STATE OF IDAHO
DEPARTMENT OF
ENVIRONMENTAL QUALITY

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C.L. "Butch" Otter, Governor
Toni Hardesty, Director

16 Mar 07

Robert Geddes
Monsanto P4 Production
P. O. Box 816
Soda Springs, ID 83276

Re: P4 Production Southeast Idaho Mine-Specific Selenium Program Monitoring Well Installation Technical Memorandum for Final 2005 Phase II Supplemental SI Groundwater Work Plan, Version 5

Dear Bob,

This letter transmits the approval of the *Draft Monitoring Well Installation Technical Memorandum for Final 2005 Phase II Supplemental SI Groundwater Work Plan, Version 5* (GW Tech Memo) prepared by Montgomery Watson Harza with the following minor revisions.

In Appendix J, Comments Resolution, Comment 21,

Page 9, Paragraph 1, Line 4. The statement that the regional investigation was for the IMA from 1997-2002 is misleading since the State took authority for the regional investigation in August 2000. Please correct the sentence.

It was stated the comment was accepted, but it appears that no change was made. Please make the change.

Page 10, Section 3.0, Paragraph 5. Please delete the last three sentences beginning with the sentence "By reporting . . ."

Page 52, Table 7.1. The EDL for lead changed between versions 4 and 5? The new EDL is unacceptable as it is above the state groundwater quality standard of 0.015 mg/L.

Page 52, Table 7.1. Nitrogen (total Kjeldahl) was dropped as a parameter between versions 4 and 5? Please include.

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Please incorporate these changes, which should require replacing only two pages in the document. In addition to the two pages for replacement in Version 5, please include a revised electronic copy of the report.

In the cover letter to the GW Tech Memo, there were four issues listed: seep, spring, headwater stream provenance; reporting limits greater than standards; reformatting of tables; and, faults always being barriers to flow. Your clarification for the provenance, reformatting, and faults issues are fine and accepted. You asked for further direction on the comment on the assumption of a concentration being at the standard when the standard is below the reporting limit for censored datum. We have been in conversation and direction on this issue will be forthcoming.

In addition, there are several other comments, mostly editorial in nature, that you can choose whether or not to include in future documents (see enclosed). It was felt that calling attention to these additional changes might facilitate incorporation of sections of the GW Tech Memo, Version 5, in subsequent documents. Please let me know if you have any questions.

Sincerely,

Mike Rowe

Mike Rowe
Regional Mining Project Manager

cc: Bill Wright (MWH)
Doug Tanner, Trina Judkins (IDEQ)
Jeff Jones, Will Frymire, Mary Kauffman (C-TNF, Soda Springs)
Jeff Cundick (BLM, Pocatello)
Allen Ruberry (IDL, Idaho Falls)
Christina Cutler (Shoshone-Bannock Tribes)
Sandi Arena (USFWS, Pocatello)
Dave Tomten (EPA, Boise)
File copy/Monsanto/Correspondence

Additional Comments to Monitoring Well Installation Technical Memorandum for Final 2005 Phase II Supplemental SI Groundwater Work Plan, Version 5 (for incorporation into future documents at P4's discretion)

General Comments

Wells were referred to as monitor wells (e.g., Activity 3b-3, Section 5.2, Section 5.3) and monitoring wells. Please be consistent.

Most of the time EVM North Dump is identified as MWD092 and the EVM South Dump is referred to as MWD091 (e.g., Table 3.1, Section 4.1.1, Section 5.1) when it looks like they should be reversed.

Specific Comments

Page 6, Paragraph 4, Line 5. The sentence beginning "The study included . . ." seems out of place.

Page 10, Section 3.0, Paragraph 3, Line 4. Eliminate the period after *inexactly*.

Page 17, Section 3.1.2, Paragraph 2, Line 7. Should rehabilitee be rehabilitate?

Page 25, Section 3.2.6, Paragraph 1, Line 4. *Due* should be do.

Page 27, 1st full paragraph, Line 3. It appears that area should be inserted to read ". . . program area are included . . ."

Page 27, 3rd full paragraph, Line 4. It appears that the last *the* should be deleted to read ". . . excavated to contact . . ."

Page 28, Section 4.2.1, Paragraph 1. Should dump WRD089 be MWD086?

Page 29, Section 4.2.2, Paragraph 2, Line 3. It appears that area should be inserted to read ". . . program area are included . . ."

Page 32, Section 4.3.3, Paragraph 2, Line 2. *Effect* should be affect.

Page 32, Section 4.3.3, Paragraph 3, Line 5. Change the sentence to read "The waste dumps (MWD080, MWD081) located west of the West Ballard Pit (MMP035) . . ."

Page 32, Section 4.3.3, Paragraph 5, Line 1. *Place* should be placed.

Page 33, Table 4.1. Monitoring well MMW009 is found under both Enoch Valley and Henry mines and should probably be listed only under EV mine.

Page 43, Table 5.2. It appears that the Estimated Bottom of Well for MMW011 should be 150.

Page 46, Section 5.9, Ballard Mine. Should MMW001, MMW002 actually be MMW020 and MMW021?

Page 56. The citation for U.S. Geological Survey (USGS), 2001 is incomplete.

MEMORANDUM

MWH
2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005
Phone: (425) 602-4000
Fax: (425) 602-4020

To: Mike Rowe, IDEQ

Date: March 26, 2007

From: Dean Brame, MWH

Reference: P4 Production Southeast Idaho Mine-Specific Selenium Program

Subject: Submital of page changes to Version 5 of the Draft Monitoring Well Installation Technical Memorandum

Mike,

Please find enclosed revisions to be incorporated into Version 5 of the Draft Monitoring Well Installation Technical Memorandum. These changes are in response to the revision requests put forth in the March 16, 2007 approval letter (M. Rowe). The following have been revised: Pages 10 and 52. A CD containing the revised document has been included, and replaces the disk included with the hard copies of Version 5 of the Draft Monitoring Well Installation Technical Memorandum.

