C/007/0019
Task ID #4642
Received 08/12/2014

GENWAL™ RESOURCES, INC.

794 North "C" Canyon Rd,
P.O. Box 910,
East Carbon, Utah 84520
Telephone (435) 888-4000 Fax (435) 888-4002

Daron Haddock
Permit Supervisor
Utah Division of Oil, Gas and Mining
P.O. Box 145801
1594 West North Temple, Suite 1210
Salt Lake City, Utah 84114-5801

August, 11, 2014

Re: Permit Revision
to add Kenilworth PHC
007/019

Dear Mr. Haddock:

As per our conversation this morning please find attached the new PHC covering the Kenilworth Lease.

A C1 and C2 form is included.

Previously a application adding the Kenilworth lease to the permit was filed.

If you have any questions please give me a call.

Sincerely,

R. Jay Marshall

R. Jay Marshall
Resident Agent

Application for Permit Processing
Detailed Schedule of Changes to the MRP

Title of Proposal: Adding Kenilworth PHC to the Permit 14-006	Permit Number: ACT/007/019
	Mine: Centennial Mine
	Permittee: UtahAmerican Energy, Inc.

Provide a detailed listing of all changes to the mining and reclamation plan which will be required as a result of this proposed permit application. Individually list all maps and drawings which are to be added, replaced, or removed from the plan. Include changes of the table of contents, section of the plan, pages, or other information as needed to specifically locate, identify and revise the existing mining and reclamation plan. **Include page, section and drawing numbers as part of the description.**

			DESCRIPTION OF MAP, TEXT, OR MATERIALS TO BE CHANGED
☐ ADD	☐ REPLACE	☐ REMOVE	Kenilworth PHC to end of Appendix L of the approved MRP
☐ ADD	☐ REPLACE	☐ REMOVE	
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Any other specific or special instructions required for insertion of this proposal into the Mining and Reclamation Plan?

APPLICATION FOR PERMIT PROCESSING

Permit Change ☐	New Permit ☐	Renewal ☐	Transfer ☐	Exploration ☐	Bond Release ☐	Permit Number: ACT/007/019
Title of Proposal: Adding Kenilworth PHC to the Permit 14-006						Centennial Coal Mine
						Permittee: UtahAmerican Energy, Inc.

Description, include reason for application and timing required to implement:

Instructions: *If you answer yes to any of the first 8 questions (gray), submit the application to the Salt Lake Office. Otherwise, you may submit it to your reclamation*

☐ Yes	☐ No	1. Change in the size of the Permit Area? ____ acres Disturbed Area? ____ acres decrease.
☐ Yes	☐ No	2. Is the application submitted as a result of a Division Order? DO #
☐ Yes	☐ No	3. Does application include operations outside a previously identified Cumulative Hydrologic Impact Area?
☐ Yes	☐ No	4. Does application include operations in hydrologic basins other than as currently approved?
☐ Yes	☐ No	5. Does application result from cancellation, reduction or increase of insurance or reclamation bond?
☐ Yes	☐ No	6. Does the application require or include public notice/publication?
☐ Yes	☐ No	7. Does the application require or include ownership, control, right-of-entry, or compliance information?
☐ Yes	☐ No	8. Is proposed activity within 100 feet of a public road or cemetery or 300 feet of an occupied dwelling?
☐ Yes	☐ No	9. Is the application submitted as a result of a Violation? NOV #
☐ Yes	☐ No	10. Is the application submitted as a result of other laws or regulations or policies? Explain:
☐ Yes	☐ No	11. Does the application affect the surface landowner or change the post mining land use?
☐ Yes	☐ No	12. Does the application require or include underground design or mine sequence and timing? (Modification of R2P2?)
☐ Yes	☐ No	13. Does the application require or include collection and reporting of any baseline information?
☐ Yes	☐ No	14. Could the application have any effect on wildlife or vegetation outside the current disturbed area?
☐ Yes	☐ No	15. Does application require or include soil removal, storage or placement?
☐ Yes	☐ No	16. Does the application require or include vegetation monitoring, removal or revegetation activities?
☐ Yes	☐ No	17. Does the application require or include construction, modification, or removal of surface facilities?
☐ Yes	☐ No	18. Does the application require or include water monitoring, sediment or drainage control measures?
☐ Yes	☐ No	19. Does the application require or include certified designs, maps, or calculations?
☐ Yes	☐ No	20. Does the application require or include subsidence control or monitoring?
☐ Yes	☐ No	21. Have reclamation costs for bonding been provided for?
☐ Yes	☐ No	22. Does application involve a perennial stream, a stream buffer zone or discharges to a stream?
☐ Yes	☐ No	23. Does the application affect permits issued by other agencies or permits issued to other entities?

X Attach 3 complete copies of the application.

I hereby certify that I am a responsible official of the applicant and that the information contained in this application is true and correct to the best of my information and belief in all respects with the laws of Utah in reference to commitments, undertakings, and obligations, herein.

R. J. Mankiewicz

Signed - Name - Position - Date

Subscribed and sworn to before me this 11th day of August, ~~19~~ 2014

Linda Kerns

Notary Public

My Commission Expires: 3.27.17, ~~19~~

Attest: STATE OF Utah

COUNTY OF Carbon

LINDA KERNS
NOTARY PUBLIC • STATE of UTAH
COMMISSION # 683615
COMM. EXP. 03/27/2017

Received by Oil, Gas & Mining

ASSIGNED TRACKING NUMBER

Baseline Hydrologic Monitoring And Determination of Probable Hydrologic Consequences of Coal Mining in the Kenilworth Addition Area at the Andalex Resources, Inc. Tower Mine, Carbon County, Utah

9 August 2014

Andalex Resources, Inc.
Price, Utah

PETERSEN HYDROLOGIC, LLC
CONSULTANTS IN HYDROGEOLOGY

Baseline Hydrologic Monitoring And Determination of Probable Hydrologic Consequences of Coal Mining in the Kenilworth Addition Area at the Andalex Resources, Inc. Tower Mine, Carbon County, Utah

9 August 2014

Andalex Resources, Inc.
Price, Utah

Prepared by:

Erik C. Petersen, P.G.
Principal Hydrogeologist
Utah P.G. No. 5373615-2250

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1.0 Introduction

The Andalex Resources, Inc. Tower Mine is located in the Book Cliffs coal field, approximately 10 miles east of Price, Utah (Figure 1). Andalex Resources has acquired the coal mining rights on new mining lands within the Kenilworth Addition area (Figure 2), which are contiguous with the existing mine permit area. The Tower Mine (Centennial Project) is unique in that it is among the deepest coal mining operations in the United States, with past mining taking place at depths of up to 3,000 feet below the overlying ground surface.

As required by Utah coal mining rule R645-301.724, each permit application shall include baseline hydrologic information for groundwaters and surface-waters from the proposed permit and adjacent area. Additionally, Utah coal mining rule R645-301-728 specifies that the applicant for a mining permit is required to prepare a determination of the probable hydrologic consequences (PHC) of coal mining prior to the approval of a mine permit application. The PHC determination is based on the baseline hydrologic, geologic, and climatic information and from other pertinent sources information.

This document presents the baseline hydrologic information for the Kenilworth Addition and adjacent area, including seasonal quantity and quality of groundwaters and surface-waters. This document also presents a determination of the probable hydrologic consequences of coal mining in the Kenilworth Addition area. Prior to the performance of the PHC determination presented

here, a site reconnaissance and supplemental hydrologic baseline data collection program was performed during the second quarter of 2014. The PHC determination presented herein is based on an analysis of the available geologic, hydrologic, and hydrogeologic information from the Kenilworth Addition and adjacent area. The information provided in this document is supplemental to the large amount of related information previously submitted to the Division of Oil, Gas and Mining by Andalex Resources, Inc.

Including this introduction, this document contains the following sections

1.0 Introduction
2.0 Methods of Study
3.0 Overview of Mining Operations
4.0 Physiography and Geology
5.0 Presentation of Data
6.0 Climate
7.0 Description of Groundwater and Surface-Water Systems
8.0 Probable Hydrologic Consequences Determination
9.0 References Cited

2.0 Methods of Study

Baseline hydrologic monitoring of groundwaters and surface-waters in the Kenilworth Addition and adjacent areas has been performed in the area for many years by several different entities. Among these entities are the Castle Gate Mine, the RAG Willow Creek Mine, the Andalex Resources, Inc. Tower Mine, Mayo and Associates, LC, and Petersen Hydrologic, LLC. For

this investigation, hydrologic information in the public domain on file with the Utah Division of Oil, Gas and Mining public information center was reviewed and incorporated into this analysis. This included information from previous mining and permitting activities in the surrounding areas, including information from the RAG Willow Creek Mine MRP. Much of this information was obtained from the Utah Division of Oil, Gas and Mining web-site (scanned MRP files available at: http://linux1.ogm.utah.gov/WebStuff/wwwroot/coal/files.html) and also from the Utah Division of Oil, Gas and Mining Utah Coal Mining Water Quality Database (an on-line electronic database of water quality and water quantity data freely available to the public at: http://linux1.ogm.utah.gov/cgibin/appx-ogm.cgi). Other information was obtained directly from Tower Mine personnel. A supplemental site reconnaissance and baseline monitoring program was performed during the second quarter of 2014 in the Kenilworth Addition and adjacent area. The hydrologic information from all sources for the Kenilworth Addition and adjacent area was compiled into an electronic database for analysis.

Hydrologic data were analyzed using graphical and statistical methods. Groundwater mineral saturation indices were calculated using WATEQF (Plummer and others, 1976).

Groundwater samples from the Tower Mine were collected for isotopic analysis. Tritium analyses were performed using electrolytic enrichment and low level counting methods by the Tritium Laboratory, University of Miami, Florida. Radiocarbon analyses used for radiometric dating were performed by Geochron Laboratories of Cambridge, Massachusetts. Solute analyses of groundwater samples collected in conjunction with isotopic sampling were performed by

David Tingey Analytical Consulting of Springville, Utah. Groundwater mean residence times were determined using methods described by Pearson and Hanshaw (1970), Fontes (1980), and Mookes (1980).

3.0 Overview of Mining Operations

The Aberdeen Mine has been in operation since 1990. Coal mining operations at the mine are carried out in the Aberdeen Seam (also known as the Castlegate A Seam) using longwall mining methods. Continuous mining methods are used primarily for development of longwall mining panels. The Tower Mine (Centennial Project) is unique in that it is among the deepest coal mining operations in the United States, with past mining taking place at depths of up to 3,000 feet below the overlying ground surface. Historically, the Tower Mine has experienced difficulties in roof control because of the geologic conditions at the mine. Under such large thicknesses of overburden, the existence of strong, massive sandstone units a few tens of feet above the mined coal seam results in the establishment of rock stresses that are not favorable to longwall-mining operations. Consequently, mining at the Tower Mine is carried out using a barrier–panel longwall design. Using this technique, substantial barriers of undisturbed coal are left between adjacent longwall panels. Because of the support of the unmined coal barriers and the structural strength of the overlying massive sandstone units, subsidence at the land surface is minimal or non-existent. It has been the experience at the Tower Mine that in areas where the overburden exceeds approximately 1,000 feet, no measurable subsidence at the land surface occurs (Tower Mine subsidence data, 2002). Mining in the Kenilworth Addition area will occur

under more than 2,000 feet of cover. Thus, no appreciable subsidence in the Kenilworth Addition area is anticipated.

Historically, the Tower Mine has been relatively dry and has only occasionally discharged water to the surface. As mining has progressed deeper into the mountain, discharges to the surface could possibly become somewhat more frequent. Most groundwater encountered in the mine discharges from sandstone channels in the mine roof. As is typical with other coal mines in the region, these roof drips commonly dry-up rapidly after first being encountered and the total water discharged from individual sandstone channels is not of significant consequence. Seasonal variations in mine-water in-flow rates are not apparent (Personal communication, Mike Glassen, 2002).

4.0 Physiography and Geology

The Kenilworth Addition area is situated in the high plateau region along the upper rim of the Book Cliffs Escarpment. The maximum elevations in the Kenilworth Addition area exceed 8,700 feet along the crest of the Book Cliffs escarpment. The mine surface facilities are located to the south along the base of the escarpment at elevations of about 7,200 feet. The land surface in the Kenilworth Addition area consists of rolling hills and gullies that are vegetated primarily with sagebrush with interspersed stands of quaking aspens. The land surface slopes moderately to the north toward the Emma Park region.

Six Cretaceous- to Tertiary-age bedrock formations crop out in the Kenilworth Addition and adjacent Tower Mine area. These include, in descending order, the Flagstaff Limestone, North Horn Formation, Price River Formation, Castlegate Sandstone, Blackhawk Formation, and the Mancos Shale. These bedrock formations were deposited during transgressions and regressions of the shoreline of the Western Cretaceous Interior Seaway during the Late Cretaceous and Early Tertiary. This ancient shoreline was located along the eastern edge of the tectonically uplifted mountains of the Sevier Orogenic Belt. Sediments eroded from the uplifted mountains were carried toward the seaway by fluvial systems and deposited as terrestrial, shoreline, marine, and interfingered non-marine and marine sedimentary sequences. The surface geology in the Kenilworth Addition area is shown on Plate 21 of the MRP. A geologic map of the Kenilworth Addition area is shown in Figure 3. (Note that in Figure 3 the Flagstaff Limestone and North Horn Formations are mapped as a single unit). The bedrock formations in the Kenilworth Addition and adjacent Tower Mine areas are described below.

Flagstaff Limestone

The Flagstaff Limestone is a freshwater limestone that contains some marls and thin sandstone stringers. Groundwater movement in the Flagstaff Limestone generally occurs in fractures or along bedding planes. Due to the low primary porosity, the groundwater storage potential of the Flagstaff Limestone is small. Consequently, springs in the Flagstaff Limestone commonly discharge only briefly in response to the annual snowmelt event and these springs dry-out rapidly after the winter snowpack diminishes. During dry years, springs in the Flagstaff Limestone may not discharge at any time during the year.

North Horn Formation

The North Horn Formation consists predominantly of shale with lesser amounts of sandstone, limestone, and conglomerate. Sandstone paleochannels exist throughout the formation. The sandstone channels are isolated vertically and horizontally by mudstone deposits and lacustrian clays that are common throughout the formation. The North Horn Formation contains hydrophyllic clays that swell when wetted. Where exposed at the surface, it commonly forms slopes. In the vicinity of the Tower Mine permit area, the North Horn Formation is approximately 600 feet thick. The Flagstaff Limestone and the North Horn Formation are exposed at the surface over most of the Kenilworth Addition area.

Price River Formation

The Price River Formation consists of two or more thick sandstone layers interbedded with subordinate shale and sandy shale. The formation commonly forms a moderately steep ledge and slope hillside above the precipitous cliffs of the underlying Castlegate Sandstone. Within the Kenilworth Addition area, the Price River Formation is exposed at the surface where rocks of the overlying Flagstaff Limestone and North Horn Formation have been removed by erosion along the Mathis Canyon and Dry Canyon drainages (Figure 3).

Castlegate Sandstone

The Castlegate Sandstone consists of predominantly coarse-grained sandstone with occasional siltstone and claystone interbeds. The sandstone was deposited in a fluvial system and the lenticular sandstone channels are varied in size and interpenetrate. Although the primary porosity is high, the existence of mudstone drapes and pervasive carbonate and silica cement

greatly reduces the ability of the formation to transmit water. The Castlegate Sandstone forms a prominent cliff above the underlying Blackhawk Formation where it is exposed at the surface. Within the Kenilworth Addition area the Castlegate does not crop out at the surface.

Blackhawk Formation

The Blackhawk Formation consists of interbedded sandstone, mudstone, claystone, and coal. In the vicinity of the Tower Mine, the massive Aberdeen Sandstone is present at the base of the formation. The Aberdeen Seam (Castlegate A Seam), in which mine workings at the Tower Mine are present, is present immediately above this sandstone. The massive Kenilworth Sandstone is present approximately 75 feet above the Aberdeen Seam. Sandstone Paleochannels (sinusoidal fluvial sandstones interpenetrating with the surrounding fine-grained rocks) are present in the Blackhawk Formation. The Blackhawk Formation is approximately 1,000 feet thick in the vicinity of the Tower Mine.

Mancos Shale

The Mancos Shale is over 4,000 feet thick and underlies vast portions of the Colorado Plateau. The low-permeability marine shale unit is carbonaceous, gypsiferous, and slightly calcareous. Because of the low permeability of the shale rocks, the migration of appreciable amounts of groundwater through the formation generally does not occur in the region. Thus, the formation usually acts as a barrier to groundwater flow. Because of the pervasive presence of soluble minerals in the marine shale unit, groundwaters that do come into contact with the Mancos Shale or Mancos Shale-derived sediments generally acquire elevated concentrations of dissolved salts (high TDS).

Structure

Rock strata in the Tower Mine and Kenilworth Addition area dip to the northeast at approximately 6º. Consequently, the overburden overlying the mineable coal seams in the region generally increases as the distance from the Book Cliffs escarpment increases in the northeast direction. No appreciable faulting has been identified within the Tower Mine permit area.

5.0 Presentation of Data

Baseline hydrologic monitoring sites in the Kenilworth Addition and adjacent area are shown on Figure 2. Baseline monitoring site details are presented in Table 1. Springs and seeps identified in the Kenilworth Addition and adjacent area are shown on Figure 2. Surface water drainage divides are also shown on Figure 2. Information on the identified seeps and springs, including locations, geologic occurrence, and use are also presented in Table 1. Baseline hydrologic information for groundwaters and surface-waters in the Kenilworth Addition and adjacent area, including information on seasonal water quantity and quality, are presented in Table 2. Climatic information for the region, as reflected by the Palmer Hydrologic Drought Index, is presented as a plot of the PHDI for Utah Region 6 in Figure 4. Supplemental isotopic information for groundwaters and surface-waters, including stable deuterium, oxygen-18, and carbon-13 ratios, and tritium and carbon-14 age dating information, is provided in Table 3

(including public information obtained from the Willow Creek Mine MRP). Radiocarbon mean residence times ("ages") of groundwaters in the Tower Mine are also presented in Table 3.

Laboratory reporting sheets for the groundwater and surface-water samples collected during the 2nd quarter 2014 baseline monitoring activities are provided in the Appendix.

