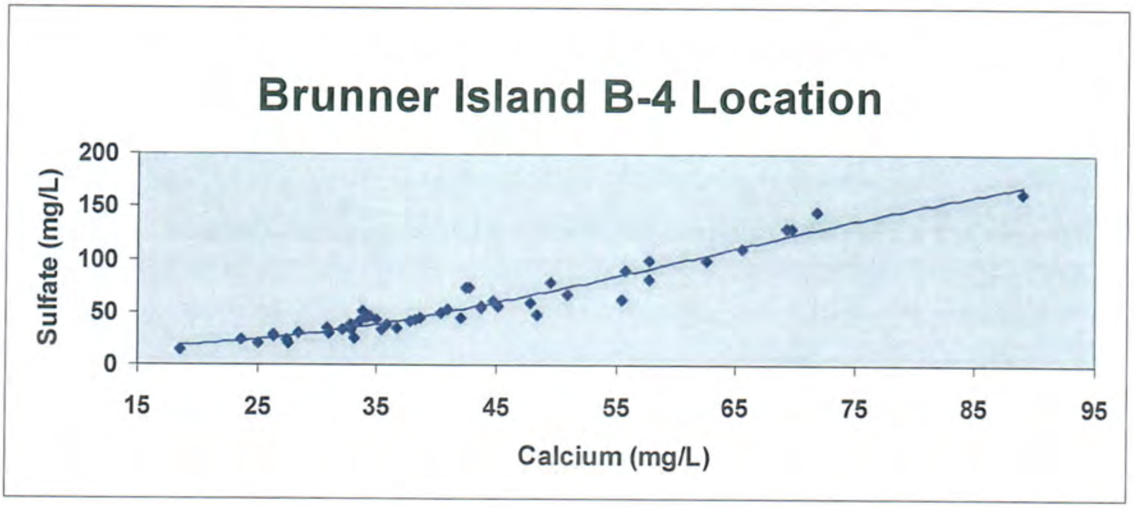
Brunner Island B-4 Location
Iron (mg/L)
2
1.5
1
0.5
0
9/23/1994
10/12/1996
11/1/1998
11/20/2000
12/10/2002
12/29/2004
1/18/2007
Sampling date