Upon receipt of these changes, please send us notification indicating the official acceptance of the final verision of the technical memorandum.

Sincerely,

Dean Brame

cc: Mark Dietrich, IDEQ
Doug Tanner, IDEQ
Karen Johnson, IDEQ
Dave Tomten, USEPA
Joe Wallace, USEPA
Lorraine Edmond, USEPA
Tim Mosko, CH2M Hill
Jeff Jones, USFS
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Christina Cutler, Shoshone Bannock Tribes
Bob Geddes, Monsanto
Glen Kurowski, Monsanto
Jim McCulloch, Monsanto
Dale Ralston, RHS
Bill Wright, MWH
Cary Foulk, MWH

Ballard Mine. Looking west from the east side of West Ballard Pit

P4 PRODUCTION
SOUTHEAST IDAHO MINE-SPECIFIC SELENIUM PROGRAM

Version 5
Monitoring Well Installation Technical Memorandum for Final 2005 Phase II Supplemental SI Groundwater Work Plan

Prepared by

MWH

2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005

February 2007

Prepared for:

P4 PRODUCTION
SOUTHEAST IDAHO MINE-SPECIFIC
SELENIUM PROGRAM

Version 5a

Monitoring Well Installation Technical Memorandum for Final 2005 Phase II Supplemental SI Groundwater Work Plan

---

Ballard, Henry, and Enoch Valley Mines

February 2007

Prepared by:

MWH

Bellevue, Washington

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† All data has been censored at the reporting limit.
‡ All data has been reported uncensored.

1.0 INTRODUCTION

This *Monitoring Well Installation Technical Memorandum* (Monitoring Well Tech Memo) is presented in fulfillment of Activity 3b-5 of the *Final 2005 Phase II Supplemental SI Work* Plan (MWH, April 2005) (Phase II Groundwater Work Plan). The Phase II Groundwater Work Plan is an addendum to the *P4 Production Southeast Idaho Mine-Specific Selenium Program 2004 Comprehensive Site Investigation Final Work Plans for Ballard, Henry and Enoch Valley Mines (MWH, March 2004)* (2004 SI Work Plan). The Phase I groundwater investigation tasks were presented in the 2004 SI Work Plan and were initiated in 2004 following approval from Idaho Department of Environmental Quality (IDEQ) and the other Agencies. The Phase I and Phase II groundwater investigations are being conducted in accordance with the requirements of the AOC signed by P4 Production, IDEQ, United States Environmental Protection Agency (USEPA), and United States Forest Service (USFS). This work supports the comprehensive mine-specific site investigations.

The groundwater investigation is being conducted in an effort to identify, characterize, and monitor groundwater flow systems associated with the potential sources at the P4 Production mines. This investigation is being conducted in a phased approach, such that initial phases of work focus on information gathering and development of site hydrogeologic conceptual models. Phase I work incorporated gathering easily accessible chemical data, such as sampling of seeps, springs and existing groundwater wells to identify specific areas of interest and further investigation.

Phase II work incorporates findings of Phase I work and identifies activities required to fill additional groundwater investigation needs. Phase II activities are included in the scope of work of this Technical Memorandum. The Monitoring Well Installation Technical Memorandum has been prepared in support of one of the Phase II activities (MWH, April 2005) (Phase II Groundwater Work Plan) and provides the rationale and scope of work for installation of several new monitoring wells located at each of the mine sites to target specific flow pathways identified through development of the conceptual model.

The information obtained from Phase II activities, including the installation and monitoring of the proposed new wells and continued monitoring of existing wells and groundwater features, will be used to refine the site-specific conceptual hydrogeologic models. Additional groundwater investigation may be necessary and may warrant installation of additional monitoring wells.

The contents of this Monitoring Well Technical Memorandum are as follows:

- Section 1.0 Introduction – This section describes the purpose and scope of the memo.
- Section 2.0 Program Area Physical Description – This section provides a discussion of the physical description of the program area, including a discussion of site location, physiography, climate, and regional geology and hydrogeology.
- Section 3.0 Groundwater Investigation Scope, Results, and Evaluation – This section contains the scope of work for Phase II groundwater investigations and describes the efforts and results of the current groundwater investigation conducted at the mines.
- Section 4.0 Mine-Specific Conceptual Hydrogeologic Models – This section discusses the specific characteristics and features of the Enoch Valley, Henry, and Ballard Mines and provides an overview of the conceptual hydrogeologic model for each site.

- Section 5.0 Monitoring Well Installation Rationale and Scope of Work – This section describes the rationale and scope of work for additional Phase II investigations to be conducted, including well installations and groundwater sampling. The rationale provided incorporates the results of the groundwater investigations in relation with the site-specific hydrogeologic conceptual models, described in Section 4.0.

- Section 6.0 Field Methods – This section describes the field methods in support of the proposed work.

- Section 7.0 Laboratory Analyses – This section describes the proposed analytical work.

- Section 8.0 Schedule – This section provides the tentative schedule for proposed work.

- Section 9.0 References – This section contains the references to citations in the text.

2.0 PROGRAM AREA PHYSICAL DESCRIPTION

This section provides a discussion of the physical description of the program area, including a discussion of site location, physiography, climate, and regional geology and hydrogeology.