6.0 Climate

Average precipitation at the Tower Mine portal area averages approximately 11 inches. Precipitation in the highest portions of the permit area, including the Kenilworth Addition area, may be up to approximately 15 inches per year. Average monthly temperatures at the mine range from about 20 ºF in January to 70 ºF in July and August (Andalex Resources, 1995).

Climatic conditions in the vicinity of the Tower Mine have varied significantly during the past several decades. This is illustrated in a plot of the Palmer Hydrologic Drought Index (PHDI) for Utah Region 6 (Figure 4). The PHDI is a monthly value generated by the National Climatic Data Center that indicates wet and dry spells. The PHDI is calculated from several hydrologic parameters including precipitation, temperature, evapotranspiration, soil water recharge, soil water loss, and runoff. Consequently, it is a useful tool for evaluating the relationship between climate and groundwater and surface water discharge data. It is apparent from Figure 4 that during the period from 1980 to 2014, the region has experienced alternating periods of wetness and drought. Notable periods of extreme wetness occurred during 1983-1984, 1997-1998, 2004-

2005, and 2011. Notable periods of drought occurred during 1988-1993, 2000-2004, and 2012 to the present. Alternating periods of wetness and drought of shorter durations have also been observed. It is interesting to note that periods of near-normal wetness (PHDI values of -1 to 1) have been relatively infrequent.

7.0 Description of Surface-Water and Groundwater Systems

Surface-water drainage patterns in the Kenilworth Addition and adjacent area are shown in Figure 2. Surface waters in the Kenilworth Addition area drain into the Willow Creek drainage through the Dry Creek, Mathis Creek, Antone Creek, Deep Creek, and Summit Creek sub-drainages. Surface waters to the south of the Kenilworth Addition area drain southward down the precipitous slopes of the Book Cliffs escarpment through a series of sub-drainages which ultimately flow into the Price River. Discharge rates in the mountain streams peak during the springtime runoff event and wane during the summer months as the melt of the winter snowpack is completed (Table 2). It is common for high flows to occur in mountain streams regionally in response to periodic torrential precipitation events that produce large amounts of surface runoff during the summertime monsoon season.

Groundwater naturally discharges from the Flagstaff Limestone/ North Horn Formation, and from the Price River Formation in the Kenilworth Addition area. Seeps and springs in the Kenilworth Addition area show rapid responses to both season and climate, suggesting short flowpaths and shallow circulation depths. It is not uncommon for many springs to cease flowing

during the late summer or fall season, particularly during drought conditions (Table 2). The groundwater systems that support the seeps and springs in the Kenilworth Addition and adjacent area exist primarily in shallow alluvial and colluvial deposits and likely in the shallow bedrock underlying these deposits. The shallow nature of these groundwater systems is largely because the abundant shale and mudstone horizons in the North Horn and Price River Formations effectively prohibit the downward migration of appreciable quantities of groundwater into underlying deeper horizons. The fact that seeps in the Kenilworth Addition area commonly cease flowing during the summer and fall months indicates that the groundwater travel time from recharge area to discharge area in these groundwater systems is likely less than one year. This also suggests that groundwater recharge locations are situated near the groundwater recharge areas (i.e., there is no regional type aquifer supporting these seeps and springs). Because shallow alluvial and colluvial groundwater systems are constrained by local surface topography, recharge and discharge areas for these systems generally must occur within the local surface-water sub-drainage in which the seep or spring is located.

Tritium and radiocarbon analysis (Table 3) was performed on three springs from the Kenilworth Addition and adjacent area (B341 and B262 from the North Horn/Flagstaff, B41 from the Price River Formation). The tritium contents from these groundwaters ranged from 8.17 to 19.6 TU, clearly indicating a substantial modern recharge component for these groundwaters. The carbon-14 compositions of these waters ranged from 55.85 to 101.2 pmC, indicating a modern radiocarbon age for these waters.

Both groundwaters and surface waters in the Kenilworth Addition area are of the calcium-bicarbonate or calcium-magnesium-bicarbonate type, with average TDS concentrations of 325 and 335 mg/l, respectively (Table 2). This solute composition is consistent with the dissolution of carbonate minerals in the presence of soil-zone CO_2 gas. Elevated concentrations of chloride, sulfate, and sodium, which commonly occur in groundwaters that circulate deeply through rocks of marine origin in the western United States, are not observed in the groundwaters or surface waters data for the Kenilworth Addition area (Table 2). This suggests that groundwater circulation depths in the systems that support these springs are not deep.

In contrast to the shallow groundwater systems that support springs and seeps and provide baseflow to streams in the region, the Blackhawk Formation groundwater systems encountered in the Tower Mine workings do not have good hydraulic communication with shallow, active recharge sources. This is evidenced by the lack of seasonal discharge variability and the short durations of in-mine groundwater inflows. Groundwaters sampled in the Tower Mine have mean residence times from 13,000 to 15,000 years (Table 3). Tritium contents, which indicate whether groundwater has received recharge in the past approximately 50 years, are near the lower laboratory detection limits using low-level detection methods (Table 3). The lack of hydraulic communication between the inactive groundwater systems encountered in the mine and shallow, near-surface recharge sources is primarily the result of heterogeneity of the rock sequence in the mine area. Although lenticular rock bodies that have the potential to transmit water exist in the Blackhawk and overlying formations (i.e. aquifer-quality sandstones), these lenticular rock bodies are of limited extent and are encased both vertically and horizontally in low-permeability fine-grained rocks. Thus, the potential for groundwater migration through these rocks, both

vertically and horizontally, is limited. Groundwater in the mine environment commonly occurs in vertically and horizontally isolated, perched groundwater systems.

8.0 Probable Hydrologic Consequences Determination

728.100, 728.200 Quality and quantity of surface water and groundwater under seasonal flow conditions and baseline hydrologic information

Water quality and discharge data for seeps, springs, and streams in the Kenilworth Addition and adjacent areas are presented in Table 2. Both groundwater discharges and surface-water flows respond rapidly to climate and season. Both groundwaters discharging from springs and surface waters flowing in streams in the Kenilworth Addition and adjacent area are of the calcium-bicarbonate or calcium-magnesium-bicarbonate type (Table 2).

The average TDS concentration of groundwaters discharging from springs and seeps in the area is 325 mg/L (Table 2). The average TDS concentrations for all springs and seeps in the area ranged from 160 to 394 mg/L. TDS concentrations at surface water monitoring stations are similar, ranging from 309 mg/L to 398 mg/L, averaging 335 mg/L.

The average specific conductance value for springs in the Kenilworth Addition and adjacent area is 585 uS/cm, ranging from a low of 499 uS/cm to a high of 689 uS/cm. The average specific conductance for surface water monitoring stations is very similar to that for springs at 572

uS/cm. The average specific conductance for surface water monitoring stations ranges from a low of 540 uS/cm to a high of 679 uS/cm.

Average pH values for springs in the Kenilworth Addition area are near neutral to slightly alkaline, ranging from 7.48 to 8.12 and averaging 7.84. For surface waters, the average pH is more alkaline than is the groundwater, ranging from 8.17 to 8.46, averaging 8.34.

Total suspended solids concentrations in surface waters at the Kenilworth Addition area show considerable variability (Table 2). Commonly, the greatest suspended solids concentrations occur during periods of high flow when stream velocities are greatest and erosion from high surface flows is occurring, with lower concentrations during the low-flow season (Table 2).

Average discharge temperatures at spring monitoring stations ranged from 5.6 to 13.9 degrees C, averaging 9.0 degrees C. The considerable variability in these measurements is likely due to the low-flows commonly present at many spring and seep monitoring sites. Spring water temperatures are readily influenced by ambient air temperatures, particularly when the flow rates are low (i.e. stagnant conditions). Average discharge temperatures at surface-water monitoring sites ranged from 9.1 to 14.2 degrees C, averaging 11.6 degrees C.

728.310 Whether adverse impacts may occur to the hydrologic balance

The likelihood of adverse impacts occurring to the hydrologic balance as a result of Coal mining and reclamation activities in the Kenilworth Addition area is considered low. As discussed previously, groundwater encountered in the mine workings occurs under isolated, perched

conditions. This groundwater is not in hydraulic communication with the shallow bedrock and alluvial groundwater systems from which groundwater seepage to seeps and springs in the Kenilworth Addition area occurs. Thus, the interception of the ancient, perched groundwater in the mine should not impact the overlying shallow groundwater systems in the Kenilworth Addition or surrounding areas.

In the general sense, subsidence above mining areas at longwall mining operations has the potential to alter pre-mining groundwater flow characteristics. For several reasons, the potential for this impact to affect groundwater and surface-water resources in the Kenilworth Addition area is minimal. The United States Mine Safety and Health Administration (MSHA 2009) describes zones of disturbance of geologic strata over mine workings (Figure 5). These zones include:

- Floor heave – Upward thrust of the floor in the mine working area.
- Caved zone – Caving of the overburden directly over a mine void and bulking of the caved material leading to support of overlying strata generally extending to a height of 3 to 10 times the extraction thickness. Assuming an extraction thickness of 10 feet, the caved zone would extend from 30 to 100 feet above the mining interval.
- Fractured zone – A zone of vertical fracturing and bed separations. Overburden in this zone moves vertically in large blocks along existing joints and new vertical fractures. Typically this zone extends no more than 24 times the extraction thickness above the mine, but can reach 30 times the extraction thickness. Assuming an extraction thickness

of 10 feet, the Fractured zone would be anticipated to extend no more than 240 feet above the mine, possibly reaching 300 feet above the mine level.

- Main roof – This zone, which is sometimes subdivided into the Dilated Zone and the Constrained Zone, is an area of no significant increase in vertical hydraulic conductivity. This zone has been characterized as extending above the Fractured Zone up to 60 times the extraction thickness. Assuming a coal extraction thickness of 10 feet, the Main roof zone would extend for 600 feet above the mine level.

- Surface zone – Surface cracks are typically present in this zone and are generally limited to areas placed in tension by subsidence. Cracks can be created in dry clayey soil and joints can open in massive sandstones. Such cracks can extend downward to a depth of 50 feet.

Similarly, the Society for Mining, Metallurgy, and Exploration (SME, 2011) has developed empirical relationships between the thickness of the extracted coal seam and the upward fracture propagation distances (see SME Chapter 10.6, "Mine Subsidence"). Utilizing these relationships, the Mining Engineers Handbook recommends that a minimum vertical distance between the mine and an overlying water body with the potential for causing *catastrophic damage* should be a minimum of 60 times the coal mining height. The same minimum vertical separation distance is recommended for protection of aquifers overlying total extraction mining areas.

Overburden thicknesses in mining areas at the Kenilworth Addition area are large (<2,000 feet). Because of this large overburden thickness, a thickness of relatively unfractured, low-permeability bedrock that is more than 1,000 feet thick will be present in the interval between the base of a potential near-surface cracking zone and the uppermost extent of the upwardly propagating fractured zone above longwall mining areas. The presence of such a thick zone of unfractured, low-permeability bedrock prevents the downward migration of active-zone groundwaters into the deeper subsurface. Hydrophilic swelling clays are present in the fine-grained lithologies within the overburden. Sealing of subsidence cracks by clays in the Blackhawk is expected to minimize long term effects of subsidence on the hydrologic system (UDOGM, 1996). For these reasons, subsidence-related impacts to shallow groundwater systems that support springs and provide baseflow to streams in the Kenilworth Addition area are not anticipated.

Where tension cracks at the surface do form, they can temporarily divert shallow, active-zone groundwaters and cause minor changes to groundwater discharge locations. Spring discharge locations could be moved a short distance down gradient as a result of groundwater flow path alterations. However, as discussed previously, because of the barrier-pillar longwall design utilized at the Tower Mine, the thickness of the overburden (>2,000 feet), and because of the presence of strong, massive sandstone units overlying the coal seams to be mined, appreciable subsidence of the overlying land surface as a consequence of proposed mining activities in the Kenilworth Addition area is not anticipated. Therefore, the potential for surface cracking to impact shallow groundwater systems is considered very low. For the same reasons, the potential

for surface-cracking to impact surface water channels overlying longwall mined areas is considered low.

728.320 Whether acid-forming or toxic-forming materials are present that could result in the contamination of surface-water or groundwater supplies

It is anticipated that the rocks in the Kenilworth Addition area will have acid- and toxic-forming potential similar to that in the rocks in the immediately adjacent existing Tower Mine permit area. No new topsoil or waste rock piles are planned as a consequence of mining in the Kenilworth Addition area. Historically, no contamination of surface-water or groundwater supplies has occurred at the Tower Mine as a result of the presence of acid-forming or toxic-forming materials. Consequently, no adverse impacts are anticipated as a result of mining in the Kenilworth Addition area.

Although iron-sulfide minerals such as iron pyrite are known to exist in the Book Cliffs and Wasatch Plateau coal fields, these materials typically do not cause contamination of surface-water or groundwater supplies. The oxidation of sulfide minerals, when exposed to water and air, releases H^+ ions (acid), which temporarily decreases the pH of the water. However, acid produced from this reaction is rapidly consumed through reactions with carbonate minerals that are pervasive in the rocks of the Utah coal district. Thus, acid mine discharge does not occur. The dissolved iron in the water is rapidly precipitated as iron-hydroxides as the water encounters oxygen (Hem, 1985). Consequently, while pools of water impounded in sulfide-rich underground mine workings can potentially have elevated iron concentrations and lowered pH

levels in-situ as a result of pyrite oxidation, such geochemical conditions are not stable in the oxygen-rich, carbonate-rich surface environment, and thus contamination of groundwater or surface-water supplies does not occur (i.e. the water is oxygenated and iron is rapidly removed by mineral precipitation reactions and the pH typically becomes neutral to moderately alkaline after interacting with carbonate minerals).

Historically, significant impacts to groundwater and surface-water supplies at the Tower Mine have not been observed. The potential for contamination of surface-water or groundwater supplies as a result of interaction with acid-forming or toxic-forming materials in the Kenilworth Addition area is considered to be low.

728.331 What impact the proposed coal mining and reclamation operation will have on sediment yield from the disturbed areas

No appreciable subsidence of the land surface overlying mining areas is anticipated as a result of the proposed mining and reclamation activities in the Kenilworth Addition area. No new surface disturbances are planned in conjunction with the mining of the Kenilworth Addition area. Thus the potential for sediment yield from disturbed areas is considered negligible.

728.332 What impact the proposed coal mining and reclamation operation will have on acidity, total suspended and dissolved solids and other important water quality parameters of local impact

No new mine discharges or surface facilities are planned as a result of mining in the Kenilworth Addition area. The chemical character of water encountered in the Kenilworth Addition area will likely be similar to that encountered previously in the Tower Mine permit area. No appreciable impacts to acidity TDS, TSS, or other important water quality impacts have been observed during historic mining operations at the Tower Mine. Thus, the potential for increases in these water quality parameters above current levels as a result of mining in the Kenilworth Addition area is considered negligible.

728.333 What impact the proposed coal mining and reclamation operation will have on flooding or streamflow alteration

No new mine discharges or surface facilities are planned as a result of mining in the Kenilworth Addition area. It is anticipated that the nature of future groundwater inflows into the Kenilworth Addition area will be similar to those encountered previously in the Tower Mine permit area. Historically, no flooding or streamflow alteration has occurred as a result of discharge from the Tower Mine. Because no subsidence is anticipated in the Kenilworth Addition area, no subsidence-related changes to stream morphology are anticipated. The potential for flooding or streamflow alteration as a result of mining in the Kenilworth Addition area is considered negligible.

728.334 What impact the proposed coal mining and reclamation operation will have on groundwater and surface-water availability

As discussed previously, the shallow alluvial and colluvial groundwater systems that support seeps in the Kenilworth Addition and adjacent area are hydraulically isolated from the deep, inactive groundwater systems encountered during mining operations. When mining in the underlying coal seam occurs, the shallow systems will be isolated from the mine environment in the Kenilworth Addition area by more than 1,000 of undamaged, low-permeability bedrock. Because of the barrier-pillar design and the geologic conditions in the Kenilworth Addition area, no appreciable subsidence is anticipated. As is common on lands used for livestock grazing, impoundments have been created in the surface drainages in the Kenilworth Addition and adjacent area to capture snowmelt and rainwater for livestock watering. Because no subsidence is anticipated in the Kenilworth Addition area, these stock-watering ponds should not be impacted.

Thus, the potential for adverse impacts to groundwater and surface-water availability as a result of mining and reclamation activities in the Kenilworth Addition area is low. Mining in the Kenilworth Addition area may make available groundwater from perched, inactive groundwater systems that would otherwise have been unavailable.

728.350 Whether the underground coal mining and reclamation activities may result in contamination, diminution or interruption of State-appropriated water

As discussed previously, mining in the Kenilworth Addition area will occur under greater than 2,000 feet of overburden. Shallow bedrock groundwater systems and alluvial and colluvial groundwater systems that support springs and seeps in the Kenilworth Addition area are

hydraulically isolated from the deep groundwater systems that will be encountered during mining operations. No subsidence of the land surface above the Kenilworth Addition area is anticipated. Thus the potential for contamination, diminution or interruption of State-appropriated water is considered low.

However, if in the unlikely event that that contamination, diminution, or interruption of State-appropriated water did occur, Andalex Resources would be required under Utah Coal Mining Rule R731.530 to replace any State-appropriated water supply that is contaminated, diminished, or interrupted by underground coal mining and reclamation activities.