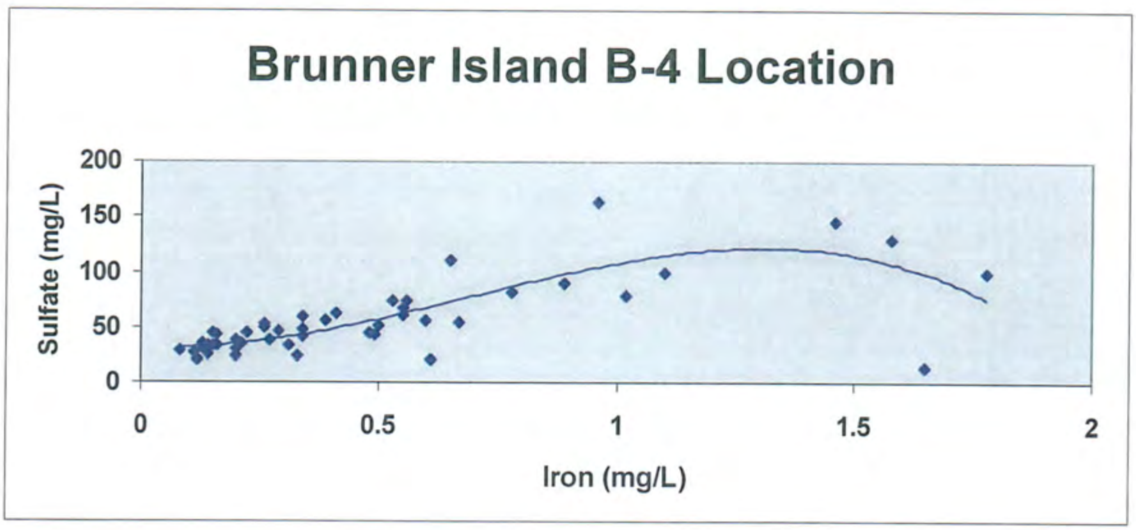


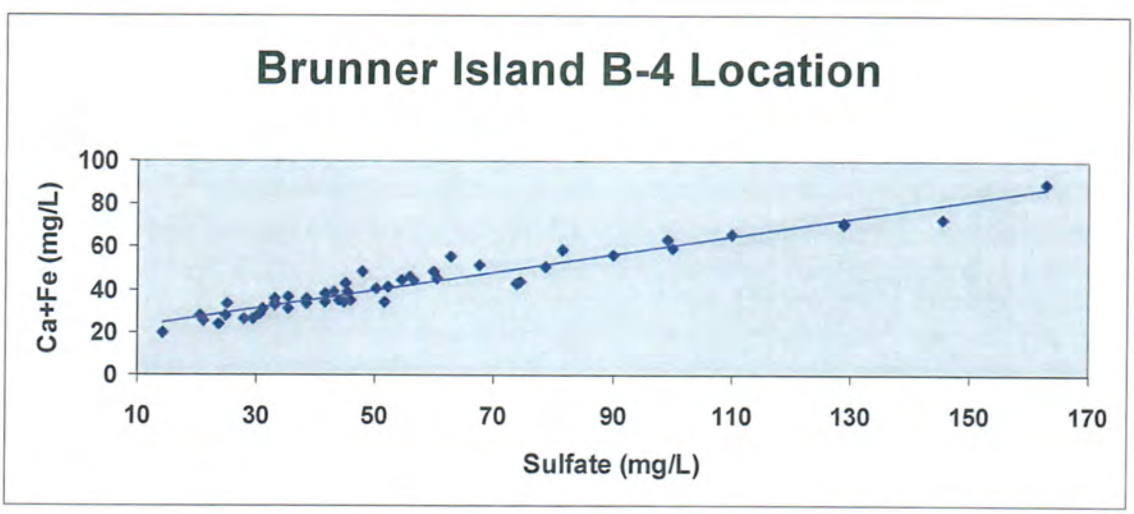
Brunner Island B-4 Location
Sulfate (mg/L)
200
150
100
50
0
9/23/1994
10/12/1996
11/1/1998
11/20/2000
12/10/2002
12/29/2004
1/18/2007
Sampling date