2.1 LOCATION

The Enoch Valley, Henry and Ballard Mines are located in Caribou County in southeastern Idaho. Enoch Valley Mine (EVM), operated by the Monsanto Company (P4 Production) from 1989 to 2004, is located in T6S, R43E, approximately 19 miles northeast of Soda Springs, Idaho. Henry Mine was operated by the Monsanto Company from 1969 to 1989 and is located in T6S, R42/43E, to the southeast of the town of Henry, Idaho. The Ballard Mine is a historic phosphate mine that was operated by the Monsanto Company from 1951 to 1969 and is located in T7S, R42/43E. The locations and topography of the vicinity of these mine sites are shown on Drawing 1, *Site Location Map*.

2.2 CLIMATE

The climate of southeastern Idaho is semi-arid with hot summers and cold winters. The climate is strongly influenced by topography, which in turn influences wind patterns, temperature and precipitation. North trending mountain ranges in the region create a natural barrier for water-saturated Pacific air masses. The rain shadow effect causes the Snake River Plain region to be semi-arid with a middle-latitude steppe climate. A National Weather Service station at Conda, Idaho, located four miles northeast of the P4 Production Plant in Soda Springs, reports approximately 19 inches of precipitation annually. Precipitation during the colder months is generally in the form of snow, while precipitation during the summer is primarily associated with localized, orographic thunderstorms.

2.3 PHYSIOGRAPHY AND SURFACE WATER DRAINAGE

The study area lies within the northern region of the Basin and Range Physiographic province, which is characterized by north- and northwest-trending mountain ranges and valleys in this area. Elevations in the area range from approximately 6,150 feet above mean sea level (AMSL) near the Blackfoot Reservoir and approximately 6,400 feet AMSL in the valleys, to approximately 6,900 feet AMSL at Henry and Ballard Mines and 7,700 feet AMSL at Enoch Valley Mine. Local relief of 1,000 to 1,500 feet is common in the area. Henry and Enoch Valley Mines are oriented along the slopes of two adjacent ridges, the Wooley Range and Rasmussen Ridge, respectively, which are separated by Enoch and Rasmussen Valleys. Long Valley is located to the west of Henry Mine and to the north of Ballard Mine, which is comprised of several pits in the Fox Hills. Wooley Valley lies to the east of the Fox Hills and Ballard Mine (Drawing 1).

Stream baseflow originates from springs in the mountain and valley areas. There are several small to medium size springs in the program area, typically located in the alluvial valleys or at the break in slope on the ridges. These springs are discharge points for groundwater systems that range from isolated alluvial aquifers to intermediate flow paths from sedimentary formations. Many headwater streams at higher elevations only flow during snowmelt runoff, but others are fed by large perennial springs.

The program area is drained by tributaries to the Blackfoot and Little Blackfoot Rivers, which flow into the Blackfoot Reservoir. From the Reservoir, the Blackfoot River flows northwest to the Snake River. Surface water from the Henry Mine and northern portions of the Ballard and Enoch Valley Mines drains

to the north and into the Reservoir via the Little Blackfoot River. Tributaries to the Little Blackfoot River include Long Valley Creek and Lone Pine Creek. The majority of surface water from Ballard Mine drains south to the Blackfoot River via small intermittent tributaries and to the east/southeast via Wooley Valley Creek (intermittent flow). Surface water from the southern portion of Enoch Valley Mine drains to Rasmussen and Angus Creeks that flow south to the Blackfoot River and into the Blackfoot Reservoir. Some of the above-mentioned creeks and streams are not officially named, but rather have been given designations (in some cases, local names are used) for the purpose of these site investigations.

2.4 REGIONAL GEOLOGY

The geology of the Basin and Range Province is characterized by linear, north-trending, fault-bounded ranges and basins formed by extensional tectonism. This extensional tectonism overprints an earlier period of compressional tectonics that included major overthrusting associated with the Bannock Thrust Zone, which resulted in synclinal-anticlinal folds and some faulting during the Upper Cretaceous and Paleocene periods. The extensional Basin and Range block faulting has occurred since the Oligocene period with differential subsidence and uplift occurring mostly with normal faulting, resulting in the current major valleys and ridges.

The principal stratigraphic units in the program area range in age from Mississippian to Quaternary and are described in Table 2.1, *Generalized Stratigraphy of the Program Area*.

Ranges in southeastern Idaho are generally composed of deformed Paleozoic and Mesozoic sedimentary rocks, including thick marine clastic units, cherts and limestones. The valleys are largely filled in with Quaternary alluvium and colluvium that overlie Pleistocene basalt flows in some places. Thick rhyolite flows of the Snake River Plain region and rhyolite domes south of the Blackfoot Reservoir comprise most of the remaining volcanic sequences in the region.

Massive accumulations of marine sediment occurred during the Paleozoic era over a large area of eastern Idaho, southwestern Montana, and northern Utah. During Permian time the Phosphoria Formation was deposited, creating the western phosphate field which includes the southeastern Idaho phosphate resource area. The Phosphoria Formation includes four members: the Meade Peak Phosphatic Shale, Rex Chert, Cherty Shale, and Retort Phosphatic Shale. (The Retort Shale is not present in the program area.) The Meade Peak member, which ranges in thickness from about 55 to 200 feet, is the source of most of the extracted phosphate ore. This is the oldest member of the Phosphoria Formation and is typically overlain by either the Rex Chert or the Cherty Shale. The Retort member is discontinuous and is found in the north and eastern parts of the region (USGS and USFS, 1977).