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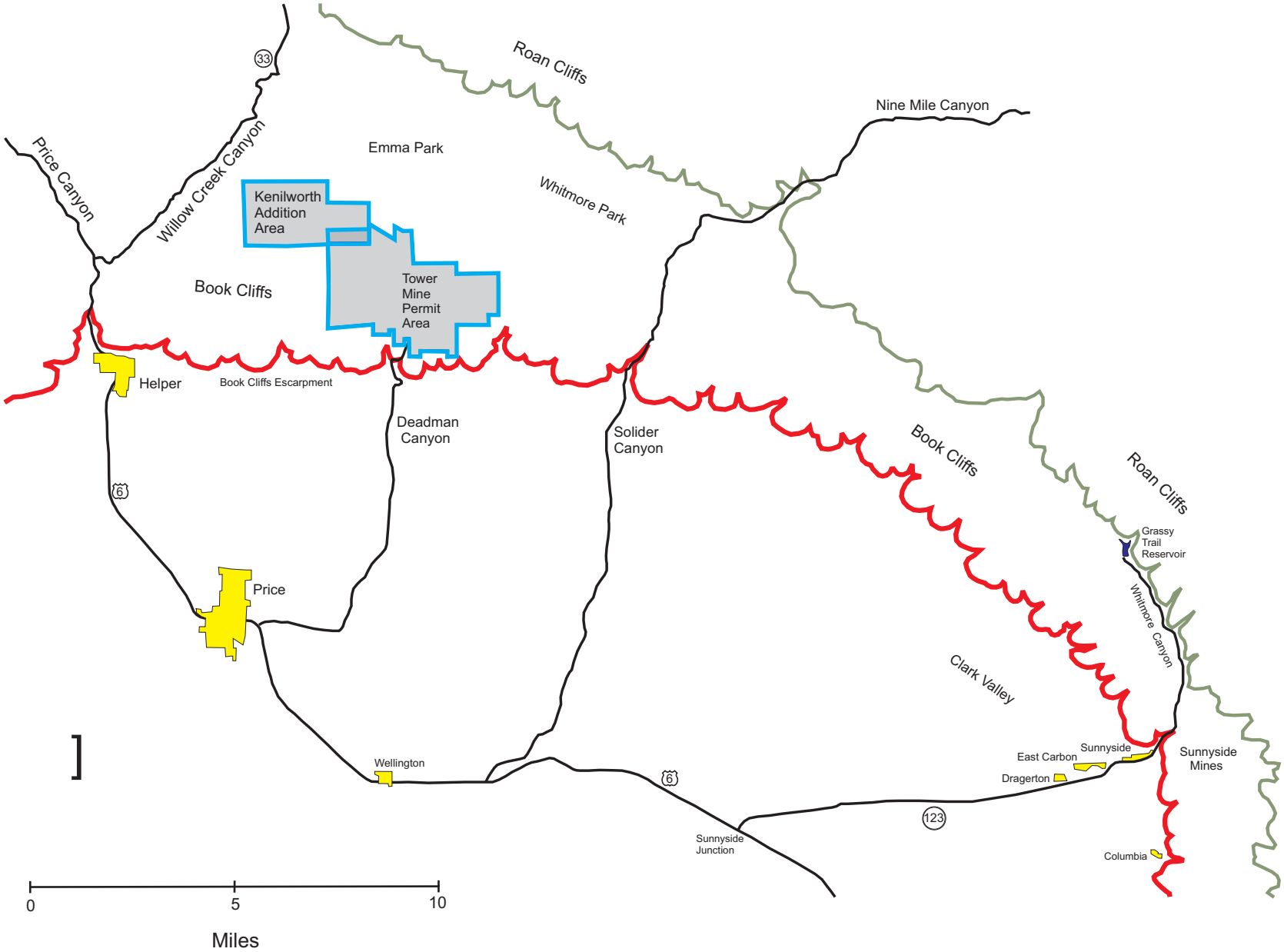
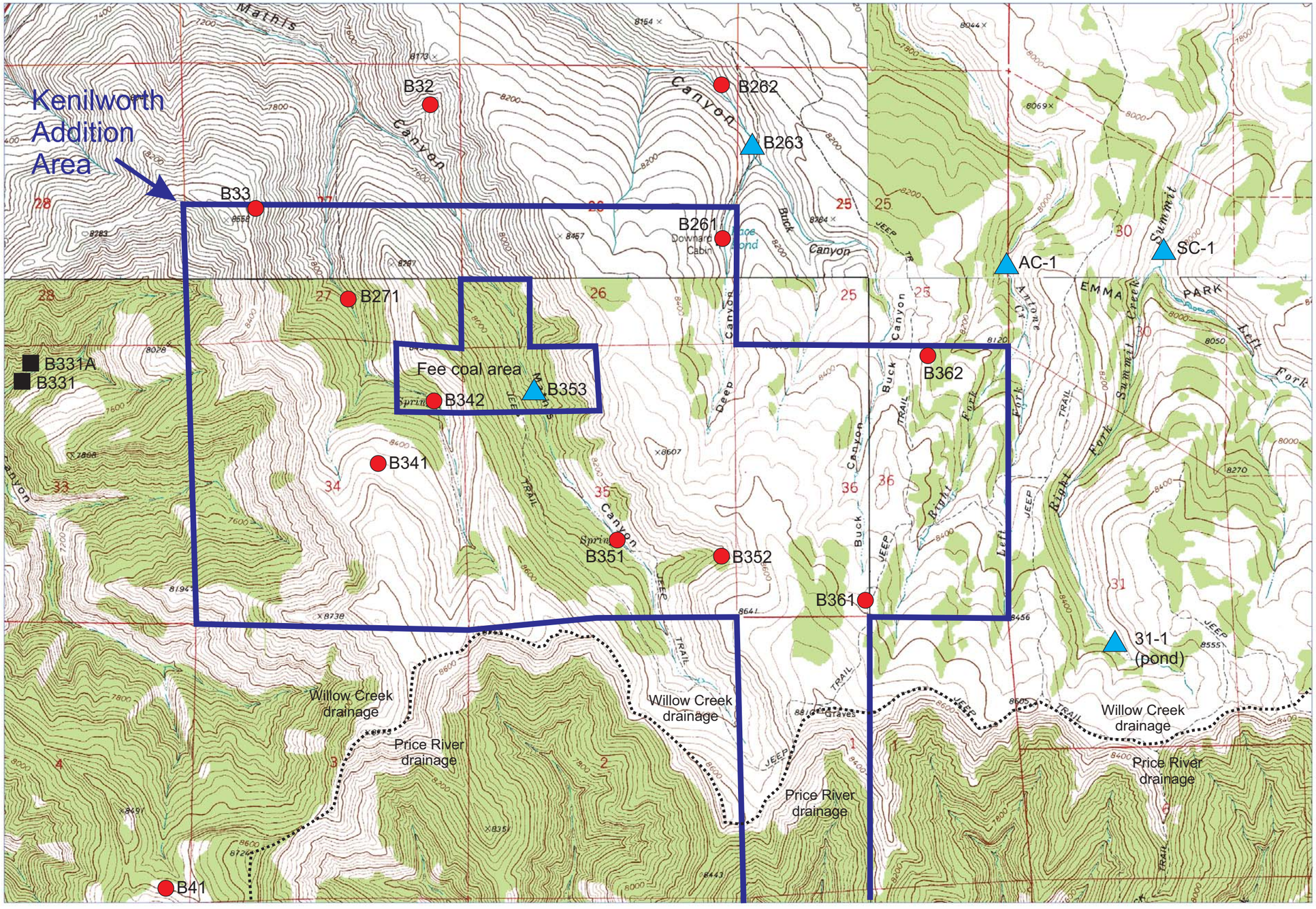


Figure 1 Location map showing the Kenilworth Addition area at the Tower Mine.



Note: B211 is located on Mathis Creek at confluence with Willow Creek 0.37 miles north of map extent.

- Spring monitoring station
- Stream monitoring station
- Well monitoring station

TN MN UTM

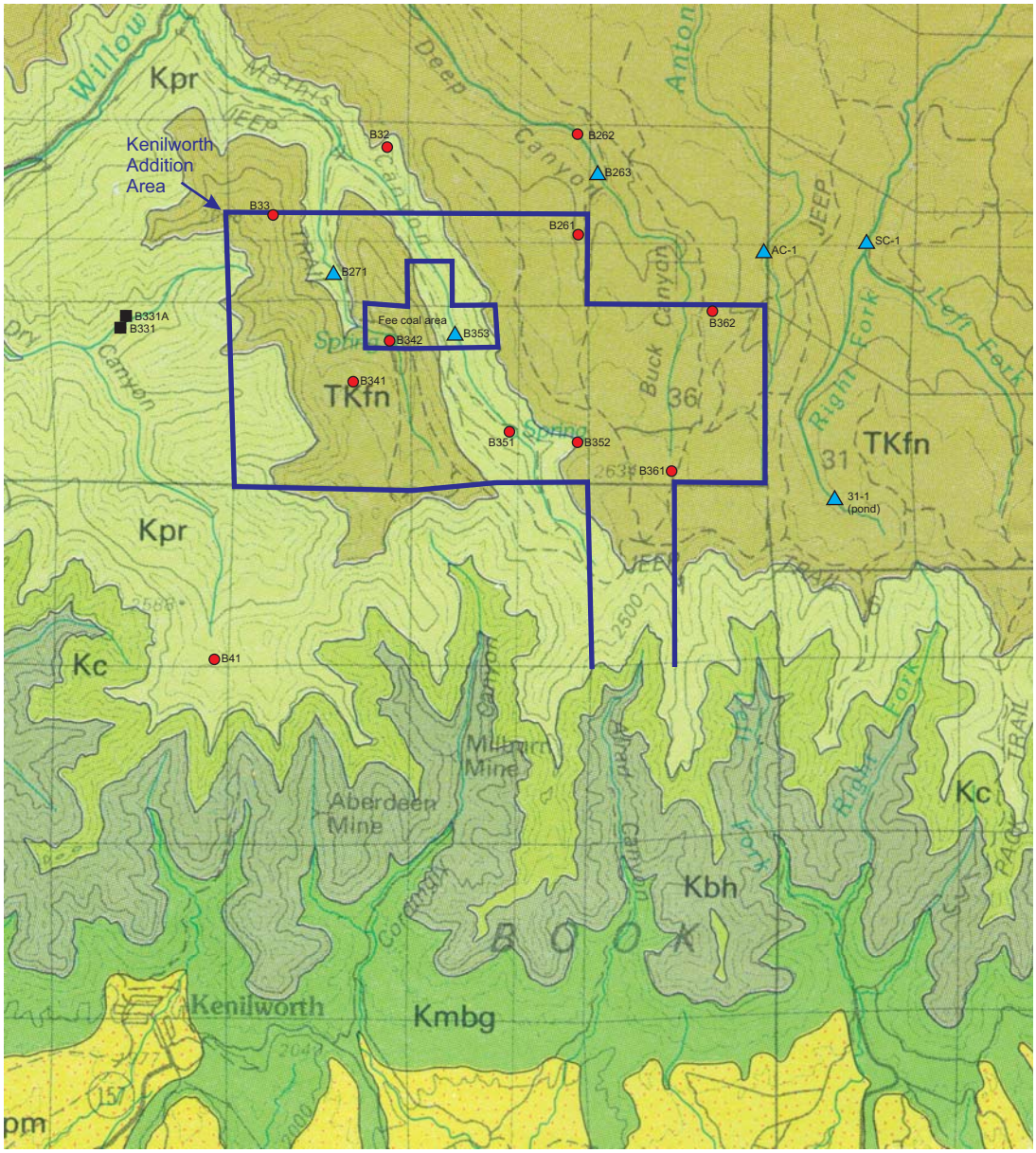
2014 Declination at Sheet Center
TN to MN 0.000° (0° 0' 0") (0 mills)
TN to UTM GN 0.151° (0° 9' 2") (3 mills)

0 ¼ ½ 1 Mile

0 1000 2000 3000 5000 Feet

0 0.5 1 Kilometer

Figure 2 Baseline hydrologic monitoring locations for the Kenilworth Addition area.



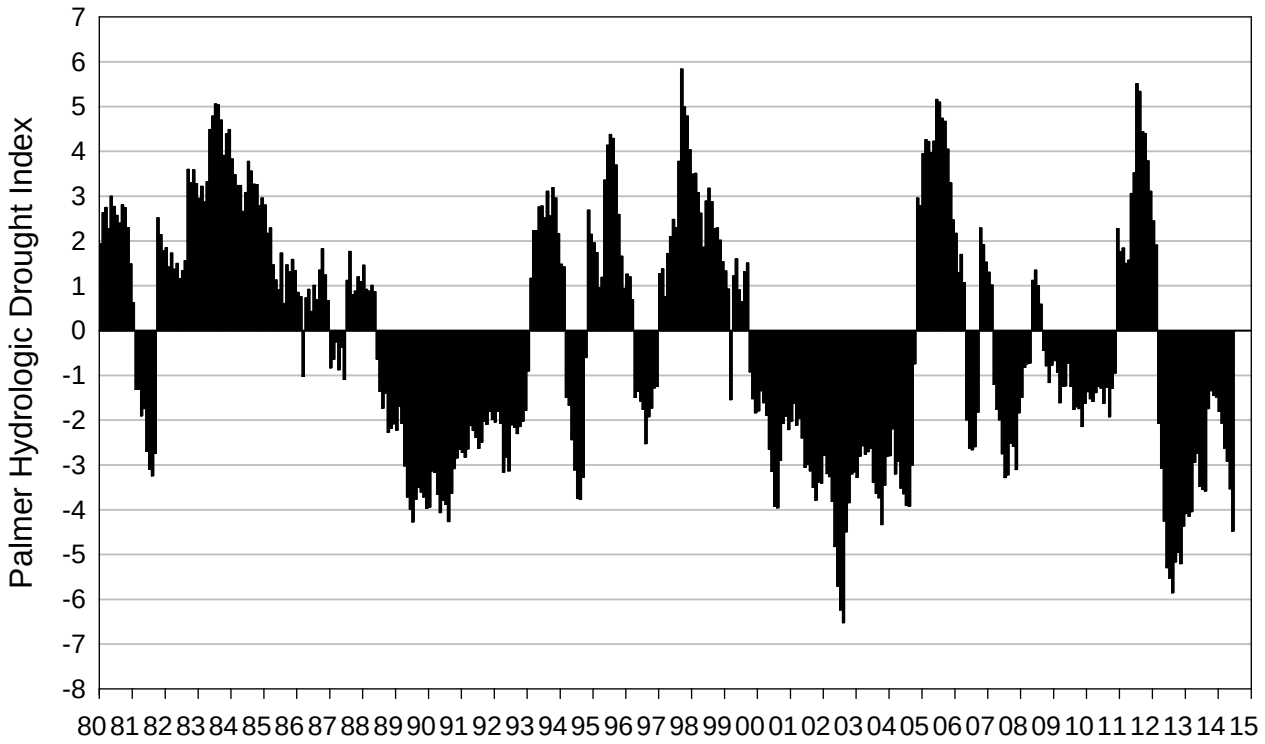
TKfn	Flagstaff Limestone - North Horn Formation, Undivided
Kp	Price River Formation
Kc	Castlegate Sandstone
Kb	Blackhawk Formation
Km	Mancos Shale

0 0.5 1
1 mile

North

- Spring monitoring station
- Stream monitoring station
- Well monitoring station

Figure 3 Geologic map of the Kenilworth Addition area.



-1 to -2	Mild Drought	1 to 2	Mild Wet Spell
-2 to -3	Moderate Drought	2 to 3	Moderate Wet Spell
-3 to -4	Severe Drought	3 to 4	Severe Wet Spell
-4 to -5	Extreme Drought	4 to 5	Extreme Wet Spell

Figure 4 Plot of the Palmer Hydrologic Drought Index for Utah Region 6.

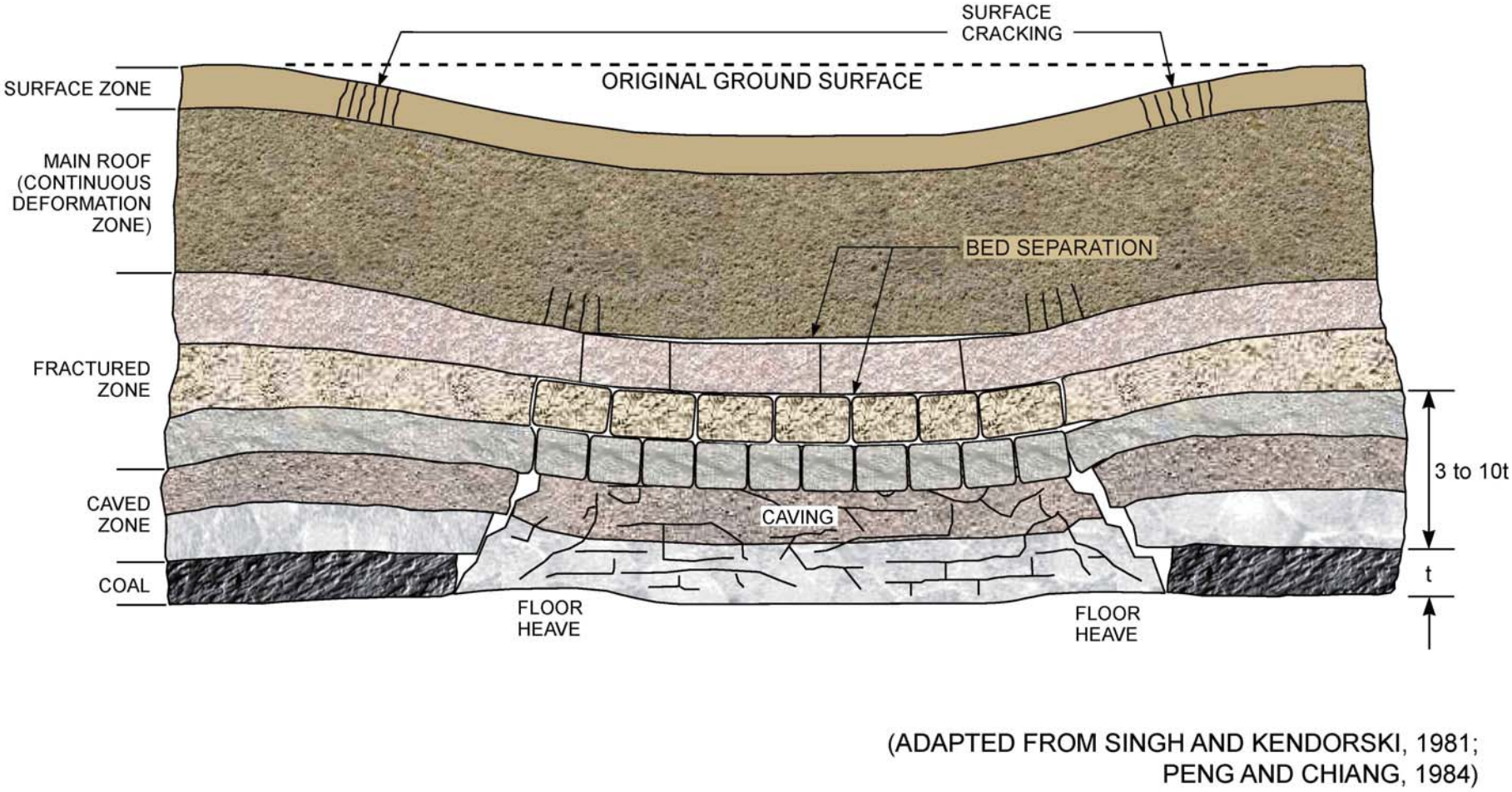


Figure 5 Subsidence disturbance zones (from MSHA, 2009).