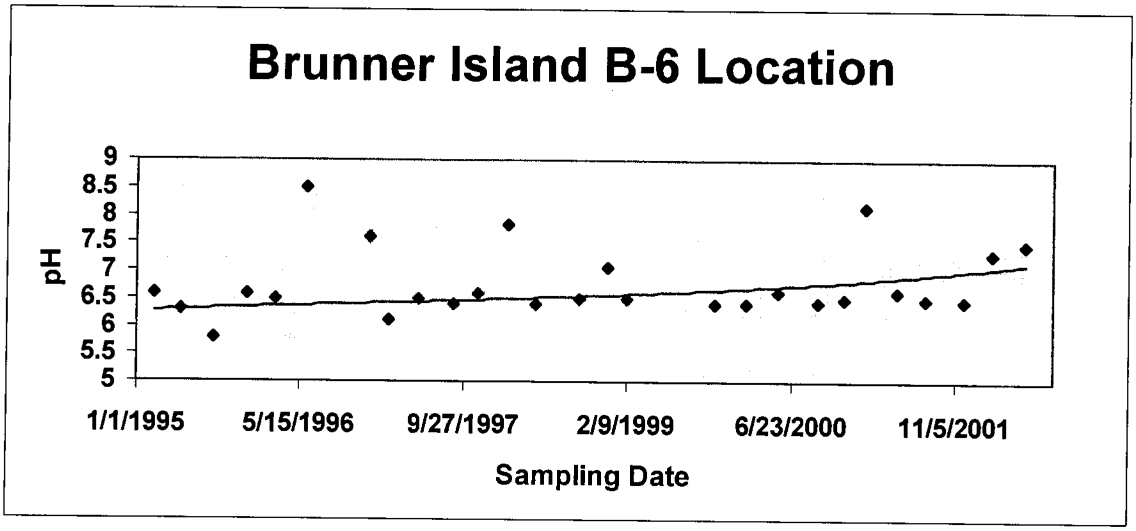


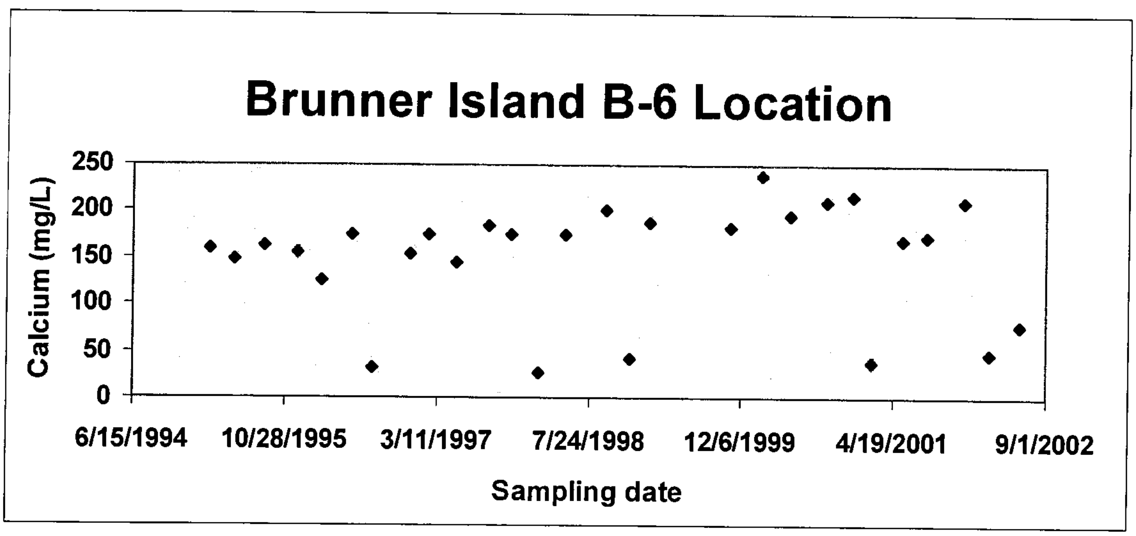
Brunner Island B-4 Location
pH
9
8.5
8
7.5
7
6.5
6
5.5
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Iron (mg/L)

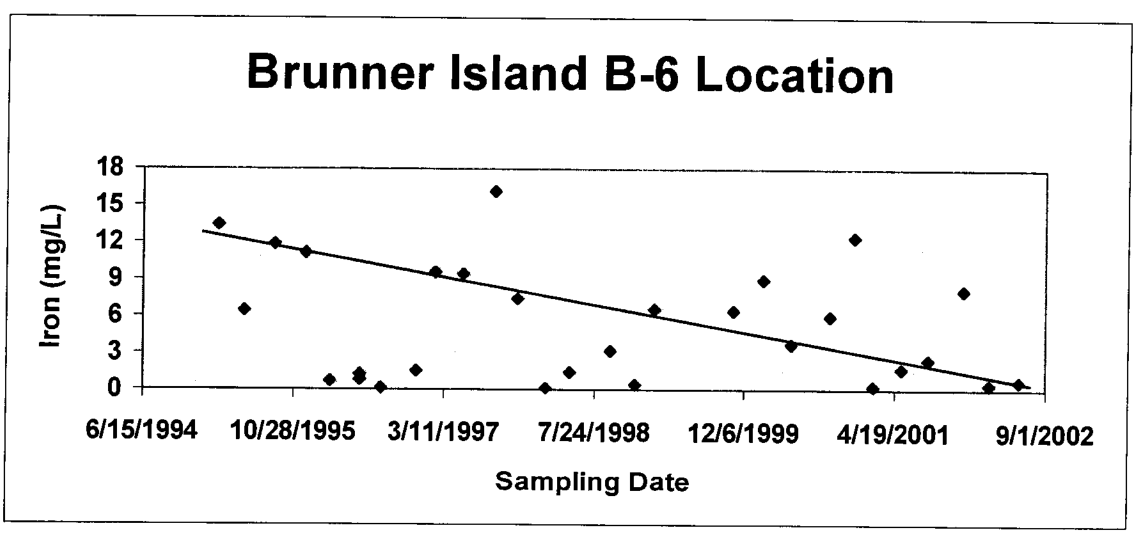

Brunner Island B-4 Location
Sulfate (mg/L)
200
150
100
50
0
15
25
35
45
55
65
75
85
95
Calcium (mg/L)