Other significant sedimentary units in the area include the Triassic Dinwoody Formation, which is made up of upper and lower units consisting of limestone, siltstone and shale layers. The lower Dinwoody Formation is directly above the Phosphoria units in stratigraphic section. The upper and lower units are often separated by a distinct layer of Woodside Shale. The Meade Peak member of the Phosphoria Formation is underlain by the upper unit of the Wells Formation, which consists of sandstone interbedded with limestone and dolomite. In some locations, the Grandeur Limestone of the Park City Formation is present above the Wells and is usually considered part of the Wells Formation for mapping purposes.

Regional geologic mapping of the program area was conducted in 1927 by the U.S. Geological Survey (USGS) (Mansfield, et al., 1927). Mine features within the program are included on the regional geologic map presented as Drawing 3. Field observations and boring logs, at the local scale, have been used in updating the mine-specific conceptual hydrogeologic models, cross-section drawings, and in determining

locations of proposed wells. Discrepancy between Drawing 3 and other drawings and field observation may exist. Efforts to update all drawings are on-going.

2.5 WATER RESOURCES

Water resource uses in the program area include municipal supplies, industrial use, power generation, irrigation, stock watering, recreational use, wildlife use, and cold-water biota use. Groundwater use in the program area is dependent on several variables including population and land use, availability and quality of surface water and availability and quality of groundwater. In the more remote regions, groundwater use is generally limited to livestock watering. In the valleys surrounding the mined areas, groundwater is primarily used for livestock watering, limited domestic use, and mine site water-supply. Mine site uses include domestic use at the Degerstrom/Enoch Valley Mine Office and Shop building, dust abatement, and washing equipment. In the vicinity of Soda Springs, groundwater is used for municipal supplies, irrigation, industrial uses and domestic supplies. The Soda Springs municipal water-supply comes primarily from Formation Creek and Ledger Creek that are natural springs located northeast of town.

2.6 REGIONAL HYDROGEOLOGY

Groundwater in the region can be divided into shallow groundwater within basin-fill alluvium and shallow to intermediate groundwater flow systems in sedimentary bedrock units. Table 2.1 and Table 2.2 provide descriptions of stratigraphy and lithologic permeability of geologic units within the study area.

2.6.1 Alluvial Groundwater Systems

Alluvium and colluvium up to 150 feet thick in the valleys is recharged by direct precipitation and shallow flow from the topographic ridges. Alluvial groundwater systems interact directly with streamflow along the valleys, acting alternately as a source of recharge and discharge to the streams at different locations. Where the bedrock sedimentary units contact alluvium, groundwater will similarly move between the bedrock and alluvium depending on the hydraulic characteristics of the units and the hydraulic gradients at different locations. Due to this interaction, the alluvial groundwater is generally present as unconfined and the water table surface and groundwater flow mirrors surface topography and surface water flow directions.

2.6.2 Bedrock Groundwater Systems

Recharge to the bedrock units generally occurs within the topographically high ridges and flows downward, typically along the dip of the geologic beds. Groundwater flow through bedrock units is controlled by several factors including the hydraulic properties of the units (i.e., horizontal and vertical hydraulic conductivities) and hydraulic gradients, the aerial extent, thickness and orientation of the geologic units, as well as structural controls such as folding, fracturing and faulting. Fracturing of bedrock rock units (especially chert and limestone) has the potential to create significant secondary hydraulic conductivity in an otherwise low-conductivity unit.

Major and minor fault zones can have a significant impact on groundwater flow paths either by acting as a conduit to flow (typical of normal faulting) or as a barrier to flow (more typical of thrust faults); however it is possible that a fault will have little or no effect on groundwater flow depending on site-specific conditions. At the conceptual level, faults are generally assumed to alter groundwater flow patterns by either acting as flow barriers or as flow conduits. This is a common hydrogeologic condition and is evidenced in the region by the occurrence of springs along or near fault traces.

No field data has been obtained for faults specific to P4 Production mine sites. However, there exists field observation data to support the hypothesis that the geologic discontinuity formed by a fault creates anisotropic conditions where flow across the fault is much less than flow along the fault.

The Thaynes, Dinwoody, Phosphoria, and Wells Formations are the principal sedimentary formations in the program area through which groundwater flow may occur. Hydrogeologic research conducted in the area indicates the following regarding potential bedrock groundwater systems in the area:

- The Thaynes and Dinwoody Formations typically support intermediate groundwater flow systems (Ralston et al., 1977; Ralston et al., 1980).

- The Phosphoria Formation does not support any major groundwater flow systems; however, the Rex Chert member may transmit groundwater, where locally fractured, enough to have moderate hydraulic conductivity (Ralston et al., 1977; Ralston et al., 1980). The main ore-bearing unit of the Phosphoria formation, the Meade Peak Phosphatic Shale, is relatively impermeable due to low vertical hydraulic conductivity (McGregor, 1993; Ralston et al., 1980). Research throughout the Western Phosphate Field in Idaho has shown that the Meade Peak Member does not support significant ground water flow, particularly when flow is directed across bedding.

- The Wells Formation supports a regional groundwater system (Ralston et al., 1977; Ralston et al., 1980). The Wells Formation has the highest hydraulic conductivity compared to the other bedrock units in the region (BLM, 1999).

In general, the flow systems in the Thaynes and Dinwoody formations are separated from the lower Wells Formation by the low hydraulic conductivity of the Phosphoria formation (in particular the Meade Peak member). This causes the upper flow systems in the Thaynes and/or Dinwoody Formations to be local in extent while the lower flow system in the Wells Formation may be more regional.