Table 1 Kenilworth Addition Area baseline monitoring site information.

Site	Description/comments	Geology	Drainage	Location	Use
Springs					
Flagstaff Limestone/North Horn Formation					
B261	Developed spring with stock tank	North Horn/Flagstaff	Deep Canyon	SE1/4, Sec. 26, T. 12 S. R. 10 E.	Wildlife, stockwatering
B262	Undeveloped spring	North Horn/Flagstaff	Deep Canyon	NW1/4, Sec. 25, T. 12 S. R. 10 E.	Wildlife, stockwatering
B271	Undeveloped spring	North Horn/Flagstaff	Right Fork, Mathis Canyon	SE1/4, Sec. 27, T. 12 S. R. 10 E.	Wildlife, stockwatering
B341	Developed spring with stock tank	North Horn/Flagstaff	Right Fork, Mathis Canyon	NE1/4, Sec. 34, T. 12 S. R. 10 E.	Wildlife, stockwatering
B342	Developed spring with stock tank	North Horn/Flagstaff	Right Fork, Mathis Canyon	NE1/4, Sec. 34, T. 12 S. R. 10 E.	Wildlife, stockwatering
B352	Undeveloped spring	North Horn/Flagstaff	Left Fork, Mathis Canyon	SE1/4, Sec. 35, T. 12 S. R. 10 E.	Wildlife, stockwatering
B361	Undeveloped seep above pond	North Horn/Flagstaff	Buck Canyon	SW1/4, Sec. 36, T. 12 S. R. 10 E.	Wildlife, stockwatering
B362	Undeveloped seep above pond	North Horn/Flagstaff	Buck Canyon	NE1/4, Sec. 36, T. 12 S. R. 10 E.	Wildlife, stockwatering
Price River Formation					
B41	Developed spring with stock tank	Price River	Right Fork, Dry Canyon	SW1/4, Sec. 4, T. 13 S. R. 10 E.	Wildlife, stockwatering
B351	Undeveloped spring	Price River	Left Fork, Mathis Canyon	SE1/4, Sec. 35, T. 12 S. R. 10 E.	Wildlife, stockwatering
Surface Water					
AC-1	Antone Creek	---	Willow Creek drainage	SE1/4, Sec. 25, T. 12 S. R. 10 E.	Wildlife, stockwatering
SC-1	Summit Creek	---	Willow Creek drainage	NE1/4, Sec. 30, T. 12 S. R. 11 E.	Wildlife, stockwatering
B353	Upper Mathis Canyon Creek	---	Willow Creek drainage	NW1/4, Sec. 35, T. 12 S. R. 10 E.	Wildlife, stockwatering
B211	Lower Mathis Canyon Creek	---	Willow Creek drainage	NE1/4, Sec. 21, T. 12 S. R. 10 E.	Wildlife, stockwatering
B263	Deep Canyon Creek	---	Willow Creek drainage	NW1/4, Sec. 25, T. 12 S. R. 10 E.	Wildlife, stockwatering
Wells					
B331	Well in Dry Canyon	Aberdeen Sandstone	Dry Canyon drainage	NW1/4, Sec. 33, T. 12 S. R. 10 E.	---
B331A	Well in Dry Canyon	Blackhawk Formation	Dry Canyon drainage	NW1/4, Sec. 33, T. 12 S. R. 10 E.	---

Table 2 Discharge and water quality data for the Kenilworth Addition area.

																	Trace Inorganic Constituents															Nutrients					Other Properties					
Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
Springs																																									
B41	09/22/92	1.35		9.1	6.22	555	350		67	32	12	2	174	16	91	11	<0.006	<0.001		0.03	<0.005	0.005	0.14	<0.02		<0.05	0.01		<0.02	0.001	<0.01		0.98	<0.01	0.07		190	299				
B41	06/07/94	0.90		3.6	7.17	652	328		61	30	12	2	210	0	84	9	<0.006	<0.001		0.04	<0.005	0.005	0.1	<0.02		<0.01	0.01	<0.01		<0.001			1.07	<0.01	0.07		210	276			<1	
B41	08/31/94	0.45		10.2	8.56	469	338		72	34	12	2	212	0	97	10	<0.006	<0.001		0.02	<0.005	0.005	0.32	<0.02		<0.01	<0.01	<0.01	<0.02	<0.001	0.01		0.77	<0.01	<0.05		212	319			<2	
B41	05/09/95	2.24		0.6	8.18	717	420		77.1	39.2	17.2	1.7	199	<2	130	19	<0.03	<0.001		0.02	<0.003	0.005	0.03	<0.01		<0.01	<0.005	<0.005	<0.02	<0.01	<0.01		1.11	<0.01	0.85			354				
B41	06/22/95	13.46		5.7	7.5	665	340		73.2	35.9	13.1	1.8	235	<2	90	12	<0.03	<0.001		0.02	<0.003	0.005	0.09	0.03		<0.01	<0.005	<0.005	<0.02	<0.01	<0.01		0.91	<0.01	0.08			331			<2	
B41	08/30/95	0																																							
B41	10/23/95	0																																							
B41	05/31/96	0																																							
B41	10/02/96	0																																							
B41	06/05/97	1.35		8	7.34	525	390		74	35.9	13.5	1.6	229	<2	110	14							0.16	0.01			<0.005	<0.005									229	333				
B41	10/30/97	0.00																																							
B41	07/27/98	2.00		8	7.56	520	368		63	31	12	3	286	<5	75	12							1.1	<0.1			<0.1	<0.1									234	285		156		
B41	10/15/98	1.34		2.5	7.22	717	386		61	29	12	2	275	<5	67	10							<0.1	<0.1			<0.1	<0.1									225	272				
B41	05/19/99	1.00		9	7.48	472	356		62	29	12	2	268	<5	80	11							0.4	<0.1			<0.1	<0.1									219	274				
B41	10/13/99	1.50		6	7.67	375	373		65	31	15	2	274	<5	87	11							0.8	<0.1			<0.1	<0.1									225	290				
B41	10/18/00	1.35		4	7.54	518	381		62	31	14	2	265	<5	87	11	<1	<0.01	<1	<0.1	<0.01	<0.1	0.3	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01			<0.03	<0.5	<0.05	217	282			<2	19
B41	05/31/01	1.80		4	7.58	527	344		62	30	12	1	271	<5	83	10							<0.1	<0.1			<0.1	<0.1									222	278				
B41	10/22/01	1.80		10	7.37	412	370		63	31	13	2	267	<5	87	11.1							3.3	<0.1			<0.05	<0.05									219	285				
B41	05/20/02	1.35		7	7.76	595	377		62	30	13	1	259	<5	87	11							<0.1	<0.1			<0.05	<0.05									212	278				
B41	08/26/02	0																																							
B41	10/23/02	0																																							
Average		**1.52**		**6.3**	**7.51**	**551**	**366**		**66**	**32**	**13**	**2**	**245**	**<5**	**90**	**12**																										
B261	06/07/94	0.8		8.8	7.39	630	290		81	26	8	1	300	0	6	3	<0.05	<0.001		0.02	<0.005	<0.01	0.07	<0.02		<0.01	0.22	0.19		<0.001			0.35	<1	0.06		300	309			<1	
B261	08/07/94	0																																							
B261	10/20/94	0																																							
B261	05/30/95	12.118		10	8.1	509	280		80.2	23.3	6.6	1.7	282	<2	20	4	0.03	<0.001		0.02	<0.003	<0.01	0.03	0.03		<0.01	0.006	0.01	<0.02	<0.002	<0.01		0.96	<0.01	<0.05			296			<2	
B261	06/27/95	13.464		10	7.9	456	310		78.6	22.5	7.8	1.6	301	<2	10	4	<0.03	<0.001		0.04	<0.003	<0.01	0.13	<0.01		<0.01	0.054	0.037	<0.02	<0.002	<0.01		0.09	<0.01	0.05			289			<2	
B261	08/17/95	0																																							
B261	10/30/95	0																																							
B-261	05/31/96	1.3464		17	9.35	255	190		43.8	10.7	3.4	16	169	< 2.	< 10.	4			0.11				1.42	0.16				0.229									169				
B-261	06/17/97	3.5904		15	8.22	597	310		90.7	27.2	7	2	332	< 2.	20	4							0.03	< .01				0.009									332				
B-261	10/29/97	0																																							
B-261	05/27/98	60		9	8.29	665	343		75	20	6	2	354	< 5.	12	4							0.1	< .1				< .1									290				
B-261	10/15/98	0																																							
B-261	05/18/99	1.1		15	7.48	573	296		70	23	7	2	350	< 5.	8	4							0.4	< .1				< .1									286				
B-261	10/13/99	0																																							
B-261	12/20/00	0																																							
B-261	05/24/01	0.763		8	8.14	496	325		77	23	6	2	348	< 5.	11	4							< .1	< .1				< .1									285				
B-261	10/22/01	0																																							
B-261	05/20/02	0																																							
B-261	08/26/02	0																																							
B-261	10/23/02	0																																							
B-261	05/24/06	0																																							
B-261	08/08/06	0																																							
B-261	10/03/06	0																																							
B-261	03/19/07	0																																							
B-261	06/05/07	0																																							
B-261	07/18/07	0																																							
B-261	10/11/07	0																																							
B-261	06/12/08	0																																							
B-261	09/03/08	0																																							

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B-261	11/03/08	0																																								
B-261	05/29/14	0																																								
Average		**3.01**		**11.6**	**8.11**	**523**	**293**		**74.5**	**22**	**6.48**	**3.5**	**304.5**	**<5**	**12.43**	**3.88**																										
B262	06/07/94	0.8		10.1	7.78	845	418		85	44	25	1	412	0	47	10	0.06	<0.001		0.04	<0.005	<0.01	1.14	0.03		<0.01	0.04	<0.01		<0.001			0.05	0.01	0.07		412	393			<1	
B262	08/07/94	4.0392		10.9	7.02	651	336		80	31	17	1	330	0	19	7	<0.05	<0.001		0.04	<0.005	<0.01	0.07	<0.02		<0.01	<0.01	<0.01	<0.02	<0.001	<0.01		0.09	<0.01	<0.05		330	327			<1	
B262	10/20/94	2.6928		10	7.6	645	320		77	31	16	2	332	0	12	7	<0.05	<0.001		0.03	<0.005	<0.01	<0.02	0.01		<0.01	<0.01	<0.01	<0.02	0.002	<0.01		0.16	<0.01	<0.05		332	320			15	
B262	06/27/95	31.416		7.5	7.3	576	340		69.2	33.5	23.5	1.2	347	<2	30	9	<0.03	<0.001		0.04	<0.003	<0.01	0.02	<0.01		<0.01	<0.005	<0.005	<0.02	<0.002	<0.01		0.06	<0.01	0.13			311			<2	
B262	08/17/95	8.0784		9.5	6.77	710	350		80.2	33	13.3	1	352	<2	30	4	<0.03	<0.01		0.03	<0.003	<0.01	0.51	<0.01		<0.01	0.007	0.017	<0.02	0.002	0.02		0.02	<0.01	<0.006			336			<2	
B262	10/30/95	4.0392		9	7.5	625	310		78.8	30.9	13	0.9	305	<2	35	5	<0.03	<0.001		0.02	<0.003	<0.01	0.16	<0.01		<0.01	0.012	0.009		<0.002	<0.01		0.03	<0.01	<0.05			324			5	
B262	05/31/96	8.53		8	7.8	491	360		79.7	34.2	18.5	1.3	350	<2	20	10			0.342				1.21	<0.01				<0.005									350	340				
B262	10/01/96	2.24		9	6.45	789	350		85.7	32.8	15.8	1.3	341	<2	20	9							<0.01	<0.01			<0.005	<0.005									341	349				
B262	06/17/97	17.95		9	8.48	746	360		82.6	36.6	19.4	1.3	342	<2	20	10							0.01	<0.01			<0.005	<0.005									342	357				
B262	10/29/97	4.04		7	8.03	832																																				
B262	07/27/98	10.00		8	7.46	754	399		80	36	17	<1	437	<5	20	12							<0.1	<0.1			<0.1	<0.1									358	348				
B262	10/15/98	5.80		9	7.02	702	431		82	35	18	1	443	<5	53	11							<0.1	<0.1			<0.1	<0.1									364	349			<2	
B262	05/18/99	2.00		13	7.65	670	418		75	40	21	1	444	<5	39	13							0.3	<0.1			<0.1	<0.1									364	352				
B262	10/13/99	0.00																																								
B262	10/18/00	0.00																																								
B262	05/24/01	20.20		9	7.77	669	396		70	36	19	<1	427	<5	30	8							<0.1	<0.1			<0.1	<0.1									350	323				
B262	10/22/01	0.00																																								
B262	05/20/02	0.00																																								
B262	08/26/02	0																																								
B262	10/23/02	0																																								
B262	05/29/14	<0.05		11.2	7.62	628	355		77.6	26.6	15.7	2.5	383	<5	17	7	<0.03	<0.01	0.214	0.02	<0.001	<0.01	0.19	<0.03	<0.2	<0.005	0.027	<0.002	<0.01	<0.02	<0.04											
Average		**6.09**		**9.35**	**7.48**	**689**	**367**		**78.8**	**34.3**	**18**	**1.3**	**374.6**	**<5**	**28**	**8.71**																										
B271	06/07/94	0.6		8.8	7.69	706																																				
B271	05/29/95	0.4488		7	8.4	615	340		79.4	28.3	13.2	1.1	308	<2	30	4	<0.03	<0.001		0.02	<0.003	<0.01	0.05	<0.01		<0.01	<0.005	<0.005	<0.02	0.002	<0.01		0.04	<0.01	<0.05			315			24	
B271	06/27/95	255.82		8.5	8.27	505	330		46.6	27.3	15.5	1	301	<2	30	5	<0.03	<0.001		0.03	<0.003	<0.01	<0.01	<0.01		<0.01	<0.005	<0.005	<0.02	<0.002	<0.01		<0.02	<0.01	<0.05			304			<2	
B271	08/17/95	0.8976		10	7.31	620	370		80.1	37.4	19.4	1.4	307	<2	22	10	0.05	<0.001		0.03	<0.003	<0.01	0.06	0.06		<0.01	0.019	0.006	<0.02	<0.002	<0.01		0.09	<0.01	<0.05			354			11	
B271	10/30/95	7.6296		3.5	7.94	535	350		85.9	32.7	16.6	1.9	333	<2	17	12	<0.03	0.001		0.03	<0.003	<0.01	0.19	<0.01		<0.01	0.017	0.013	<0.02	<0.001	<0.01		0.06	<0.01	<0.05				<0.4	<5	<2	
B271	05/31/96	3.14		10	8.7	391	330		77.3	30.4	12.1	1	306	<2	30	4			0.107				0.03	<0.01				0.006									306	318				
B271	10/01/96	0.90		7	7.08	741	360		85.5	34.7	16.3	1.3	333	<2	30	5							0.09	<0.01			<0.005	<0.005									333	356				
B271	06/17/97	162.02		9	8.49	566	330		81.9	31	14.3	1	332	<2	40	5							0.02	0.01			<0.005	<0.005									332	332				
B271	10/29/97	3.14		4	8.28	780	300		76	29	13	1	310	<10	29	5.7							0.14	0.02			0.03	0.014									310	310				
B271	05/27/98	448.80		4.5	8.7	734	385		79	25	12	<1	381	<5	33	7							0.3	<0.1			<0.1	<0.1									313	300				
B271	10/15/98	4.00		2.5	8.53	639	380		72	29	12	<1	368	<5	25	5							<0.1	<0.1			<0.1	<0.1									302	299				
B271	05/18/99	6.00		4.5	7.63	575	324		70	29	11	1	355	<5	31	5							<0.1	<0.1			<0.1	<0.1									291	294				
B271	10/13/99	0.90		5	7.77	385	327		74	31	14	<1	386	<5	27	5							1.7	<0.1			<0.1	<0.1									316	312				
B271	10/18/00	1.80		2	7.98	534	358		73	29	13	<1	366	<5	56	6	<1	<0.01	<1	<0.1	<0.01	<0.1	<0.1	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01			<0.03	<0.5	<0.05	300	302			<2	27
B271	05/31/01	44.88		7	8.38	540	329		71	28	13	<1	342	<5	36	5							0.2	<0.1			<0.1	<0.1									280	293				
B271	10/22/01	4.04		7	8.24	430	359		73	31	13	<1	391	<5	31.6	6.2							3	<0.1			0.08	<0.05									320	310				
B271	05/20/02	0.50		12	7.65	512	376		69	31	13	<1	368	<5	29	6							1	<0.1			0.05	<0.05									302	300				
B271	08/26/02	0																																								
B271	10/23/02	0																																								
B271	06/23/14	0																																								
Average		**47.3**		**6.6**	**8.06**	**577**	**347**		**75**	**30**	**14**	**1**	**343**	**<5**	**31**	**6**																										
B341	06/07/94	0.8976		4.7	7.54	848	398		68	28	54	<1	334	12	66	4	<0.05	<0.001		0.05	<0.005	<0.01	0.02	<0.02		<0.01	<0.01	<0.01		0.005			0.23	<0.01	<0.05		346	285			<1	
B341	08/07/94	0.4488		8.2	7.81	810	422		75	30	63	<1	322		74	5	<0.05	<0.001		0.05	<0.005	<0.01	<0.02	<0.02		<0.01	<0.01	<0.01	<0.02	0.003	<0.01		0.13	<0.01	<0.05		322	311			<1	
B341	10/20/94	0.4488		3	8	748	406		69	28	60	<1	368		64	4	<0.05	<0.001		0.04	<0.005	<0.01	<0.02	<0.02		<0.01	<0.01	<0.01	<0.02	0.005	<0.01		0.18	<0.01	<0.05		368	287			23	
B341	05/29/95	2.244		7	7.5	650	350		90.1	28.1	12.9	0.7	303	<2	30	4	<0.03	<0.001		0.02	<0.003	<0.01	<0.01	<0.01		<0.01	<0.005	<0.005	<0.02	0.003	<0.01		0.12	<0.01	<0.05			341		30	14	
B341	06/27/95	49.368		4	7.26	650	390		102	28.8	14.4	0.7	352	<2	70	5	<0.03	<0.001		0.03	<0.003	<0.01	<0.01	<0.01		<0.01	<0.005	<0.005	<0.02	0.002	<0.01		0.07	<0.01	<0.05			373			<2	
B341	08/17/95	4.0392		9	7.42	740	370		86.4	32.6	26.8	0.8	337	<2	40	5	0.05	<0.001		0.03	<0.003	<0.01	0.74	0.09		<0.01	0.02	<0.005	<0.02	0.004	<0.01		0.09	<0.01	<0.05			350			9	
B341	10/30/95	0.8976		5	7.5	680	300		64.1	30.2	15.5	1.4	290	<2	30	10	0.06	0.001		0.03	<0.003	<0.01	0.63	0.08		<0.01	0.052	0.037	<0.02	<0.005	<0.01		0.03	<0.01	<0.05				<0.1	30	<2	
B341	05/31/96	0.04		6	8.01	517	410		73.3	29.3	52.8	0.9	353	<2	50	5			0.075				0.04	<0.01				<0.005									353	304				
B341	06/17/97	336.60		6.5	8.2	623	390		107	31.2	12.9	0.6	391	<2	40	6							0.01	<0.01			<0.005	<0.005									391	396				