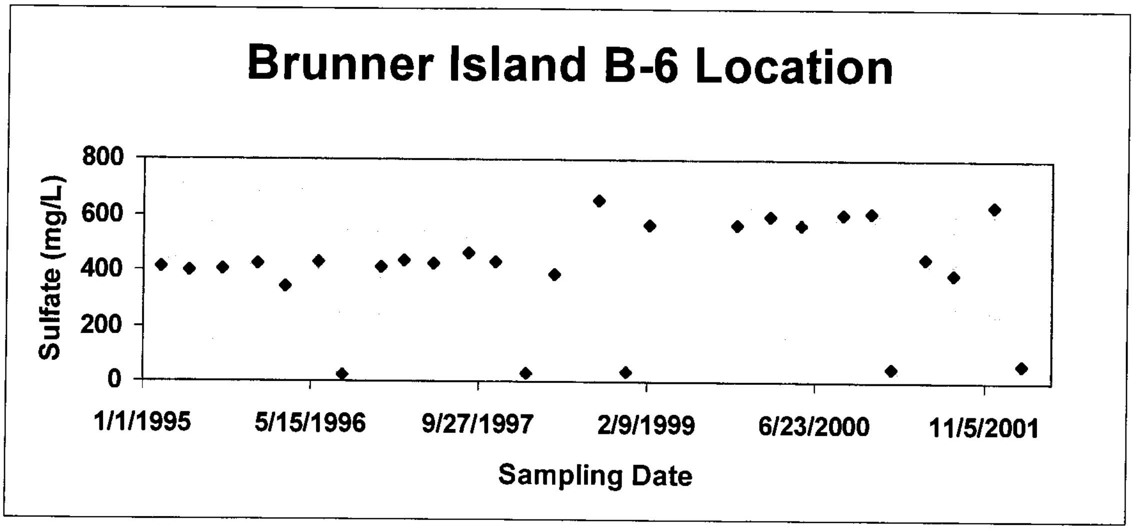

Brunner Island B-4 Location
Sulfate (mg/L)
200
150
100
50
0
0
0.5
1
1.5
2
Iron (mg/L)

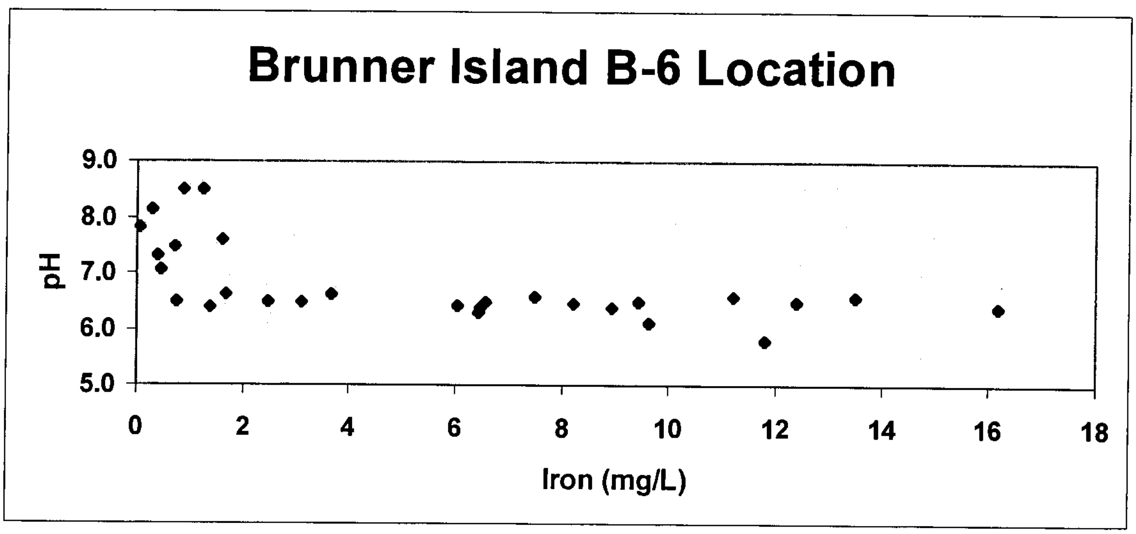

Brunner Island B-4 Location
Ca+Fe (mg/L)
100
80
60
40
20
0
10
30
50
70
90
110
130
150
170
Sulfate (mg/L)