A spring survey was conducted of the southeast Idaho phosphate field to gain evidence of the potential groundwater system(s) (Winter, 1980; Ralston et al., 1980). The study was conducted by Tom Brooks and reported in a 1982 University of Idaho thesis "Hydrology of the Proposed North Henry Mine, Southeaster Idaho". A review of this thesis will be conducted during Activity 3b-8—Review of Available Hydrogeologic Information efforts. The study included analysis of data from 16 wells and five stream station on the Little Blackfoot River. A total of 88 springs were identified in the survey. The provenance of 53 springs was determined by comparing stream flows to water levels in wells. The study concluded that 42 springs flowed from the Thaynes or Dinwoody Formations at an average discharge rate of 25 gallons per minute (gpm); eight springs flowed from the Wells formation at the highest average rate of 130 gpm; and the Phosphoria Formation supported the fewest springs (three). This spring survey provides evidence of the types and extent of typical flow systems in each of the bedrock units. Many of these springs are a source of perennial flow for surface water streams in the region.

Table 2.1
Generalized Stratigraphy of the Program Area[1]

	Age	Formation	Members	General Description	Hydrogeologic Characteristics[2]	Permeability Description[4]
CENOZOIC	Quaternary	ALLUVIUM (Qal and Qw)	--	Alluvium or colluvium	Supports local groundwater flow system.	--
CENOZOIC	Quaternary/ Tertiary	BASALT (Qb)	--	Basalt flows	Can support intermediate groundwater flow system where fractured.	--
MESOZOIC	Triassic	THAYNES (Trt)	Several Members	Mostly limestone with sandstone layers. Some siltstone and shale members.	Supports intermediate groundwater flow system.	upper: moderate to high middle: low to moderate lower: low to moderate
MESOZOIC	Triassic	DINWOODY FM (Trd)	Upper Unit	Grey, fossiliferous limestone interbeded with olive-brown calcareous siltstone	Supports intermediate groundwater flow system.	moderate for limestone and siltstone, low for shale and silt
MESOZOIC	Triassic	DINWOODY FM (Trd)	Woodside Shale	Reddish-brown siltstone and shale. Discontinuous in program area.	Does not support groundwater flow system.	--
MESOZOIC	Triassic	DINWOODY FM (Trd)	Lower Unit	Olive-brown calcareous siltstone and shale with thin-bedded limestone	Supports intermediate groundwater flow system.	moderate for limestone and siltstone, low for shale and silt
PALEOZOIC	Permian	PHOSPHORIA FM (Pp)	Retort Phosphatic Shale	Phosphatic shale. Discontinuous in program area.	Does not support groundwater flow system. Low hydraulic conductivity layer.	--
PALEOZOIC	Permian	PHOSPHORIA FM (Pp)	Cherty Shale	Thin-bedded dark-brown to black cherty mudstone, siliceous shale and argillaceous chert	Does not support groundwater flow system. Low hydraulic conductivity layer.	--
PALEOZOIC	Permian	PHOSPHORIA FM (Pp)	Rex Chert	Thick-bedded black to white chert with some mudstone and some limestone lenses	May support groundwater flow where highly fractured in areas.	permeable when fractured
PALEOZOIC	Permian	PHOSPHORIA FM (Pp)	Meade Peak Phosphatic Shale (Ppm)	Dark-brown to black mudstone, limestone and phosphorite. Meade Peak member is typically mined.	Does not support groundwater flow system. Low hydraulic conductivity layer.	low to semi-permeable
PALEOZOIC	Permian/ Pennsylvanian	PARK CITY FM[3]	Grandeur Limestone	Light grey dolomite and cherty dolomite with some sandstone. Discontinuous in program area. Often mapped with Wells Fm.	--	--
PALEOZOIC	Permian/ Pennsylvanian	WELLS FM (PPw)	Upper Unit (PPwu)	Light grey to reddish-brown sandstone, some interbedded limestone and dolomite	Supports groundwater flow systems.	moderate
PALEOZOIC	Permian/ Pennsylvanian	WELLS FM (PPw)	Lower Unit (PPl)	Medium bedded grey chety limestone, some interbedded sandstone	Supports groundwater flow systems.	moderate to high
PALEOZOIC	Mississippian	BRAZER OR MONROE CANYON FM (Mb)	Brazer Limestone	Light grey limestone with interbedded sandstone, occasionally with grey and green shale.	--	upper: very low middle: high lower: high

1. Stratigraphy based on Ralston, et al., 1980 and Ralston, et al., 1983.
2. Notes on hydrologic characteristics are based on several sources of information. Information not available for all units.
3. Often mapped as part of the Wells Formation.
4. Permeability descriptions from Cannon, 1979. Information not available for all units.

Table 2.2
Lithologic Permeabilities of the Program Area[1]

AGE		FORMATION	MEMBERS	Study Area	Test Procedure	Trasmissivity (T) ft^2/day	Hydraulic Conductivity (K) ft^2/day	Storativity (S)
CENOZOIC	Quaternary	ALLUVIUM (Qal and Qw)	--	Diamond Creek	Field-Pump Test	3200	55	--
MESOZOIC	Triassic	DINWOODY FM (Trd)	Middle of Formation	Lower Dry Valley	Field-Slug Test	83	--	--
PALEOZOIC	Permian	PHOSPHORIA FM (Pp)	Rex Chert (fractured)	Lower Dry Valley	Field-Pump Test	12000	75	0.00030
						2300	28	0.0010
			Rex Chert (unfractured)	Lower Dry Valley	Field-Pump Test	450	2.2	--
				Diamond Creek	Field-Pump Test	750	2.5	0.0070
			Meade Peak Phosphatic Shale (fractured)	Lower Dry Valley	Field-Slug Test	2000	25	0.00050
			Meade Peak Phosphatic Shale (unfractured)	Lower Dry Valley	Field-Slug Test	8.0	0.30	--
						64	1.6	--
						23	0.40	--
						16	0.14	--
						63	0.44	--
						6.0	0.070	--
			Meade Peak Phosphatic Shale (middle waste)	Lower Dry Valley	Field-Slug Test	300	4.0	0.0013
			Meade Peak Phosphatic Shale (ore)	Little Long Valley	Field-Slug Test	11	2.2	
			Meade Peak Phosphatic Shale (middle waste with bedding)	Little Long Valley	Lab	--	5.2	--
			Meade Peak Phosphatic Shale (middle waste across bedding)	Little Long Valley	Lab	--	0.40	--