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B341	10/29/97	1.80		4.5	8.25	1064	300		77	27	31	0.8	370	<10	46	5.1							0.12	<0.01			<0.005	<0.005									370	300				
B341	07/27/98	6.00		5	7.61	609	464		94	30	17	<1	454	<5	39	6							<0.1	<0.1			<0.1	<0.1									372	358				
B341	10/15/98	1.34		2.5	7.22	717	461		80	30	34	1	432	<5	42	5							<0.1	<0.1			<0.1	<0.1									354	323			<2	
B341	05/18/99	0.00																																								
B341	10/13/99	1.00		7	7.96	418	401		74	30	45	<1	418	<5	58	5							<0.1	<0.1			<0.1	<0.1									342	308				
B341	10/18/00	0.22		1	8.15	560	426		66	29	43	2	480	<5	57	6	<1	<0.01	<1	1	<0.01	<0.1	<0.1	7.7			0.2	<0.1	<0.1	<0.01	0.01			<0.03	<0.5	<0.05	394	284			<2	14
B341	05/24/01	60.14		6	7.57	617	383		77	27	14	<1	386	<5	35	4							<0.1	<0.1			<0.1	<0.1									316	303				
B341	10/22/01	1.80		8	7.62	451	401		75	29	39	<1	414	<5	53.6	5.3							<0.1	<0.1			<0.05	<0.05									340	307				
B341	05/20/02	0.27		8	8.04	680	429		69	29	41	<1	401	<5	56	5							<0.1	<0.1			<0.05	<0.05									329	292				
B341	08/26/02	0																																								
B341	10/23/02	0																																								
B341	06/23/14	0																																								
Average		**22.3**		**5.61**	**7.74**	**670**	**394**		**79.2**	**29.2**	**33.9**	**1**	**376.8**	**<5**	**50.04**	**5.26**																										
B342	06/07/94	2.244		7	7.53	750	352		80	31	14	<1	312	8	35	4	<0.05	<0.001		0.03	<0.005	<0.01	0.11	<0.02		<0.01	<0.01	<0.01		0.003			0.1	<0.01	<0.006		320	327			<1	
B342	08/07/94	0.8976		13.1	8.3	842	360		82	32	16	1	280	20	47	5	<0.05	<0.001		0.04	<0.005	<0.01	0.07	<0.02		<0.01	0.02	<0.01	<0.02	0.002	<0.01		0.08	<0.01	0.05		300	336			<1	
B342	05/29/95	0.4488		5.3	7.7	651	350		87.9	29.8	14.4	0.9	308	<2	30	4	<0.03	<0.001		0.02	<0.003	<0.01	0.39	0.01		<0.01	0.01	<0.005	<0.02	0.004	<0.01		0.07	<0.01	<0.05			342			<2	
B342	08/17/95	103.22		14	7.4	645	340		81.8	33.3	13.5	1.1	307	<2	30	4	<0.03	<0.001		0.03	<0.003	<0.01	0.05	0.05		<0.01	0.017	0.021	<0.02	<0.002	<0.01		0.09	<0.01	<0.05			341			<2	
B342	10/30/95	0.4488		5	7.56	638	300		68.1	33.1	9.6	1	269	<2	38	5	<0.03	<0.001		0.02	<0.003	<0.01	0.2	<0.01		<0.01	0.009	<0.005	<0.02	<0.001	<0.01		0.07	<0.01	<0.05				<1	<5	<2	
B342	05/31/96	4.94		7.5	8.47	441	350		84.5	30.5	13.8	0.8	307	<2	30	4			0.098				0.26	<0.01				0.006									307	337				
B342	06/17/97	8.98		8	8.06	663	360		98	29.6	12.2	0.7	355	<2	40	4							0.16	<0.01			<0.005	<0.005									355	367				
B342	10/29/97	3.14		5	7.82	809	190		70	24	12	0.6	330	<10	20	2.6							0.12	<0.01			0.021	<0.005									330	270				
B342	05/27/98	359.04		4.5	8.1	757	388		79	24	11	<1	385	<5	32	6							0.3	<0.1			<0.1	<0.1									316	296				
B342	10/15/98	0.00																																								
B342	05/18/99	6.00		4.5	7.84	607	355		77	27	12	<1	373	<5	36	4							<0.1	<0.1			<0.1	<0.1									306	303				
B342	10/13/99	2.24		5	7.76	360	354		83	31	16	<1	398	<5	36	5							1	<0.1			<0.1	<0.1									326	335				
B342	10/18/00	1.80		1	8.19	633	385		77	29	14	1	388	<5	36	5	<1	<0.01	<1	0.1	<0.01	<0.1	0.4	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01			<0.03	<0.5	<0.05	318	312			<2	15
B342	05/24/01	49.37		5	7.49	526	367		72	27	13	<1	344	<5	33	4							<0.1	<0.1			<0.1	<0.1									310	291				
B342	10/22/01	4.04		9	8.22	436	381		85	30	14	<1	403	<5	37.1	5.4							0.3	<0.1			<0.05	<0.05									331	336				
B342	05/20/02	0.90		10	8.26	573	373		77	29	14	<1	375	<5	38	5							0.9	<0.1			<0.05	<0.05									307	312				
B342	08/26/02	0																																								
B342	10/23/02	0																																								
B342	06/23/14	0.25		19.4	8.4	704	414		81.1	31.7	17	4.2	396	<5	49	8							1.31	<0.03			0.106	<0.002										333				
Average		**28.8**		**7.71**	**7.94**	**627**	**351**		**80.2**	**29.5**	**13.5**	**1.3**	**346**	**14**	**35**	**4.69**																										
B351	06/07/94	0.4488		9	7.39	643	294		72	27	8	1	284	0	29	3	<0.05	<0.001		0.02	<0.005	<0.01	0.63	<0.02		<0.01	0.03	<0.01		<0.001			0.94	<0.01	0.06		284	291			<0.1	
B351	08/28/94	0																																								
B351	10/20/94	0																																								
B351	05/30/95	197.47		8	8.15	546	280		79.2	25.6	8	1.1	279	<2	10	3	<0.03	<0.001		0.02	<0.003	<0.01	0.08	0.03		<0.01	0.01	<0.005	<0.02	<0.002	<0.01		0.65	<0.01	<0.05			303			<2	
B351	06/27/95	22.44		7.7	7.4	420	280		71.9	20.6	5.8	1.1			30	4	<0.03	<0.001		0.02	<0.003	<0.01	0.69	<0.01		<0.01	0.022	<0.005	<0.02	<0.002	<0.01		0.97	<0.01	0.08			264				
B351	08/17/95	0.4488		12	6.24	626	310		82.7	32.8	90	0.9	307	<2	20	3	<0.03	<0.001		0.02	<0.003	<0.01	0.07	<0.01		<0.01	0.033	0.036	<0.02	<0.002	0.03		0.09	<0.01	<0.05			342			<2	
B351	10/30/95	12.118		6	8.13	580	370		82.6	30.6	38.7	0.8	342	<2	59	5	<0.03	<0.001		0.04	<0.003	<0.01	<0.01	<0.01		<0.01	<0.005	<0.005	<0.02	0.004	0.03		0.16	<0.01	<0.05			332			<2	
B351	05/31/96	3.59		10		393	320		76.1	31.2	9.6	0.7	299	<2	40	3			0.117				0.49	<0.01				0.012									299	318				
B351	05/30/97	0																																								
B351	06/17/97	22.4		7.1	8.12	549	270		80.1	24.8	5.2	0.7	280	<2	20	3							0.07	<0.01			<0.005	<0.005									280	302				
B351	10/29/97	0																																								
B351	05/27/98	65		12	8.28	596	318		71	17	4	<1	333	<5	13	4							0.1	<0.1			<0.1	<0.1									273	247				
B351	10/15/98	0																																								
B351	05/18/99	0																																								
B351	10/13/99	0																																								
B351	03/29/00	0																																								
B351	10/18/00	0																																								
B351	05/24/01	6.28		11	7.84	474	303		73	22	4	<1	330	<5	12	2							0.1	<0.1			<0.1	<0.1									270	273				
B351	10/22/01	0																																								
B351	04/11/02	1.85		3.4	8.05	319																																				
B351	05/20/02	0.00																																								
B351	06/28/02			9	7.4	510	387		82	33	11	< 1.	372	< 5.	66	5		< .01		0.17			< .1	< .1			< .05	< .05		< .01		0.34			< .1		305		< .1	2	< 5.
B351	09/19/02	0.3		8	7.3	730	418		89	36	14	< 1.	360	< 5.	95	5							< .1	< .1			< .05	< .05				0.23		< .03			295				

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B351	11/19/02	0																																								
B351	03/29/03	0																																								
B351	06/05/03	2.5			8.7	490	354		77.7	31.6	10	1.3	339	< 5.	51	5							0.256	< .005			0.018	0.008									278					
B351	08/21/03	1		14	8.1	650	418		84.2	36.2	12.5	1	359	< 5.	77	6							0.31	< .005			0.035	0.025									294					
B351	10/06/03	0.01		13	7	700																																				
B351	06/03/04	3		15	8.46	610	378		77.4	26.7	11.2	1.1	402	< 5.	53.1	15.8							0.044	0.041			0.077	0.035														
B351	09/09/04			10	8.48	650	390		46.1	35	11.6	1.2	168	3.54	66.47	15.8							1.23	0.02			0.081	0.041														
B351	11/04/04	8		0.6	8.45	630	398		82.5	33.2	10.7	1.1	372	< 5.	53	5							1.59	0.49			0.068	0.056									305					
B351	06/29/05	200		9	8.49	560	323		79.2	30.2	7.68	0.6	337	< 5.	25	6		< .01		0.02			0.23	< .03			0.016	< .002				0.72			< .1		276		< .1			< 5.
B351	08/27/05			10	8.68	700	512		82.6	25.2	6.4	0.8	374	< 5.	20.17	< .5							0.45	< .01			0.03	0.04														
B351	11/07/05	6		4	8.6	590	373		75.3	21.7	10.4	1	389	< 5.	18.93	< .5		0.012		0.078			0.148	0.013			0.026	0.028		< .005							319					
B351	05/24/06	150		7.5	8.9	580	309		70.7	29.9	8.48	1	399	< 5.	26.34	< .5							0.37	0.02			0.037	< .005									327					
B351	08/08/06	12.5		20	8.26	585	358		72.2	29.9	9.3	1	350	< 10.	34	6							6.66	< .005			0.294	0.034									290					
B351	10/03/06	5		7.7	9.05	680	392		80.8	33.7	10.1	1.1	377	< 10.	37	4.7							2.623	0.021			0.131	0.025									309					
B351	06/05/07			10.5	8.14	663	351		77	32.9	15.1	1.1	361	< 10.	45	5.3							1.606	0.023			0.075	0.023									296					
B351	07/18/07	3		20	8.45	700	330		62.4	31.8	10.5	1.3	376	< 10.	50	5.4							0.557	0.017			0.061	0.034									308					
B351	10/11/07	0.5		13	8.08	398	304		55.8	27.1	8.98	4	288	< 10.	38	5.1							0.643	0.015			0.092	0.091									236					
B351	06/12/08	10		8.2	9.2	550	366		79	32	9.82	0.8	360	< 10.	36	4							0.163	< .01			0.013	0.012									295					
B351	09/03/08	5		8.8	8.75	600	397		82.5	32.2		1.3	372	< 10.	49	5.1							2.588	< .01			0.12	0.001									305					
B351	05/29/14	0.205		9.3	7.45	725	454		80.3	31.9	12.2	1.2	340	<5	96	5	<0.03	<0.01	0.120	<0.01	<0.001	<0.01	<0.05	<0.03	<0.2	<0.005	<0.002	<0.005	<0.01	<0.02	<0.004		0.66	<0.05	<0.1	<0.05	279	404	<0.1			14
Average		**18.951**		**9.78**	**8.12**	**582**	**356**		**75.9**	**29.3**	**13.5**	**1.1**	**339**	**1.77**	**41.8**	**5.37**																										
B352	06/07/94	0.1		11.9	7.9	800																																				
B352	08/28/94	0																																								
B352	10/20/94	0																																								
B352	05/30/95	23.79		8	7.9	549	280		69.1	26.5	16.8	0.2	277	<2	10	6	<0.03	<0.001		0.03	<0.003	<0.01	0.12	<0.01		<0.01	0.045	<0.005	<0.02	<0.002	<0.01		0.29	<0.01	<0.05			282			<2	
B352	06/27/95	0.90		8.5	7.28	542	340		72.4	30.9	18.9	1.4	306	<2	30	10	<0.03	<0.001		0.05	<0.003	<0.01	0.19	<0.01		<0.01	0.007	<0.005	<0.02	<0.002	<0.01		0.2	<0.01	<0.05			308			<2	
B352	08/17/95	0																																								
B352	10/30/95	0																																								
B352	05/31/96	0																																								
B352	10/01/96	0																																								
B352	05/30/97	0																																								
B352	06/17/97	2.69		10	8.26	537	340		82.9	30.6	21	1.3	310	<2	30	12							0.07	<0.01			0.006	0.009									310	333		<5		
B352	10/29/97	0																																								
B352	05/27/98	24.2		8	7.85	688	305		68	23	14	2	366	<5	19	10							1	<0.1			<0.1	<0.1									300	265				
B352	10/15/98	0																																								
B352	05/18/99	0																																								
B352	10/13/99	0																																								
B352	10/18/00	0																																								
B352	05/24/01	1.80		7	7.46	508	330		62	24	19	<1	363	<5	17	8							<0.1	<0.1			<0.1	<0.1									298	254				
B352	10/22/01	0.13		10	7.35	451	401		78	30	25	1	404	<5	25.6	13.5							0.1	<0.1			<0.05	<0.05									331	318				
B352	04/11/02	0.0987		6.6	7.56	657																																				
B352	05/20/02	0.00																																								
B352	06/28/02	0																																								
B352	09/19/02	0																																								
B352	11/19/02	0																																								
B352	06/05/03	0																																								
B352	08/21/03	0																																								
B352	10/01/03	0																																								
B352	06/03/04	0																																								
B352	09/09/04	0																																								
B352	11/04/04	0																																								
B352	06/29/05	2		9	8.28	570	352		83.7	29	17.7	1	401	< 5.	20	11		< .01		0.04			6.1	< .03			0.232	< .002				0.08			< .1		329		< .1			< 5.
B352	08/27/05	0																																								
B352	11/01/05	0																																								
B352	05/24/06	0		11	8.6	600																																				
B352	08/08/06	0																																								
B352	10/03/06	0																																								

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B352	06/05/07	0																																								
B352	07/18/07	0																																								
B352	10/11/07	0																																								
B352	06/12/08	0																																								
B352	09/03/08	0																																								
B352	05/29/14	0																																								
Average		**1.3263**		**9**	**7.84**	**590**	**335**		**73.7**	**27.7**	**18.9**	**1.1**	**347**	**<5**	**21.66**	**10.1**																										
B361	06/07/94	<0.2		17.7	7.59	726																																				
B361	08/07/94	0																																								
B361	10/20/94	0																																								
B361	05/30/95	3.59		10	8.3	311	160		51.7	9.5	2.4	6.9	173	<2	<10	2	<0.03	0.002		0.03	<0.003	<0.01	0.08	<0.01		0.024	0.007		<0.01	<0.002	<0.01		0.05	<0.01	<0.05			168				
B361	06/27/95	0																																								
B361	08/17/95	0																																								
B361	10/30/95	0																																								
B361	10/30/95	0																																								
B361	05/31/96	0																																								
B361	10/01/96	0																																								
B361	06/17/97	0.00																																								
B361	10/29/97	0																																								
B361	07/27/98	0																																								
B361	10/15/98	0																																								
B361	05/18/99	0																																								
B361	10/13/99	0																																								
B361	05/24/01	0																																								
B361	10/22/01	0																																								
B361	04/11/02	0																																								
B361	05/20/02	0.00																																								
B361	08/26/02	0																																								
B361	10/23/02	0																																								
Average		**0.17**		**13.9**	**7.95**	**519**	**160**		**51.7**	**9.50**	**2.40**	**6.90**	**173**	**<2**	**<10**	**2.0**																										
B362	06/07/94	0.5		16.4	7.25	575																																				
B362	10/20/94	0																																								
B362	06/27/95	3.14		6	7.2	479	300		76.1	21.5		1	275	<2	10	5	<0.03	<0.001		0.03	<0.003	<0.01	<0.01	<0.01		<0.1	<0.005	<0.005	<0.02	<0.002	<0.01		0.46	<0.01	<0.05			279				<2
B362	08/17/95	0																																								
B362	10/30/95	0																																								
B362	05/31/96	0																																								
B362	10/01/96	0																																								
B362	06/17/97	0																																								
B362	10/29/97	0																																								
B362	07/27/98	0																																								
B362	10/15/98	0																																								
B362	05/18/99	0																																								
B362	10/13/99	0																																								
B362	10/18/00	0																																								
B362	05/24/01	1.57		9	8.55	442	269		60	15	7	2	284	<5	9	6							0.5	<0.1			<0.1	<0.1									238	212				
B362	10/22/01	0																																								
B362	05/20/02	0																																								
B362	05/20/02	0.00																																								
B362	08/26/02	0																																								
B362	10/23/02	0																																								
B362	05/24/06	0																																								
B362	09/26/06	0																																								
B362	10/03/06	0																																								
B362	03/19/07	0																																								
B362	06/05/07	0																																								
B362	07/18/07	0																																								