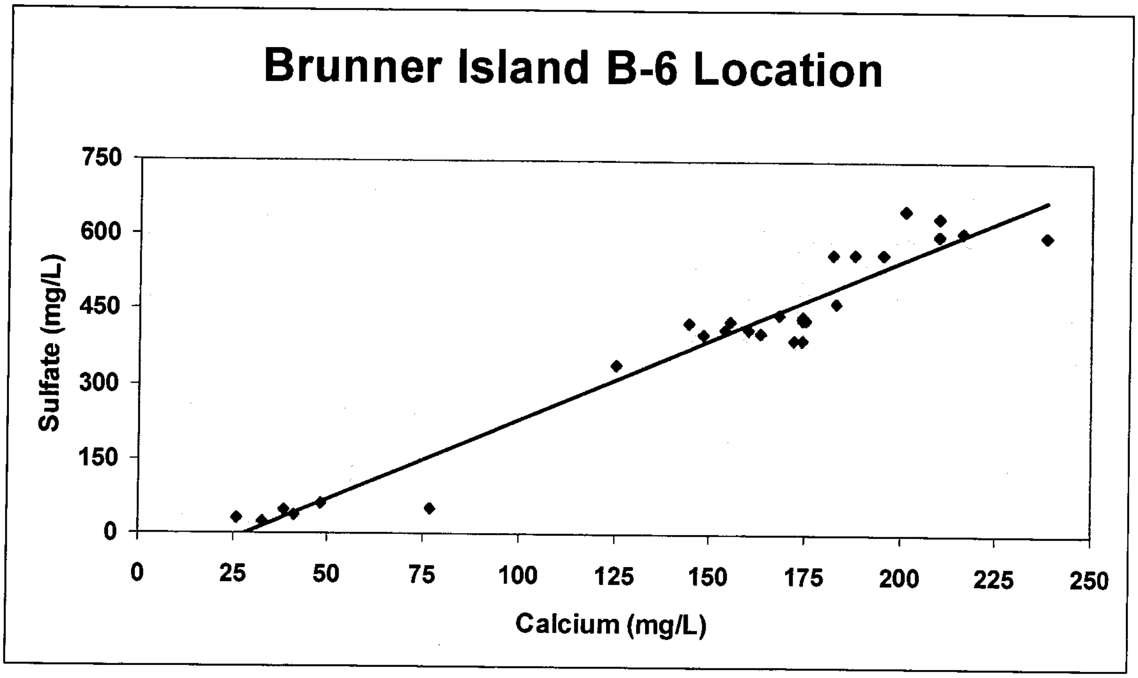

Brunner Island B-6 Location
pH
9
8.5
8
7.5
7
6.5
6
5.5
5
1/1/1995
5/15/1996
9/27/1997
2/9/1999
6/23/2000
11/5/2001
Sampling Date


Brunner Island B-6 Location
Calcium (mg/L)
250
200
150
100
50
0
6/15/1994
10/28/1995
3/11/1997
7/24/1998
12/6/1999
4/19/2001
9/1/2002
Sampling date

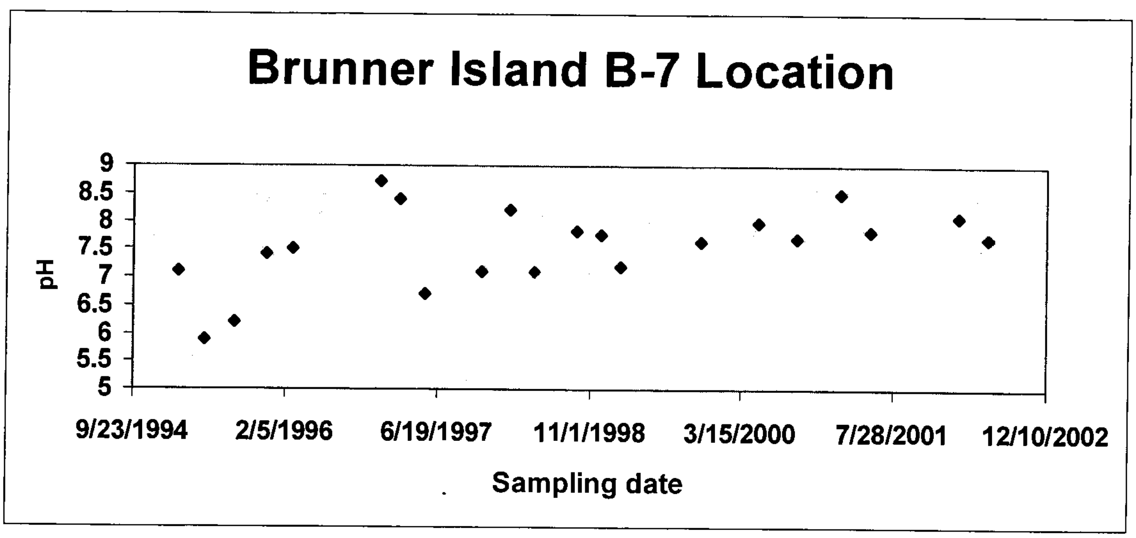

Brunner Island B-6 Location
Iron (mg/L)
18
15
12
9
6
3
0
6/15/1994
10/28/1995
3/11/1997
7/24/1998
12/6/1999
4/19/2001
9/1/2002
Sampling Date