1. Permeability values taken from Cannon, 1979. Information not available for all units.

2.7 SELENIUM RELEASE

Selenium is the main constituent of concern that is being released at the program mine sites, as well as other historic mine sites within the resource area. Elevated selenium concentrations have been observed in samples of waste rock, in vegetation growing on the dumps, and in surface water stock ponds at the mines (which include the pit ponds and runoff control ponds constructed in, on or adjacent to waste rock dumps). The Meade Peak member of the Phosphoria Formation is the source of produced phosphate ore. Concentrations of selenium in the Meade Peak member are higher than typical concentrations found in other marine sedimentary rocks. Phosphate ore (phosphorite) was stockpiled at the mine sites prior to transport to the processing plant near Soda Springs. Available information regarding stockpiled ore, including location, size, and duration will be gathered as part of Activity 3b-8—Review of Available Hydrogeologic Information. This information will be used to evaluate the potential for ore stockpile to be a source of selenium release at the mine sites. Waste rock mostly consists of carbonate rock, mudstone and shales of the surrounding Phosphoria Formation. Selenium concentrations in these waste materials have been reported as being 100 to 1,000 times greater than the averages in continental crust (USGS and USFS, 1977).

Waste rock is disposed of as backfill to open pits or in large waste rock dumps located at each mine site; it is the weathering of this material that contributes most to the mobilization of selenium to waters. Direct precipitation falling onto the dumps or infiltrating snowmelt result in weathering and oxidizing the waste rock and leaching selenium into the water. This selenium-rich water may be transported via one or more potential pathways: (1) surficial runoff over the dumps, (2) shallow interflow through the uppermost layers of the dumps (3) direct infiltration into the dumps under both unsaturated and saturated flow conditions. Water traveling as surface runoff or shallow interflow may be transported quickly to the surface water system or may infiltrate to groundwater. Water infiltrating through waste rock may emerge as seeps or be transported directly to the groundwater systems. Groundwater flow paths range from shallow interflow at the near-surface, to intermediate flow paths, to more regional groundwater flow pathways. The potential groundwater transport pathways at the mine sites are the focus of this study.

3.0 GROUNDWATER INVESTIGATION SCOPE, RESULTS, AND EVALUATION

The following sections describe the efforts and results of the groundwater investigation that is being conducted to investigate potential impacts to groundwater as a result of mining activities at Enoch Valley Mine, Henry Mine and Ballard Mine. The investigation of the mines has been conducted in three parts: a regional investigation funded by the Idaho Mining Association (1997-2002); interim surface water and sediment sampling effort (2002-2003); and mine-specific site investigations (2004-present). The State took authority for the regional investigation in August 2000.

The scope of these investigations focused on accumulating, evaluating, and summarizing existing geologic and hydrogeologic information, and also included sampling of existing wells, seeps, springs, and headwater streams. Information derived from the investigations has been used to update the mine-specific conceptual hydrogeologic models presented in Section 4.0 and support the rationale for the installation of several new monitoring wells at each mine as presented in Section 5.0.

Measurements whose values are known only to be above or below a threshold are called "censored" data in the statistical literature. In environmental studies, censored data are commonly encountered as values below a detection limit. Called "less-thans" or "nondetects," these low values for constituents, such as trace metals, are known inexactly (Helsel, 2005).

MWH uses the phrase "detection limit" (DL) to denote a method-specific performance parameter. Sample-specific deviations from the method--e.g., sample dilution, small sample size, detections of an analyte in a blank--may result in a lower level of analytical performance in a given sample. Because such sample-specific deviations do not alter the performance of the method, but rather the performance of the analysis for the specific sample in question, MWH uses the phrase "reporting limit" (RL) to denote the value at which a given datum is censored. In most instances the DL and RL will be identical. In some instances the RL will be greater than the DL.

In a blank, a sample containing a zero concentration of the analyte in question, the analytical result should ideally be 0. Due to random errors associated with even the best forms of sampling and analysis, repeated measurements of a blank should ideally be normally distributed with a mean of 0. When a sample contains a trace amount of analyte, the analytical results will behave similar to those of a blank, and for a normal distribution with a mean of zero, half the results will be negative. While negative concentrations do not exist in the environment, they do exist as noise in laboratory analytical results. Inclusion of both censored and uncensored data sets allows for the examination of sample values that otherwise may be hidden or lost due to detection or reporting limits, while keeping in mind that very low uncensored values--those near zero--are uncertain and must be evaluated only within the context of the overall data set (Rettmann, 2003).

The following activities were proposed to be completed during the Phase I groundwater investigation. Sections 3.1 and 3.2 provides discussion of these efforts. The Phase I investigation was outlined in the *P4 Production Southeast Idaho Mine-Specific Selenium Program 2004 Comprehensive Site Investigation Final Work Plans for Ballard, Henry and Enoch Valley Mines (MWH, March 2004)* (2004 SI Work Plan). These activities fell within *Task 3—Geology and Groundwater Investigation, Subtask 3a—Phase I Investigation* of the SI Work Plans.