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B362	10/11/07	0																																								
B362	06/12/08	0																																								
B362	09/03/08	0																																								
B362	11/03/08	0																																								
B362	05/29/14	0																																								
Average		**0.17**		**10.5**	**7.67**	**498.7**	**285**		**68.1**	**18.3**	**7**	**1.5**	**280**	**<5**	**9.5**	**5.5**																										
Streams																																										
AC-1	06/20/05	75		20	8.46	450	288	7.9	94	32.2	8	1.4	397	< 5.	6.38	< .5							0.05	0.02			0.042	0.036														
AC-1	08/27/05	1.5		16	8	900	537		118	19.4	7.4	1.7	447	< 5.	2.47	15.9							0.98	0.05			0.04	0.18								367					
AC-1	11/07/05	2.5		4	8.85	380	284	8	61.6	15.2	8.06	3.7	263	3.234	9.47	21.5		< .005		< .05			0.301				0.068	0.034		< .005						228					
AC-1	05/24/06	30		18	8.45	490	249	9.2	71.7	19.4	7.41	1.5	374	< 5.	19.35	< .5		0.018		0.09			0.08	0.06			0.04	0.029		0.02			0.88		< .1	307	21		< .5	28	
AC-1	09/26/06	0																																								
AC-1	10/03/06	0																																								
AC-1	06/05/07	5		17.5	8.38	544	218	9	83.9	19	8.57	1.2	354	< 10.	12	10.5		< .02		0.03			0.445	0.014			0.05	0.025		< .02			< .05		0.08	290		< .2		< 5.	< 10.
AC-1	07/18/07	1		18	7.75	657	322	9	86.2	22.1	9.76	2	386	< 10.	9	6.3		< .01		< .05			0.706	0.022			0.176	0.176		< .01			< .05		< .05	317		< .2		< 5.	< 10.
AC-1	10/11/07	0																																								
AC-1	06/12/08	100		15	8.7	490	318	9	77.8	18.3	8.74	1	324	< 10.	10	4.2		< .01		< .05			0.129	< .01			0.018	0.005		< .01			< .05		< .05	268		< .2		< 5.	< 10.
AC-1	09/03/08	3		12	8.68	528	333	9.9	85.8	18.9	8.07	1.5	347	< 10.	12	4.2		< .01		< .05			0.301	< .01			0.036	0.003		< .01			0.05		0.06	292		< .2		< 5.	< 10.
AC-1	11/03/08	2		7.6	8.7	546	309	9.5	89.6	19.5	7.96	1.2	358	< 10.	11	4.3		< .01		< .05			0.493	0.026			0.059	0.033		< .01			0.07		< .05	294		0.2		< 5.	< 10.
Average		**18.3**		**14.2**	**8.44**	**554**	**318**	**8.94**	**85.4**	**20.5**	**8.22**	**1.7**	**361**	**<10**	**10.19**	**7.54**																										
SC-1	06/16/04	0																																								
SC-1	09/01/04	0																																								
SC-1	11/19/04	0																																								
SC-1	06/20/05	1570.8		17.5	8.45	460	274	11	85.7	35.4	8.7	1.3	393	< 5.	4.12	<0.5							0.04	< .01			0.033	0.02								341					
SC-1	08/27/05	500		17	8.55	700	578	9.7	93	21.8	9.6	1.5	416	< 5.	14.82	<0.5							0.76	0.01			0.05	0.19													
SC-1	11/07/05	30		5	8.67	530	284	9.2	74.8	20.4	12.7	1.3	378	3.234	11.11	12.6		< .005		< .05			0.422	0.02			0.035	0.069		< .005						322					
SC-1	05/24/06	200		14	7.85	570	236	9.9	69.2	22.7	11.4	0.8	390	< 5.	17.7	<0.5		0.022		0.18			0.06	0.06			0.05	0.008		0.023			2.6		< .1	320		0.1		< .5	27.5
SC-1	09/19/06	30		11	8.58	599	301	10.6	83.6	25.9	11.2	1.6	377	< 10.	16	5.3		< .02		0.04			0.596	0.018			0.071	0.044		< .02			< .05		0.09	309		< .2		< 5.	< 10.
SC-1	10/03/06	35		11.5	8.7	570	314	10.2	75.5	25.5	11.3	1.5	340	< 10.	15	4.6		< .02		0.03			1.266	0.226			0.127	0.061		< .02			< .05		0.05	283		< .2		< 5.	< 10.
SC-1	06/05/07	20		20	8.52	518	265	9.9	72.6	20.1	11.2	1.3	326	6.6	11	3.2		< .02		0.03			0.135	0.024			0.024	0.021		< .02			< .05		0.05	278		< .2		< 5.	< 10.
SC-1	07/18/07	10		22	8.42	600	264	9.8	63.8	23.7	10.6	1.4	315	< 10.	16	3.7		< .01		< .05			0.457	0.027			0.053	0.014		< .01			< .05		0.05	265		< .2		< 5.	< 10.
SC-1	10/11/07	5		5.1	7.94	409	328	11	77.3	25.2	10.4	1.5	368	< 10.	18	3.8		< .01		< .05			1.683	0.015			0.133	0.081		< .01			0.06		0.26	302		< .2		< 5.	< 10.
SC-1	06/12/08	1122		13	8.6	480	290	10	67.5	20.3	9.8	1	307	< 10.	13	2.9		< .01		< .05			0.101	< .01			0.013	0.003		< .01			< .05		< .05	254		< .2		< 5.	< 10.
SC-1	09/03/08	50		15	8.44	580	356	10.3	83.8	23.4	11.2	2.9	376	< 10.	17	4.4		< .01		< .05			0.602	0.188			0.06	0.019		< .01			0.07		0.05	308		< .2		< 5.	< 10.
SC-1	11/03/08	60		0.8	8.8	475	330	13.1	75.5	23.4	11.4	1.5	330	< 10.	16	4.6		< .01		< .05			0.279	0.031			0.037	0.034		< .01			< .05		< .05	271		< .2		< 5.	< 10.
Average		**242**		**13**	**8.46**	**541**	**318**	**10**	**77**	**24**	**11**	**1**	**360**	**<10**	**14**	**3.9**																									
B211	06/08/94			19.3	7.85	704	408	7.25	51	57	26	2	314	16	86	9	<0.5	<0.001		0.05	<0.005	<0.01	0.03	<0.02		<0.01	<0.01	<0.01		0.001			0.02	<0.01	0.06	330	361		2	<1	
B211	07/09/94	2.244		25.1	8.5	705		5.9																																		
B211	08/28/94	0																																								
B211	09/23/94	0.8976		16.3	8.62	714	444	7	44	64	36	2	305	20	99	13	<0.05	0.001		0.05	<0.005	<0.01	0.08	<0.02		<0.01	<0.01	<0.01	<0.02	0.001	<0.01		0.06	<0.01	<0.05	325	372	<0.1	2	<1	
B211	10/30/94	3.1416		1.5	8.45	910		6.7																																		
B211	03/19/95	20.196		7	8.52	768	450	9	49.5	52.9	28.1	1.2		<2	80	12	<0.03	<0.001		0.03	<0.003	<0.01	0.07	<0.01		<0.01	0.006	<0.005	<0.02	0.007	<0.01		0.01	<0.01	<0.05			<0.1	<5	<2	
B211	05/30/95	1122		8.6	8.63	568	280	9.2	58	39.6	16.9	1.2	272	<2	20	6	<0.03	<0.001		0.03	<0.003	<0.01	0.2	<0.01		<0.01	0.015	<0.005	<0.02	0.002	<0.01		0.05	<0.01	<0.05			<0.1	<5	<2	
B211	06/28/95	1122		14.3	8.6	652	310	8.4	55.7	44.6	42.9	1.7	296	<2	70	8	<0.03	<0.001		0.09	<0.003	<0.01	0.13	<0.01		<0.01	<0.005	0.006	<0.02	0.004	<0.01		0.05	<0.01	<0.05			<0.1	<5	<2	
B211	07/20/95	897.6		17.1	8.47	512		9																																		
B211	08/17/95	314.16		11.4	7.64	700	370	9	60.1	53.2	20.2	1.5	302	10	59	7	<0.03	<0.001		0.04	<0.003	<0.01	0.07	0.02		<0.01	0.007	0.007	<0.02	0.003	<0.01		0.1	<0.01	<0.05			<0.1	<5	<2	
B211	09/19/95	212.28		10.2	7.85	675		9																																		
B211	10/13/95			7.6	7.55	663		9.4																																		
B211	10/22/95	119.83		6.4	8.41	664	420	9.2	63.8	60.9	20.1	1.5	322	17	67	9	<0.004	0.002		0.04	<0.003	<0.01	0.01	<0.01		<0.01	<0.005	<0.005	<0.02	0.007	<0.01		<0.02	<0.01	<0.05			<0.1	<5	3	
B211	11/28/95	25.133		1.5	7.69	772		10.9																																		
B211	05/31/96	60.139		6.6	8.55	517	380	11.3	58.6	53	22.3	1.4	334	<2	60	9			0.083				0.08	0.03			<0.005	0.005								334	364	<0.1	<5		
B211	06/28/96	233.38		13	8.54	527	360	10.2	56.1	48.3	20.1	1.7	313	<2	60	9			0.094				2.99	0.21			0.071	0.012								313	339	<0.1	150	<2	
B211	10/16/96	3.1416		6.8	8.64	751	490	8.5	57.5	67	35.8	1.8	368	10	100	14							0.19	0.03			0.011	0.007								379	419		10		

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B211	04/30/97	511.63		6.3	9.42	586	300	9.3	53.1	38.2	17.1	1.5	262	17	50	4							0.29	0.01			0.012	0.008									279	290		26	<2	
B211	06/18/97	583.44		17	8.54	535	350	10.6	52.7	44.6	18.1	1.2	296	<2	50	8							0.06	<0.01			<0.005	<0.005									296	315		<5	4	
B211	10/30/97	413.34		5	8.45	720	360	9.1	56	47	20	1.1	330	<10	65	8.2							0.05	<0.01			0.007	<0.005									330	330		7	<5	
B211	05/27/98	1570.8		11.5	8.67	730	372		52	38	16	1	285	43	47	9							0.4	<0.1			<0.1	<0.1									305	286		53	<2	
B211	07/22/98	201.96		13	8.51	601	406	8.1	50	50	21	1	392	<5	61	12							<0.1	<0.1			<0.1	<0.1									321	331		8	<2	
B211	10/16/98	39.943		3	8.24	868	424		52	51	21	2	412	<5	49	9							<0.1	<0.1			<0.1	<0.1									337	430		5	<2	
B211	03/30/99			5	8.24	923	419	5.1	58	52	23	1	383	9	76	11							<0.1	<0.1			<0.1	<0.1									329	359		<5	<2	
B211	05/21/99	67.32		15	8.43	581		7.5																																		
B211	06/18/99	76.296		17	8.38	640	377	7.1	52	48	21	1	375	8	59	8							0.2	<0.1			<0.1	<0.1									320	328		11	<2	
B211	10/14/99	12.00		3	8.25	541	465	7.6	58	63	31	1	433	<5	88	12							<0.1	<0.1			<0.1	<0.1									372	404		<5	<2	
B211	08/22/00	8.98		10	8.28	818	427	9.3	45	58	30	2	397	<5	91	13							<0.1	<0.1			<0.1	<0.1									325	351		5	<2	
B211	09/25/00	20.20		9	8.31	838		8.1																																		
B211	10/18/00	20.20		6	8.35	811	421	8.8	58	54	23	1	450	<5	63	10	<1	<0.01	<1	0.1	<0.01	<0.1	<0.1	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01			<0.03	<0.5	<0.05	369	367		<5	<2	
B211	02/22/01	0.00																																								
B211	03/22/01	12.12		3	8.25	719	395	8.3	55	47	20	1	397	<5	63	8							1.5	<0.1			<0.1	<0.1									331	331		74	<2	
B211	05/25/01	148.10		6	8.56	577	368		52	41	17	<1	378	<5	48	8							0.5	<0.1			<0.1	<0.1									314	299		53	<2	
B211	06/26/01	35.90		10	8.45	534	367	8.1	51	47	20	1	378	5	58	9.6							0.1	<0.1			<0.1	<0.1									319	321		39	<2	
B211	07/20/01	35.90		16	8.35	517		6.8																																		
B211	08/23/01	26.93		13	7.92	666	427	6.7	49	49	22	2	381	<5	60	11.2							<0.1	<0.1			<0.05	<0.05									317	324		<5	2	
B211	09/20/01	8.08		10	8.48	495		6.3																																		
B211	10/18/01	26.93		12	8.36	648	440	6.7	52	57	25	2	436	<5	65.6	11.4							0.2	<0.1			<0.05	<0.05									358	365		8	<2	
B211	11/21/01	14.81		4	8.31	840		8.4																																		
B211	03/21/02	0.00																																								
B211	05/20/02	5.83		22	8.23	660	449	7.7	49	59	29	2	405	<5	87	13							0.1	<0.1			<0.05	<0.05									339	365		20	2	
B211	08/26/02	0																																								
B211	10/23/02	0.8976		9	8.38	820	467	8.2	56	65	33	1	437	5	98	13							< .1	< .1			< .05	< .05									366	408		11	< 2.	
average		**199**		**10**	**8.36**	**679**	**398**	**8**	**54**	**52**	**24**	**1**	**358**	**15**	**67**	**10**																										
B263	07/09/94	2.6928		21.1	8.27	548		5.8																																		
B263	08/07/94	0																																								
B263	09/23/94	0																																								
B263	10/20/94	3.5904		1	8.44	513		6																																		
B263	06/27/95	260.3		15.6	8.3	468	310	6.9	75.9	25.9	14.4	1.8	286	<2	50	9	0.12	0.001		0.04	<0.003	<0.01	0.83	0.09		<0.01	0.047	0.029	<0.02	<0.001	<0.01		0.03	<0.01	0.05			<0.1	38	<2	
B263	07/21/95	116.69		18.3	8.35	470		8.3																																		
B263	08/17/95	26.928		22.5	7.52	592	330	7	77.2	30.5	15.4	2.6	296	10	11	9	0.68	0.001		0.03	0.009	<0.01	3.86	0.53		<0.01	0.122	0.093	<0.02	<0.001	<0.01		0.08	<0.01	<0.05			0.1	140	<2	
B263	09/19/95	20.196		14	7.75	605		8.5																																		
B263	10/13/95	0																																								
B263	10/30/95	0.033		4	8.19	626		10																																		
B263	05/31/96	60.1		11.1	8.47	401	290	8.1	71.9	26.5	12.3	1.8	290	<2	10	7			0.285				1.97	<0.01			0.085	0.006									290	289	<0.1	72		
B263	06/17/97	448.8		12	8.42	469	290	10.2	71.3	27.1	12.7	2.5	314	<2	20	9							0.22	0.01			0.028	0.016									314	290		<5	<2	
B263	10/29/97	143.6		3.5	8.31	916	270		75	27	14	1.6	320	<10	13	9.9							0.13	<0.01			0.18	0.008									320	300		15	<5	
B263	07/27/98	1.0		13	8.03	705	362		74	29	12	1	392	<5	13	10							0.1	<0.1			<0.1	<0.1									321	304				
B263	10/15/98	8.5		8.9	7.95	538	400		78	32	15	2	393	<5	12	10							0.1	<0.1			<0.1	<0.1									322	327		8	<2	
B263	05/18/99	30		14.5	8.23	553	295		63	23	11	2	318	6	12	8							<0.1	<0.1			<0.1	<0.1									271	252		7	<2	
B263	10/13/99	0.3		7	8.37	405	311		67	30	16	3	352	7	13	9							0.3	<0.1			<0.1	<0.1									300	291		25	<2	
B263	10/18/00	2.69		4	8.15	616	367	8.6	74	28	14	2	384	<5	12	9	<1.	<0.01	<1.	0.1	<0.01	<0.1	<0.1	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01	0.08		<0.03	<0.5	<0.05	315	300		<5	<2	11
B263	05/24/01	125		15	8.5	531	310	7.2	71	23	10	1	335	<5	10	6							0.6	<0.1			<0.1	<0.1									275	272		37	<2	
B263	10/22/01	1.80		8	7.91	440	357		80	30	14	2	411	<5	10.6	11							<0.1	<0.1			<0.05	<0.05									337	323		<5	<2	
B263	05/20/02	0																																								
B263	08/26/02	0																																								
B263	10/23/02	0																																								
B263	06/20/05	448.8		20	8.64	470	300	8	83.4	40.3	12.1	2.1	402	< 5.	14.41	< .5							0.1	< .01			0.027	0.015														
B263	08/27/05	3		15	8.69	700	619		82.2	27	10.6	4.5	435	< 5.	4.53	< .5							0.81	< .01			0.1	0.19									357					
B263	11/07/05	6		4	8.93	530	373	8.4	72.8	23.2	17.1	3.3	351	7.752	14.82	15.9		0.007		0.061			0.264	0.013			0.149	0.121		< .005							313					
B263	05/24/06	80		13	8.55	550	243	9.2	79.2	24.8	12.4	1.9	487	< 5.	13.99	< .5		0.018		0.06			0.25	0.24			0.043	0.05		0.019			5		< .1		400		12		< .5	26.1
B263	08/08/06	0																																								
B263	10/03/06	0																																								
B263	03/19/07	20		5.6	7.84	371	269	11.1	45.6	12.4	10.3	3.8	223	< 10.	8.7	5.3		< .02		< .01			3.726	0.134			0.087	< .005		< .02			0.48		0.1		183		0.4		< 5.	< 10.