Brunner Island B-6 Location
800
600
400
200
0
Sulfate (mg/L)
1/1/1995
5/15/1996
9/27/1997
2/9/1999
6/23/2000
11/5/2001
Sampling Date

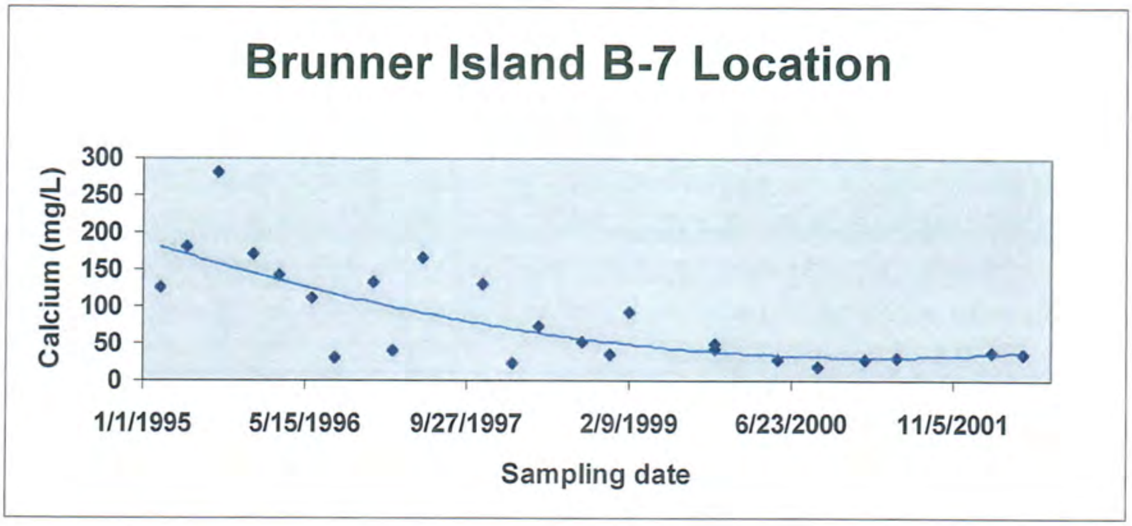

Brunner Island B-6 Location
9.0
8.0
7.0
6.0
5.0
pH
0
2
4
6
8
10
12
14
16
18
Iron (mg/L)