Activity 3a-1—Review of Available Hydrogeologic Information
Activity 3a-2—Well Inventory
Activity 3a-3—Spring and seep survey
Activity 3a-4—Spring and dump seep flow characterization
Activity 3a-5—Sampling existing mine and domestic wells, springs, and seeps
Activity 3a-6—Revise conceptual hydrogeological model

The following activities are proposed to be completed during the Phase II groundwater investigation. Some of the activities were proposed in the *Final 2005 Phase II Supplemental SI Work* Plan (MWH, April 2005) (Phase II Groundwater Work Plan) and have been completed. Additional activities have been incorporated into this to satisfy groundwater investigation data needs. The Phase II Groundwater Work Plan was an addendum to the *P4 Production Southeast Idaho Mine-Specific Selenium Program 2004 Comprehensive Site Investigation Final Work Plans for Ballard, Henry and Enoch Valley Mines (MWH, March 2004)* (2004 SI Work Plan). The activites listed below fall within *Task 3—Geology and Groundwater Investigation, Subtask 3b—Phase II Investigation* of the SI Work Plans.

Activity 3b-1—Aerial mapping of Ballard Mine
Refer to Section 3.2.2.

Activity 3b-2—Focused investigation of existing wells
Refer to Section 3.2.5.

Activity 3b-3—Existing well sampling and groundwater level monitoring
Following new well installation all monitoring wells, including existing monitoring wells, will be sampled. Low stress sampling techniques will be used where possible. Low flow sampling may not be possible in existing wells if dedicated pumps are already installed, or if the required sampling equipment cannot access the well. Samples will be analyzed for the parameters listed in Table 7.1, *Groundwater Monitoring Analytes* (Section 7.1). In addition to the groundwater parameters that are typically analyzed, these groundwater samples may also be analyzed for the speciated selenium compounds, selenate and selenite.

Activity 3b-4—Revise conceptual hydrogeologic site model
A conceptual hydrogeologic site model was presented in the 2004 SI Work Plan. The updated mine-specific models are presented in this memorandum in Section 4.0.

Activity 3b-5—Preparation of a technical memorandum for monitoring well installations
This *Monitoring Well Installation Technical Memorandum*) is presented in fulfillment of Activity 3b-5.

Activity 3b-6—Water Balance
This activity is scheduled to be completed in 2007. Please refer to Section 3.2.3 for discussion.

Activity 3b-7—2006 groundwater sampling
Groundwater was sampled in May 2006. The Data Validation Summary has been submitted for Agency review and approval; once approved, the data will be evaluated.

Activity 3b-8—Review of Available Hydrogeologic Information
Section 3.2.1 provides discussion of this effort. Continued efforts will include: 1) collection and review of information regarding excavation and backfilling below the water table; 2) collection and review of information regarding ore stockpile location and duration of use; 3) updating topographic and geologic drawings for the mine sites.

Activity 3b-9—Geochemical typing of wells, seeps, and springs
Section 3.1.4 provides discussion of current geochemical typing efforts. This effort will be expanded to determine the provenance associated with different water types in the monitoring wells, seeps, and springs.

Activity 3b-10—Spring Flow Characterization
Field efforts for this activity were initiated in 2006. Evaluation of data is scheduled for completion in 2007. Spring flow characterization may be evaluated in conjunction with water-typing data to determine provenance of springs and seeps.

Activity 3b-11—Groundwater Level Measurements
Groundwater levels in monitoring wells will be monitored to provide information to evaluate seasonal variances and for predicting gradient and other characteristics of the flow systems. This information may also be used to produce groundwater elevation maps and in flow or transport modeling. Data loggers may be used to complete this task.

Discussion of Phase I and Phase II Groundwater Investigation activities is included in Sections 3.1 and 3.2. For reference, current mine pit and waste rock dump locations and sample IDs are listed in Table 3.1. Current and historical groundwater monitoring sampling locations are given in Table 3.2.

Table 3.1 Mine Pit and Waste Rock Inventory			
Mine	**Type**	**Name**	**ID**
Enoch Valley Mine	Mine Pit	Enoch Valley Mine North Pit	MMP045
	Waste-Rock Dump	Enoch Valley Mine South Dump	MWD091
		Enoch Valley Mine North Dump	MWD092
Henry Mine	Mine Pit	Henry Mine North Pit	MMP041
		Henry Pit #1	MMP042
		Henry Pit #2	MMP043
		Henry Mine South Pit	MMP044
	Waste-Rock Dump	Henry Mine North Pit Overburden Dump	MWD085
		Henry Mine Pit #1 Overburden Dump	MWD086
		Henry Mine Pit #1 Canyon Fill Dump	MWD087
		Henry Mine Pit #2 Overburden Dump	MWD088
		Henry Mine South Pit Overburden Dump	MWD090
Ballard Mine	Mine Pit	Ballard Mine Pit #1	MMP035
		Ballard Mine Pit #2	MMP036
		Ballard Mine Pit #3	MMP037
		Ballard Mine Pit #4	MMP038
		Ballard Mine Pit #5	MMP039
		Ballard Mine Pit #6	MMP040
	Waste-Rock Dump	Ballard Mine Pit #1 Overburden Dump #1	MWD080
		Ballard Mine Pit #1 Overburden Dump #2	MWD081
		Ballard Mine Pit #3 Overburden Dump	MWD082
		Ballard Mine Pit #4 Overburden Dump	MWD083
		Ballard Mine Pits #5 and #6 Overburden Dump	MWD084
		Ballard Mine Pit #2 Overburden Dump	MWD093