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^- mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^- mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/L	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
B263	06/05/07	2		17.7	8.52	564	313	8.2	58.5	27.4	19.5	4.1	355	< 10.	11	5.3		< .02		0.05			2.454	0.035			0.687	0.045		< .02			< .05		0.09		297		< .2		< 5.	< 10.
B263	07/18/07	0																																								
B263	10/11/07	0																																								
B263	06/12/08	150		9.2	8.5	470	307	12.4	75.2	19.6	9	1.7	311	9.6	8	3.3		< .01		< .05			0.236	0.017			0.034	0.023		< .01			0.06		< .05		271		< .2		11.7	< 10.
B263	09/03/08	0																																								
B263	11/03/08	0																																								
B263	05/29/14	0.034		16.8	7.84	633	336		68.6	29.4	14.2	2	362	<5	13	7	<0.03	<0.01	0.275	0.03	<0.001	<0.01	1.26	<0.03	<0.2	<0.005	0.189	0.008	<0.01	<0.02	<0.004											
Average		**53.0**		**11.8**	**8.27**	**547**	**333**		**72.2**	**26.8**	**13.3**	**2.3**	**351**	**8.07**	**13.75**	**8.45**																										
B353	07/09/94	3.5904		20.6	8.34	501		7																																		
B353	08/28/94	4.0392		13.5	9	508	248		62	33	11	2	250	0	31	5	<0.05	0.001		0.03	<0.005	<0.01	0.29	0.02		<0.01	0.02	<0.01	<0.02				<0.02	<0.01	<0.05		250	290			2	
B353	09/23/94	4.488		9.3	8.51	573	296	7.4	66	34	11	2	275	0	29	4	<0.05	0.002		0.02	<0.005	<0.01	0.08	<0.02		<0.01	<0.01	0.01	<0.02	<0.01			<0.02	<0.01	<0.05		275	304	<0.1	<2	2	
B353	05/30/95	197.47		6.1	8.5	566	230	9.8	75.9	27.6	8.1	1.1	275	<2	10	4	<0.03	<0.001		0.02	<0.003	<0.01	0.16	0.03		<0.01	0.015	0.006	<0.02				0.4	<0.01	<0.05				<0.4	<5	<2	
B353	06/27/95	201.96		9.6	8.3	468	280	9	70.2	25.9	8.9	0.9	281	<2	40	4	<0.03	<0.001		0.02	<0.003	<0.01	0.22	<0.01		<0.01	0.018	0.009	<0.02	<0.001	<0.01		0.21	<0.01	<0.05				<0.1	18	<2	
B353	07/21/95	224.4		11.1	8.3	488		10.7																						<0.001	<0.01											
B353	08/17/95	58.344		11.6	7.53	575	300	8.4	73.6	34	9.6	1.1	281	<2	26	3	<0.03	<0.001		0.02	<0.003	<0.01	0.43	<0.01		<0.01	0.02	0.008	<0.02				0.06	<0.01	<0.05				0.05	24	<2	
B353	09/19/95	40.392		10.2	8.02	555		8.6																						<0.002	<0.01											
B353	10/13/95	18.85		6.2	8.47	574																																				
B353	10/30/95	21.991		4.8	8.48	549		9.9																																		
B353	11/28/95	12.118		0	5.57	650		10.8																																		
B353	03/27/96	0																																								
B353	05/31/96	9.87		10.1	9.41	354	270	8.2	60.1	30	9	1	253	<2	30	3			0.103				0.09	0.01			<0.005	0.005									253	274	<0.1	<5		
B353	10/02/96	0.00																																								
B353	04/30/97	0																																								
B353	06/17/97	130		6.1	7.6	523	290	12	72.1	31.5	8.8	0.9	308	<2	30	5							0.21	<0.01			0.011	<0.005									308	310		8	<2	
B353	10/29/97	0.45		4	8.26	666	310		70	29	9	1	360	<10	32	3.6							0.06	<0.01			<0.005	<0.005									360	290		<1	<5	
B353	03/23/98	0																																								
B353	05/27/98	673		10.5	8.47	641	330		71	24	8	<1	373	<5	22	5							0.4	<0.1			<0.1	<0.1									306	276		28	<2	
B353	10/15/98	21.5		6	8.01	490	363		69	32	9	1	344	<5	33	5							0.3	<0.1			<0.1	<0.1									82	304		15	<2	
B353	03/30/99	0																																								
B353	05/18/99	15		11	8.07	491	293		61	25	7	1	309	<5	29	3							0.1	<0.1			<0.1	<0.1									253	255		7	<2	
B353	10/13/99	2		6	8.12	371	314		70	30	12	<1	356	<5	30	4							<0.1	<0.1			<0.1	<0.1									291	298		13	<2	
B353	03/29/00	0																																								
B353	10/18/00	8.98		7	8.31	597	318	8.6	62	32	11	1	339	<5	30	5		<0.01	<1.	0.1	<0.01	<0.1	<0.1	<0.1			<0.1	<0.1	<0.1	<0.01	<0.01	<0.03		<0.03	<0.5	<0.05	278	287		9	<2	
B353	05/24/01	125.7		12	8.31	540	296	7.4	58	29	8	<1	333	<5	25	4							0.2	<0.1			<0.1	<0.1									273	264		15	<2	
B353	10/22/01	14.8		7	8.33	385	348		64	34	10	1	350	<5	32.2	4.9							<0.1	<0.1			<0.05	<0.05									287	300		5	<2	
B353	05/20/02	1.35		14	7.94	517	347		62	32	11	<1	336	<5	39	5							<0.1	<0.1			<0.05	<0.05									275	287		13	<2	
B353	08/26/02	0																																								
B353	10/23/02	1.3464		7	8.1	745	357		69	36	11	< 1.	365	< 5.	49	5							< .1	< .1			< .05	< .05									300	321		< 5.	< 2.	
B353	05/29/14	1.40		13.6	8.14	633	375	7.65	76.9	35.1	10.3	2.4	384	<5	38	6	<0.03	<0.01	0.121	0.01	<0.001	0.03	0.64	<0.03	<0.2	<0.005	0.103	0.003	<0.01	<0.02	0.026		0.14	<0.05	<0.1	<0.05	315	379	0.2	86	<5	<5
Average		**57.9**		**9.05**	**8.17**	**540**	**309**	**8.96**	**67.4**	**30.8**	**9.59**	**1.3**	**320.7**	**0**	**30.84**	**4.36**																										
Stock Watering Ponds																																										
31-1	11/03/08	0																																								
31-1	09/03/08	0																																								
31-1	06/12/08	0																																								
31-1	10/11/07	0																																								
31-1	07/18/07	0																																								
31-1	06/05/07	0																																								
31-1	03/19/07	0																																								
31-1	10/12/06	0																																								
31-1	08/08/06																																									
31-1	05/24/06	0																																								
31-1	11/01/05	0																																								
31-1	08/27/05	0																																								
31-1	06/20/05	0																																								
31-1	12/22/80	---		2	8.3	198	200		54	13.2	5.9	12	185	31.2	7	4		0.002	0.018	0.005	<0.001	0.01	1.6	0.06	<0.0002		1.05	0.005	<0.001	<0.001	0.007				<0.01	0.08	204				26.2	<0.1
Average		**0**		**2**	**8.3**	**198**	**200**		**54**	**13.2**	**5.9**	**12**	**185**	**31.2**	**7**	**4**																										

Site	Date	Flow gpm	W.L. feet	T °C	pH S.U.	Cond. µS/cm	TDS mg/L	D.O. mg/l	Ca^{2+} mg/L	Mg^{2+} mg/L	Na^{+} mg/L	K^{+} mg/L	HCO_3^{-} mg/L	CO_3^{2-} mg/L	SO_4^{2-} mg/L	Cl^{-} mg/L	Al (D) mg/l	As (D) mg/L	Ba (D) mg/l	B (D) mg/L	Cd (D) mg/L	Cu (D) mg/l	Fe (T) mg/L	Fe (D) mg/L	Hg (D) ug/L	Mb (D) mg/L	Mn (T) mg/L	Mn (D) mg/L	Pb (D) mg/L	Se (D) mg/L	Zn (D) mg/l	NO_3+NO_2 mg/L (N)	NO3 mg/L	NO_2 mg/L	NH3 mg/l	PO_4 mg/L	T Alk. mg/L	Hard. mg/L	S Sol. ml/l	TSS mg/L	O&G mg/L	Acid. mg/l
32-1	12/22/80	---		2	7.3	262	265		44	30	9	15	317	<0.01	<3.0	10		<0.001	0.040	0.015	<0.001	0.02	0.36	0.06	<0.0001		0.135	0.12	<0.001	<0.001	0.015				0.2	0.08	260				15	6
36-1	12/22/80	---		2	8.0	205	220		54	13.2	29	11	185	31	<3.0	4		0.002	0.022	0.016	<0.001	0.01	0.49	0.06	<0.0002		0.475	0.195	<0.001	<0.001	0.007				<0.01	0.13	214				24.2	<0.1

Wells

B331	07/30/96	6274.3
B331	07/08/97	6290.5
B331	10/31/97	6288.2
B331	05/28/98	6292.8
B331	07/22/98	6292.8
B331	10/19/98	6290.5
B331	03/31/99	6313.6
B331	07/23/99	6318.2
B331	10/14/99	6372.2
B331	07/21/00	6369.6
B331	10/19/00	6368.6
B331	05/30/01	6367.4
B331	07/24/01	6367
B331	10/17/01	6366.7
B331	05/28/02	6366.2
B331	07/29/02	6365.8
B331	09/27/02	6365.8
B331	10/31/02	6365.8
B331A	07/30/96	6871.2
B331A	07/08/97	6810.3
B331A	10/31/97	6812
B331A	05/28/98	6812.2
B331A	07/22/98	6811.5
B331A	10/19/98	6808.9
B331A	03/31/99	6812.1
B331A	07/23/99	6811.2
B331A	10/14/99	6809.1
B331A	07/21/00	6808.4
B331A	10/19/00	6808.2
B331A	05/30/01	6808.2
B331A	07/24/01	6808
B331A	10/17/01	6808
B331A	05/28/02	6807.8
B331A	07/29/02	6807.6
B331A	09/27/02	6809.8
B331A	10/31/02	6807.8

In-Mine Groundwater

Aberdeen Mine groundwater sample										
	7/2001	3644	76	69	807	36	884	<0.1	1283	95
Pinacle Mine groundwater sample										
	7/2001	3279	67	74	409	35	862	<0.1	549	81

Table 3 Isotopic compositions and radiocarbon ages of groundwaters, surface waters, and in-mine groundwaters.

Sampling Site	Date	Data Source	$\delta^{18}O$ ‰	$\delta^{2}H$ (‰)	$\delta^{34}S$ ‰	$\delta^{13}C$ ‰	^{3}H (TU)	^{14}C (pmc)	radiocarbon age
Springs									
North Horn Formation									
B341	15-Oct-98	Willow Creek Mine MRP	-15.33	-116.07	-16.6	-9.6	16	82.66	modern
B262	15-Oct-98	Willow Creek Mine MRP	-15.04	-114.2	+4.0	-15.2	15.7	98.92	modern
Price River Formation									
B41	15-Oct-98	Willow Creek Mine MRP	-14.87	-114.92	+11.2	-12.1	19.6	101.2	modern
B41	19-May-99	Willow Creek Mine MRP	-16.25	-121.09		-10.6	8.17	55.85	modern
Surface Water									
B353	15-Oct-98	Willow Creek Mine MRP	-14.75	-113.9					
B211	01-Oct-97	Willow Creek Mine MRP	-14.40	-110.16					
B211	16-Oct-98	Willow Creek Mine MRP	-14.57	-113.82					
B263	15-Oct-98	Willow Creek Mine MRP	-14.65	-112.91					
Underground in-mine water									
Aberdeen Mine	July 2001	Tower Mine MRP				-13.1	0.18	9.01	15,000 years
Pinacle Mine	July 2001	Tower Mine MRP				-10.1	0.28	10.79	13,000 years

Appendix

Laboratory reporting sheets

SGS Minerals Service Laboratories

Huntington, Utah

Analysis Report

June 26, 2014

ANDALEX RESOURCES INC
ACCOUNTS PAYABLE
46226 NATIONAL ROAD W
SAINT CLAIRSVILLE OH 43950

Client Sample ID:	B351	Sample ID By:	Andalex Resource Inc.
Date Sampled:	May 29, 2014	Sample Taken At:	B351
Date Received:	May 29, 2014	Sample Taken By:	E.P.
Product Description:	WATER	Time Received:	2130
		Time Sampled:	1445

Comments: Dissolved Metals Filtered at Lab

SGS Minerals Sample ID: 782-1424509-001

TESTS	RESULT	UNIT	METHOD	REPORTING LIMIT	ANALYZED DATE	ANALYZED TIME	ANALYST
Hardness, mg equivalent CaCO3/L	404	mg/L	SM2340-B	1	2014-06-10	11:00:52	AL
Anions	7.73	meq/L	SM1030E	0	2014-06-20	09:00:49	AL
Balance	-3.63	%	SM1030E	-10	2014-06-20	09:00:49	AL
Cations	7.19	meq/L	SM1030E	0	2014-06-20	09:00:49	AL
Acidity	14	mg/L	D1067	5	2014-06-09	10:45:00	AL
Alkalinity, mg CaCO3/L (pH 4.5)	279	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Carbonate Alkalinity as CaCO3	<5	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Bicarbonate Alkalinity as CaCO3	279	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Nitrogen, Ammonia	<0.1	mg/L	SM4500-B-D	0.1	2014-06-04	07:30:00	AL
pH	7.38		SM4500-H	0.01	2014-05-30	13:20:00	AL
pH Temperature	20.10	°C	SM4500-H	0.01	2014-05-30	13:20:00	AL
Conductivity	757	µmhos/cm	SM2510	0.1	2014-05-30	13:20:00	AL
Total Dissolved Solids	454	mg/L	SM2540-C	30	2014-06-03	15:30:00	AL
Settleable Solids	<0.1	mL/L	SM2540-F a	0.1	2014-05-30	10:45:00	AL
Nitrate	0.66	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Nitrite	<0.05	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Chloride, Cl	5	mg/L	EPA 300.0	1	2014-05-30	22:50:00	AL
Sulfate, SO4	96	mg/L	EPA 300.0	1	2014-05-30	22:50:00	AL
Ortho-Phosphate-P	<0.05	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Fluoride, Fl	0.15	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Mercury, Hg - Total	<0.2	µg/L	EPA 245.1	0.2	2014-06-10	13:46:00	AL
Phosphorus, Total	<0.05	mg/L	SM4500-P E	0.05	2014-06-05	07:15:00	AL
METALS BY ICP							
Aluminum, Al - Dissolved	<0.03	mg/L	EPA 200.7	0.03	2014-06-06	16:53:00	AL

Lab Supervisor

Domenic Ibanez
Lab Supervisor

SGS North America Inc. | Minerals Services Division
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SGS

Analysis Report

June 26, 2014

ANDALEX RESOURCES INC
ACCOUNTS PAYABLE
46226 NATIONAL ROAD W
SAINT CLAIRSVILLE OH 43950

Client Sample ID:	B351	Sample ID By:	Andalex Resource Inc.
Date Sampled:	May 29, 2014	Sample Taken At:	B351
Date Received:	May 29, 2014	Sample Taken By:	E.P.
Product Description:	WATER	Time Received:	2130
		Time Sampled:	1445

Comments: Dissolved Metals Filtered at Lab

SGS Minerals Sample ID: 782-1424509-001

TESTS	RESULT	UNIT	METHOD	REPORTING LIMIT	ANALYZED DATE	ANALYZED TIME	ANALYST
METALS BY ICP (continued)							
Arsenic, As - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Boron, B - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Barium, Ba - Dissolved	0.120	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Cadmium, Cd - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Calcium, Ca - Dissolved	80.28	mg/L	EPA 200.7	0.03	2014-06-06	16:53:00	AL
Chromium, Cr - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Copper, Cu - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Iron, Fe - Dissolved	<0.03	mg/L	EPA 200.7	0.03	2014-06-06	16:53:00	AL
Iron, Fe - Total	<0.05	mg/L	EPA 200.7	0.05	2014-06-08	21:08:00	AL
Lead, Pb - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Magnesium, Mg - Dissolved	31.85	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Manganese, Mn - Dissolved	<0.002	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Manganese, Mn - Total	<0.002	mg/L	EPA 200.7	0.002	2014-06-08	21:08:00	AL
Molybdenum, Mo - Dissolved	<0.005	mg/L	EPA 200.7	0.005	2014-06-06	16:53:00	AL
Nickel, Ni - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Potassium, K - Dissolved	1.15	mg/L	EPA 200.7	0.14	2014-06-06	16:53:00	AL
Selenium, Se - Dissolved	<0.02	mg/L	EPA 200.7	0.02	2014-06-06	16:53:00	AL
Silver, Ag - Dissolved	<0.002	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Sodium, Na - Dissolved	12.21	mg/L	EPA 200.7	0.09	2014-06-06	16:53:00	AL
Zinc, Zn - Dissolved	<0.004	mg/L	EPA 200.7	0.004	2014-06-06	16:53:00	AL

Lab Supervisor

Domenic Ibanez
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SGS

Analysis Report

June 26, 2014

ANDALEX RESOURCES INC
ACCOUNTS PAYABLE
46226 NATIONAL ROAD W
SAINT CLAIRSVILLE OH 43950

Client Sample ID:	B353	Sample ID By:	Andalex Resource Inc.
Date Sampled:	May 29, 2014	Sample Taken At:	B353
Date Received:	May 29, 2014	Sample Taken By:	E.P.
Product Description:	WATER	Time Received:	2130
		Time Sampled:	1545
Comments:	Dissolved Metals Filtered at Lab		