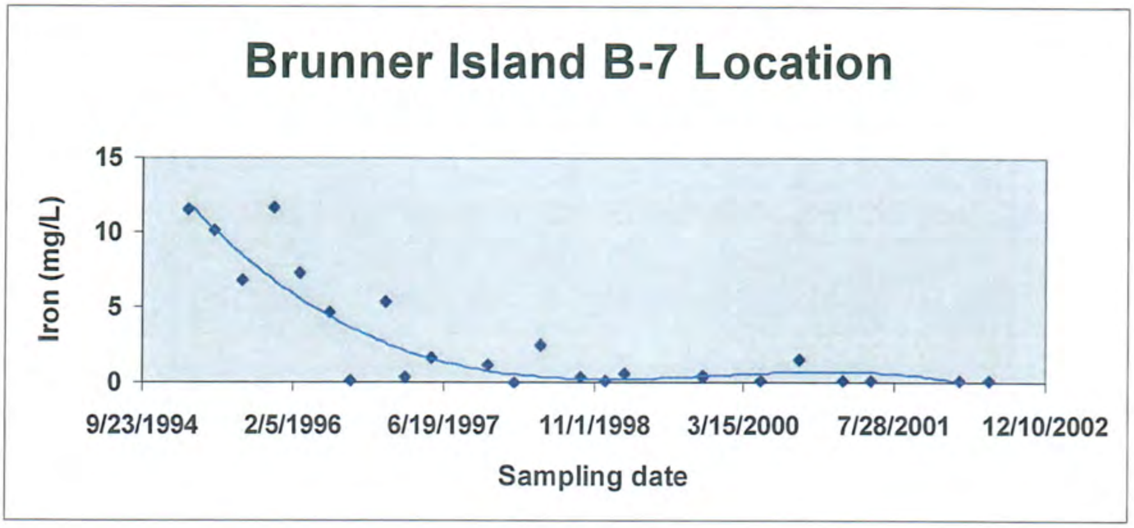


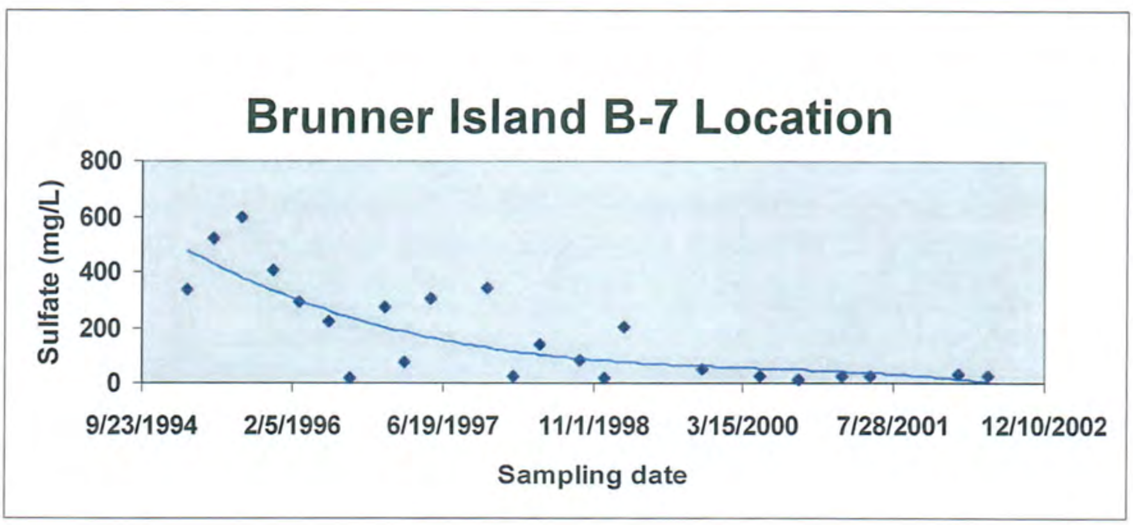
Brunner Island B-6 Location
Sulfate (mg/L)
750
600
450
300
150
0
0
25
50
75
100
125
150
175
200
225
250
Calcium (mg/L)

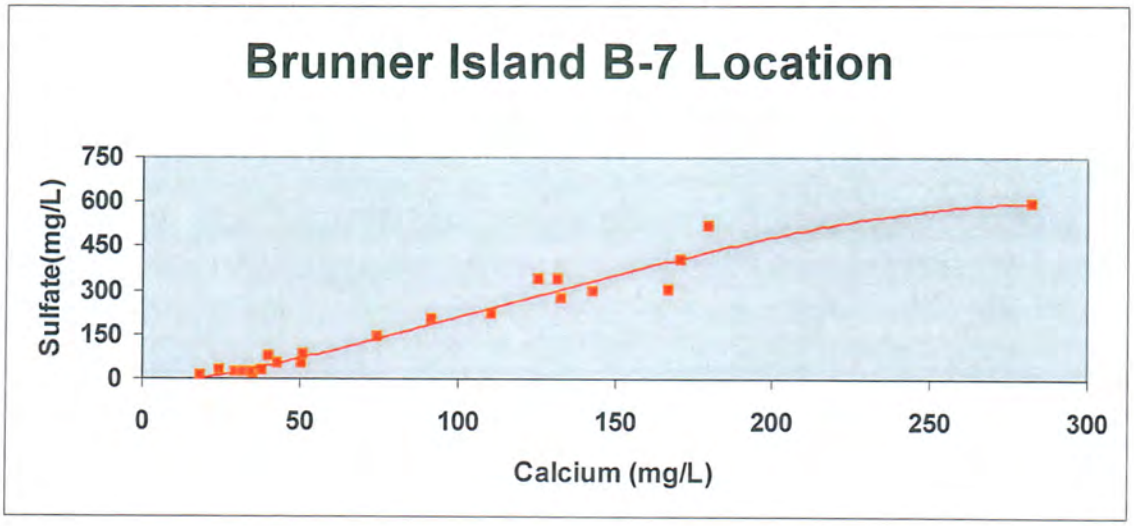


Brunner Island B-7 Location
pH
9
8.5
8
7.5
7
6.5
6
5.5
5
9/23/1994
2/5/1996
6/19/1997
11/1/1998
3/15/2000
7/28/2001
12/10/2002
Sampling date


Brunner Island B-7 Location
Calcium (mg/L)
300
250
200
150
100
50
0
1/1/1995
5/15/1996
9/27/1997
2/9/1999
6/23/2000
11/5/2001
Sampling date


Brunner Island B-7 Location
Iron (mg/L)
15
10
5
0
9/23/1994
2/5/1996
6/19/1997
11/1/1998
3/15/2000
7/28/2001
12/10/2002
Sampling date


Brunner Island B-7 Location
Sulfate (mg/L)
800
600
400
200
0
9/23/1994
2/5/1996
6/19/1997
11/1/1998
3/15/2000
7/28/2001
12/10/2002
Sampling date


Brunner Island B-7 Location
Sulfate(mg/L)
750
600
450
300
150
0
0
50
100
150
200
250
300
Calcium (mg/L)

Andrey Lernerman
Environmental Professional

PPL Generation, LLC
Two North Ninth Street (GENPL6)
Allentown PA 18101-1179
Tel. 610-774-2594
alernerman@pplweb.com

5 ppl 4/pdfs

February 9, 2015

Mr. John Oren
Pennsylvania Department of Environmental Protection
Waste Management Program
909 Elmerton Ave.
Harrisburg, Pennsylvania 17110

DEPT OF ENV PROTECTION
Waste Mgmt Program
FEB 11 2015
909 Elmerton Avenue
Harrisburg PA 17110-8

RE: PPL Brunner Island, LLC
Disposal Area 8 – Liner Anchoring and Leachate Detection Zone Update

Dear Mr. Oren,

On November 11, 2013 PPL completed anchoring of the geosynthetic liner system on the southeast side of Area 8 at Brunner Island. In 2013, field investigations identified that the liner system on southern portion of the east side of Area 8 was not placed in an anchor trench with the edge being exposed. This created a potential for lateral infiltration via run-on from outside the liner limits.

The unanchored liner was exposed and an anchor trench was excavated along the entire length of the unanchored portion. The liner was placed into the trench, backfilled with clay, and compacted. A "rain flap" was also installed on the east side of Area 8. The rain flap was welded to the existing liner and placed over the temporary east berm. The rain flap was installed as a precautionary measure to prevent contact water from laterally leaving the interior of the landfill. For your records, attached please find as-build drawings, a completed Form 19R, and a QAQC picture set complied by D'Huy Engineering.

PPL continues to monitor flow from the leachate detection zone of Area 8. Flows appear to be seasonal beginning in October/ November and ceasing in March/April. Since the completion of the liner anchoring in November 2013 flow appears to have decreased in volume; however, a seasonal pattern is still evident. Water quality of the leachate detection zone liquid remains significantly less impacted by metal constituents as compared to the liquid in the leachate collection zone. A significant contrast in water quality between the leachate detection and leachate collection zone is also exemplified by pH which varies by four units between zones.

PPL began monitoring groundwater elevations around Area 8 in July 2013. Seven piezometer located in the immediate surrounding area of the landfill (see attached location map) are monitored on a monthly basis. Since monitoring began in July 2013, water elevations have remained fairly stable demonstrating a maximum fluctuation of 4ft in PZ-5-2. Groundwater elevations derived from piezometers around Area 8 are compared to the base of the landfill which is determined to be at 280ft as indicated by drawing number E325747 (previously provided to the Department).

The highest water elevation on record, to-date is 279.24ft in P-8-5 recorded on 4/8/2014. Based on the groundwater data gathered since July 2013 a separation of a minimum of 0.76ft exists between the water table and the base of Area 8. It should be noted that P-8-5 is located approximately 680ft south of Area 8 near the recently (2012) closed pyrites tomb. The excavation and backfilling of the pyrites tomb created a small area that more readily infiltrates water compared to the rest of the basin. Water elevation in P-8-5 is likely affected by infiltrating stormwater in the area of the former pyrites tomb, and is not representative of water elevations in the rest of Basin 5. Water level data and graph for all seven piezometers is attached. Based on the evaluation of the piezometer data collected, it can be concluded that it is unlikely that groundwater is infiltrating the landfill and contributing to the flow from the leachate detection zone.

PPL will continue to sample and monitor and evaluate flow from the leachate collection and detection zones. Flow and water chemistry data from this monitoring is submitted to the Department on a quarterly basis via Form 50. If any significant changes to the flows or water quality are observed, PPL will notify the Department and evaluate the need for further actions.

Sincerely

Andrey Lemerman

Andrey Lemerman

Enclosures: Water elevations table, water elevations graph, piezometer location map, Form 19R, QAQC picture set, and as-built drawing set (C1 - C6).

CC:

Kurt Fritz	PADEP (SCRO)
Ajaz Uddin	PADEP (SCRO)
Craig Shamory	PPL (GENPL2)
Thomas Hickes	PPL (BRUPT)
Deb Runkle	PPL (BRUPT)
Larry LaBuz	PPL (GENPL6)