SGS Minerals Sample ID: 782-1424509-002

TESTS	RESULT	UNIT	METHOD	REPORTING LIMIT	ANALYZED DATE	ANALYZED TIME	ANALYST
Hardness, mg equivalent CaCO3/L	379	mg/L	SM2340-B	1	2014-06-10	11:00:53	AL
Oil and Grease, (HEM)	<5	mg/L	EPA 1664A	5	2014-06-05	08:00:00	AL
Anions	7.24	meq/L	SM1030E	0	2014-06-20	09:00:49	AL
Balance	-0.05	%	SM1030E	-10	2014-06-20	09:00:49	AL
Cations	7.24	meq/L	SM1030E	0	2014-06-20	09:00:49	AL
Acidity	<5	mg/L	D1067	5	2014-06-09	10:45:00	AL
Alkalinity, mg CaCO3/L (pH 4.5)	315	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Carbonate Alkalinity as CaCO3	<5	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Bicarbonate Alkalinity as CaCO3	315	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Nitrogen, Ammonia	<0.1	mg/L	SM4500-B-D	0.1	2014-06-04	07:30:00	AL
pH	8.16		SM4500-H	0.01	2014-05-30	13:22:00	AL
pH Temperature	20.10	°C	SM4500-H	0.01	2014-05-30	13:22:00	AL
Conductivity	645	µmhos/cm	SM2510	0.1	2014-05-30	13:20:00	AL
Total Dissolved Solids	375	mg/L	SM2540-C	30	2014-06-03	15:30:00	AL
Total Suspended Solids	86	mg/L	SM2540-D	5	2014-06-03	15:30:00	AL
Settleable Solids	0.2	mL/L	SM2540-F a	0.1	2014-05-30	10:45:00	AL
Nitrate	0.14	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Nitrite	<0.05	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Chloride, Cl	6	mg/L	EPA 300.0	1	2014-05-30	22:50:00	AL
Sulfate, SO4	38	mg/L	EPA 300.0	1	2014-05-30	22:50:00	AL
Ortho-Phosphate-P	<0.05	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Fluoride, Fl	0.20	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Mercury, Hg - Total	<0.2	µg/L	EPA 245.1	0.2	2014-06-10	13:46:00	AL
Phosphorus, Total	0.16	mg/L	SM4500-P E	0.05	2014-06-05	07:15:00	AL

Lab Supervisor

Domenic Ibanez
Lab Supervisor

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SGS

Analysis Report

June 26, 2014

ANDALEX RESOURCES INC
ACCOUNTS PAYABLE
46226 NATIONAL ROAD W
SAINT CLAIRSVILLE OH 43950

Client Sample ID:	B353	Sample ID By:	Andalex Resource Inc.
Date Sampled:	May 29, 2014	Sample Taken At:	B353
Date Received:	May 29, 2014	Sample Taken By:	E.P.
Product Description:	WATER	Time Received:	2130
		Time Sampled:	1545
Comments:	Dissolved Metals Filtered at Lab		

SGS Minerals Sample ID: 782-1424509-002

TESTS	RESULT	UNIT	METHOD	REPORTING LIMIT	ANALYZED DATE	ANALYZED TIME	ANALYST
METALS BY ICP							
Aluminum, Al - Dissolved	<0.03	mg/L	EPA 200.7	0.03	2014-06-06	16:53:00	AL
Arsenic, As - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Boron, B - Dissolved	0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Barium, Ba - Dissolved	0.121	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Cadmium, Cd - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Calcium, Ca - Dissolved	76.91	mg/L	EPA 200.7	0.03	2014-06-06	16:53:00	AL
Chromium, Cr - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Copper, Cu - Dissolved	0.03	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Iron, Fe - Dissolved	<0.03	mg/L	EPA 200.7	0.03	2014-06-06	16:53:00	AL
Iron, Fe - Total	0.64	mg/L	EPA 200.7	0.05	2014-06-08	21:08:00	AL
Lead, Pb - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Magnesium, Mg - Dissolved	35.13	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Manganese, Mn - Dissolved	0.003	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Manganese, Mn - Total	0.103	mg/L	EPA 200.7	0.002	2014-06-08	21:08:00	AL
Molybdenum, Mo - Dissolved	<0.005	mg/L	EPA 200.7	0.005	2014-06-06	16:53:00	AL
Nickel, Ni - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Potassium, K - Dissolved	2.38	mg/L	EPA 200.7	0.14	2014-06-06	16:53:00	AL
Selenium, Se - Dissolved	<0.02	mg/L	EPA 200.7	0.02	2014-06-06	16:53:00	AL
Silver, Ag - Dissolved	<0.002	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Sodium, Na - Dissolved	10.29	mg/L	EPA 200.7	0.09	2014-06-06	16:53:00	AL
Zinc, Zn - Dissolved	0.026	mg/L	EPA 200.7	0.004	2014-06-06	16:53:00	AL

Lab Supervisor

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SGS

Analysis Report

June 26, 2014

ANDALEX RESOURCES INC
ACCOUNTS PAYABLE
46226 NATIONAL ROAD W
SAINT CLAIRSVILLE OH 43950

Client Sample ID:	B263	Sample ID By:	Andalex Resource Inc.
Date Sampled:	May 29, 2014	Sample Taken At:	B263
Date Received:	May 29, 2014	Sample Taken By:	E.P.
Product Description:	WATER	Time Received:	2130
		Time Sampled:	1745

Comments: Dissolved Metals Filtered at Lab

SGS Minerals Sample ID: 782-1424509-003

TESTS	RESULT	UNIT	METHOD	REPORTING LIMIT	ANALYZED DATE	ANALYZED TIME	ANALYST
Hardness, mg equivalent CaCO3/L	358	mg/L	SM2340-B	1	2014-06-10	11:00:55	AL
Anions	6.41	meq/L	SM1030E	0	2014-06-20	09:00:49	AL
Balance	0.79	%	SM1030E	-10	2014-06-20	09:00:49	AL
Cations	6.51	meq/L	SM1030E	0	2014-06-20	09:00:49	AL
Acidity	11	mg/L	D1067	5	2014-06-09	10:45:00	AL
Alkalinity, mg CaCO3/L (pH 4.5)	297	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Carbonate Alkalinity as CaCO3	<5	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Bicarbonate Alkalinity as CaCO3	297	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Nitrogen, Ammonia	0.4	mg/L	SM4500-B-D	0.1	2014-06-04	07:30:00	AL
pH	8.13		SM4500-H	0.01	2014-05-30	13:25:00	AL
pH Temperature	20.20	°C	SM4500-H	0.01	2014-05-30	13:25:00	AL
Conductivity	599	µmhos/cm	SM2510	0.1	2014-05-30	13:20:00	AL
Total Dissolved Solids	336	mg/L	SM2540-C	30	2014-06-03	15:30:00	AL
Settleable Solids	0.5	mL/L	SM2540-F a	0.1	2014-05-30	10:45:00	AL
Nitrate	0.29	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Nitrite	<0.05	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Chloride, Cl	7	mg/L	EPA 300.0	1	2014-05-30	22:50:00	AL
Sulfate, SO4	13	mg/L	EPA 300.0	1	2014-05-30	22:50:00	AL
Ortho-Phosphate-P	<0.05	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Fluoride, Fl	0.29	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Mercury, Hg - Total	<0.2	µg/L	EPA 245.1	0.2	2014-06-10	13:46:00	AL
Phosphorus, Total	0.64	mg/L	SM4500-P E	0.05	2014-06-05	07:15:00	AL
METALS BY ICP							
Aluminum, Al - Dissolved	<0.03	mg/L	EPA 200.7	0.03	2014-06-06	16:53:00	AL

Lab Supervisor

Domenic Ibanez
Lab Supervisor

SGS North America Inc. | Minerals Services Division
2035 North Airport Road Huntington UT 84528 t (435) 653-2311 f (435)-653-2436 www.sgs.com/minerals

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SGS

Analysis Report

June 26, 2014

ANDALEX RESOURCES INC
ACCOUNTS PAYABLE
46226 NATIONAL ROAD W
SAINT CLAIRSVILLE OH 43950

Client Sample ID:	B263	Sample ID By:	Andalex Resource Inc.
Date Sampled:	May 29, 2014	Sample Taken At:	B263
Date Received:	May 29, 2014	Sample Taken By:	E.P.
Product Description:	WATER	Time Received:	2130
		Time Sampled:	1745
Comments:	Dissolved Metals Filtered at Lab		

SGS Minerals Sample ID: 782-1424509-003

TESTS	RESULT	UNIT	METHOD	REPORTING LIMIT	ANALYZED DATE	ANALYZED TIME	ANALYST
METALS BY ICP (continued)							
Arsenic, As - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Boron, B - Dissolved	0.03	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Barium, Ba - Dissolved	0.275	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Cadmium, Cd - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Calcium, Ca - Dissolved	68.56	mg/L	EPA 200.7	0.03	2014-06-06	16:53:00	AL
Chromium, Cr - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Copper, Cu - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Iron, Fe - Dissolved	<0.03	mg/L	EPA 200.7	0.03	2014-06-06	16:53:00	AL
Iron, Fe - Total	1.26	mg/L	EPA 200.7	0.05	2014-06-08	21:08:00	AL
Lead, Pb - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Magnesium, Mg - Dissolved	29.40	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Manganese, Mn - Dissolved	0.008	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Manganese, Mn - Total	0.189	mg/L	EPA 200.7	0.002	2014-06-08	21:08:00	AL
Molybdenum, Mo - Dissolved	<0.005	mg/L	EPA 200.7	0.005	2014-06-06	16:53:00	AL
Nickel, Ni - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Potassium, K - Dissolved	1.95	mg/L	EPA 200.7	0.14	2014-06-06	16:53:00	AL
Selenium, Se - Dissolved	<0.02	mg/L	EPA 200.7	0.02	2014-06-06	16:53:00	AL
Silver, Ag - Dissolved	<0.002	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Sodium, Na - Dissolved	14.20	mg/L	EPA 200.7	0.09	2014-06-06	16:53:00	AL
Zinc, Zn - Dissolved	<0.004	mg/L	EPA 200.7	0.004	2014-06-06	16:53:00	AL

Lab Supervisor

Domenic Ibanez
Lab Supervisor

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SGS

Analysis Report

June 26, 2014

ANDALEX RESOURCES INC
ACCOUNTS PAYABLE
46226 NATIONAL ROAD W
SAINT CLAIRSVILLE OH 43950

Client Sample ID:	B262	Sample ID By:	Andalex Resource Inc.
Date Sampled:	May 29, 2014	Sample Taken At:	B262
Date Received:	May 29, 2014	Sample Taken By:	E.P.
Product Description:	WATER	Time Received:	2130
		Time Sampled:	1815
Comments:	Dissolved Metals Filtered at Lab		

SGS Minerals Sample ID: 782-1424509-004

TESTS	RESULT	UNIT	METHOD	REPORTING LIMIT	ANALYZED DATE	ANALYZED TIME	ANALYST
Hardness, mg equivalent CaCO3/L	335	mg/L	SM2340-B	1	2014-06-10	11:00:57	AL
Anions	6.82	meq/L	SM1030E	0	2014-06-25	11:12:18	AL
Balance	-0.06	%	SM1030E	-10	2014-06-25	11:12:18	AL
Cations	6.81	meq/L	SM1030E	0	2014-06-25	11:12:18	AL
Acidity	12	mg/L	D1067	5	2014-06-09	10:45:00	AL
Alkalinity, mg CaCO3/L (pH 4.5)	314	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Carbonate Alkalinity as CaCO3	<5	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Bicarbonate Alkalinity as CaCO3	314	mg/L	SM2320-B	5	2014-06-09	08:45:00	AL
Nitrogen, Ammonia	<0.1	mg/L	SM4500-B-D	0.1	2014-06-04	07:30:00	AL
pH	7.69		SM4500-H	0.01	2014-05-30	13:27:00	AL
pH Temperature	19.90	°C	SM4500-H	0.01	2014-05-30	13:27:00	AL
Conductivity	637	µmhos/cm	SM2510	0.1	2014-05-30	13:20:00	AL
Total Dissolved Solids	355	mg/L	SM2540-C	30	2014-06-03	15:30:00	AL
Settleable Solids	<0.1	mL/L	SM2540-F a	0.1	2014-05-30	10:45:00	AL
Nitrate	<0.05	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Nitrite	<0.05	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Chloride, Cl	7	mg/L	EPA 300.0	1	2014-05-30	22:50:00	AL
Sulfate, SO4	17	mg/L	EPA 300.0	1	2014-05-30	22:50:00	AL
Ortho-Phosphate-P	<0.05	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Fluoride, Fl	0.20	mg/L	EPA 300.0	0.05	2014-05-30	22:50:00	AL
Mercury, Hg - Total	<0.2	µg/L	EPA 245.1	0.2	2014-06-10	13:46:00	AL
Phosphorus, Total	0.09	mg/L	SM4500-P E	0.05	2014-06-05	07:15:00	AL
METALS BY ICP							
Aluminum, Al - Dissolved	<0.03	mg/L	EPA 200.7	0.03	2014-06-06	16:53:00	AL

Lab Supervisor

Domenic Ibanez
Lab Supervisor

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Analysis Report

June 26, 2014

ANDALEX RESOURCES INC
ACCOUNTS PAYABLE
46226 NATIONAL ROAD W
SAINT CLAIRSVILLE OH 43950

Client Sample ID:	B262	Sample ID By:	Andalex Resource Inc.
Date Sampled:	May 29, 2014	Sample Taken At:	B262
Date Received:	May 29, 2014	Sample Taken By:	E.P.
Product Description:	WATER	Time Received:	2130
		Time Sampled:	1815
Comments:	Dissolved Metals Filtered at Lab		

SGS Minerals Sample ID: 782-1424509-004

TESTS	RESULT	UNIT	METHOD	REPORTING LIMIT	ANALYZED DATE	ANALYZED TIME	ANALYST
METALS BY ICP (continued)							
Arsenic, As - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Boron, B - Dissolved	0.02	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Barium, Ba - Dissolved	0.214	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Cadmium, Cd - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Calcium, Ca - Dissolved	77.59	mg/L	EPA 200.7	0.03	2014-06-24	20:16:00	AL
Chromium, Cr - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Copper, Cu - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Iron, Fe - Dissolved	<0.03	mg/L	EPA 200.7	0.03	2014-06-06	16:53:00	AL
Iron, Fe - Total	0.19	mg/L	EPA 200.7	0.05	2014-06-08	21:08:00	AL
Lead, Pb - Dissolved	<0.01	mg/L	EPA 200.7	0.01	2014-06-06	16:53:00	AL
Magnesium, Mg - Dissolved	26.61	mg/L	EPA 200.7	0.01	2014-06-24	20:16:00	AL
Manganese, Mn - Dissolved	<0.002	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Manganese, Mn - Total	0.027	mg/L	EPA 200.7	0.002	2014-06-08	21:08:00	AL
Molybdenum, Mo - Dissolved	<0.005	mg/L	EPA 200.7	0.005	2014-06-06	16:53:00	AL
Nickel, Ni - Dissolved	<0.001	mg/L	EPA 200.7	0.001	2014-06-06	16:53:00	AL
Potassium, K - Dissolved	2.47	mg/L	EPA 200.7	0.14	2014-06-24	20:16:00	AL
Selenium, Se - Dissolved	<0.02	mg/L	EPA 200.7	0.02	2014-06-06	16:53:00	AL
Silver, Ag - Dissolved	<0.002	mg/L	EPA 200.7	0.002	2014-06-06	16:53:00	AL
Sodium, Na - Dissolved	15.72	mg/L	EPA 200.7	0.09	2014-06-24	20:16:00	AL
Zinc, Zn - Dissolved	<0.004	mg/L	EPA 200.7	0.004	2014-06-06	16:53:00	AL

Lab Supervisor

Domenic Ibanez
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Analysis Report

July 02, 2014

ANDALEX RESOURCES INC
ACCOUNTS PAYABLE
46226 NATIONAL ROAD W
SAINT CLAIRSVILLE OH 43950

Client Sample ID:	B 342	Sample ID By:	Andalex Resource Inc.
Date Sampled:	Jun 23, 2014	Sample Taken At:	B 342
Date Received:	Jun 24, 2014	Sample Taken By:	KO
Product Description:	WATER	Time Received:	1524
		Time Sampled:	1530
		Field - pH:	8.4 pH
		Field - Flow:	0.25 GPM
		Field - Conductivity:	704 UMHOS/CM
		Field - Temperature:	19.4 DEG. C

Comments: Dissolved Metals Filtered at Lab

SGS Minerals Sample ID: 782-1424898-001

TESTS	RESULT	UNIT	METHOD	REPORTING LIMIT	ANALYZED DATE	ANALYZED TIME	ANALYST
Hardness, mg equivalent CaCO3/L	333	mg/L	SM2340-B	1	2014-07-01	08:57:41	AL
Anions	7.73	meq/L	SM1030E	0	2014-07-01	08:57:41	AL
Balance	-1.52	%	SM1030E	-10	2014-07-01	08:57:41	AL
Cations	7.50	meq/L	SM1030E	0	2014-07-01	08:57:41	AL
Alkalinity, mg CaCO3/L (pH 4.5)	325	mg/L	SM2320-B	5	2014-06-26	10:40:00	AL
Carbonate Alkalinity as CaCO3	<5	mg/L	SM2320-B	5	2014-06-26	10:40:00	AL
Bicarbonate Alkalinity as CaCO3	325	mg/L	SM2320-B	5	2014-06-26	10:40:00	AL
Total Dissolved Solids	414	mg/L	SM2540-C	30	2014-06-27	13:35:00	AL
Chloride, Cl	8	mg/L	EPA 300.0	1	2014-06-26	05:31:00	AL
Sulfate, SO4	49	mg/L	EPA 300.0	1	2014-06-26	05:31:00	AL
METALS BY ICP							
Calcium, Ca - Dissolved	81.09	mg/L	EPA 200.7	0.03	2014-06-26	10:59:00	AL
Iron, Fe - Dissolved	<0.03	mg/L	EPA 200.7	0.03	2014-06-26	10:59:00	AL
Iron, Fe - Total	1.31	mg/L	EPA 200.7	0.05	2014-06-26	12:09:00	AL
Magnesium, Mg - Dissolved	31.65	mg/L	EPA 200.7	0.01	2014-06-26	10:59:00	AL
Manganese, Mn - Dissolved	<0.002	mg/L	EPA 200.7	0.002	2014-06-26	10:59:00	AL
Manganese, Mn - Total	0.106	mg/L	EPA 200.7	0.002	2014-06-26	12:09:00	AL
Potassium, K - Dissolved	4.19	mg/L	EPA 200.7	0.14	2014-06-26	10:59:00	AL
Sodium, Na - Dissolved	16.99	mg/L	EPA 200.7	0.09	2014-06-26	10:59:00	AL

Lab Supervisor

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