Table 3.2 Groundwater Monitoring Locations					
Mine	**Feature**	**Name**	**ID**	**Latitude**	**Longitude**
	Agricultural Wells	School Bus Well	MAW001	42 53 15.00	111 26 40.00
		(b) (6) Field Well	MAW002	42 53 51.00	111 26 42.00
		(b) (6) Field Well	MAW003	42 53 24.00	111 27 21.60
		(b) (6) Field Well	MAW004	42 51 57.01	111 29 22.21
		(b) (6) Windmill Field Well	MAW005	42 51 44.32	111 23 08.80
		(b) (6) Field Well West	MAW006	42 51 59.54	111 30 49.85
		(b) (6) Field Well North	MAW007	42 52 30.00	111 29 49.20
	Domestic Wells	(b) (6) House Well	MDW001	42 53 24.00	111 27 26.00
		(b) (6) House Well	MDW002	42 54 18.00	111 26 49.20
		(b) House Well	MDW003	42 52 30.00	111 26 46.00
		(b) (6) House Well	MDW004	42 49 26.40	111 33 14.40
		Cedar Bay RV Park Well	MDW005	42 54 32.40	111 31 51.60
		(b) House Well	MDW006	42 54 43.20	111 28 48.00
Enoch Valley Mine	Production Wells	Agrium Production Well	MPW006	42 51 46.80	111 23 27.60
		EVM Shop Well	MPW019	42 52 37.40	111 25 16.53
		Degerstrom Well at EVM	MPW020	42 53 01.90	111 25 01.57
	Dump Seeps	EVM W Dump Seep	MDS025	42 52 12.50	111 24 11.50
		EVM S Dump Seep	MDS026	42 51 48.70	111 23 35.70
	Springs	Hedin Spring	MSG001	42 52 55.90	111 25 42.00
	Ponds	EVM South Pond	MSP017	42 52 04.90	111 23 32.00
		EVM Keyhole Pond	MSP018	42 52 09.80	111 23 52.40
		EVM Bat Cave Pond	MSP019	42 52 24.50	111 24 05.70
		EVM West Pond	MSP020	42 52 22.60	111 24 23.70
		EVM Stock Pond	MSP021	42 52 32.90	111 24 18.50
		EVM Tipple Pond	MSP022	42 52 39.60	111 25 08.69
		EVM Haul Road Pond	MSP023	42 52 43.30	111 25 20.40
		EVM Shop Pond	MSP031	42 52 34.40	111 25 11.40
	Streams	W Rasmussen Creek #1, above Lone Pine Creek	MST059	42 53 42.39	111 26 15.30
		W Rasmussen Creek #2, above Lone Pine Creek	MST060	42 53 36.35	111 26 19.33
		W Rasmussen Creek #3, above Lone Pine Creek	MST061	42 53 31.92	111 26 23.67
		Rasmussen Creek, Headwaters near EVM Pond	MST136	42 52 34.00	111 25 03.00
		W Pond Creek Headwaters, below W Pond	MST144	42 52 13.50	111 24 18.10
		E Fork Rasmussen Creek Headwaters	MST269	42 52 18.10	111 23 41.69
		W Fork Rasmussen Creek Above Rasmussen Creek	MST274	42 51 31.40	111 23 34.80
		N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	42 51 56.70	111 25 15.60

Table 3.2 continued Groundwater Monitoring Locations					
Mine	**Feature**	**Name**	**ID**	**Latitude**	**Longitude**
Henry Mine	Monitoring Wells	Henry North Pit Well S	MMW003	42 53 50.50	111 29 24.80
		Henry North Pit Well N	MMW004	42 54 07.70	111 29 46.50
	Production Wells	Henry South Pit Well	MPW022	42 52 03.50	111 27 28.40
		Henry Center Pit Well	MPW023	42 52 17.70	111 27 47.20
	Dump Seeps	S Pit Overburden Dump Seep	MDS016	42 51 40.20	111 26 48.40
		S Pit Overburden Limestone Drain	MDS022	42 51 58.60	111 27 05.90
	Springs	Taylor Spring	MSG002	42 52 02.90	111 27 03.00
	Ponds	HM Henry Pond	MSP014	42 52 18.20	111 27 43.20
		HM Smith Pond	MSP015	42 53 13.00	111 28 43.00
		HM Center Henry Pond	MSP016	42 53 24.80	111 28 54.80
		HM South Pit Pond	MSP055	42 51 35.37	111 27 05.63
	Streams	Lone Pine Creek above W Fork Lone Pine Creek	MST058	42 51 54.10	111 26 24.30
		W Fork Lone Pine Creek Above Tributary	MST064	42 51 54.10	111 26 30.20
		E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	42 51 42.27	111 25 55.16
		Tributary Above W Fork Lone Pine Creek	MST276	42 51 53.50	111 26 29.10
		Lone Pine Creek, Spring Fed Tributary	MST277	42 51 54.10	111 29 05.60

Table 3.2 continued Groundwater Monitoring Locations					
Ballard Mine	Monitoring Wells	Ballard Pit East Well	MMW001	42 49 36.39	111 29 03.32
		Ballard Pit West Well	MMW002	42 49 35.40	111 29 23.60
	Dump Seeps	Pit #2 Upper Dump Seep	MDS030	42 49 43.00	111 29 22.00
		Pit #2 Lower Dump Seep S	MDS031	42 49 43.00	111 29 25.00
		Pit #2 Lower Dump Seep N	MDS032	42 49 46.30	111 29 23.50
		Goat Seep	MDS033	42 49 51.00	111 29 26.00
	Springs	Garden Hose Spring	MSG003	42 49 40.90	111 29 19.00
		Holmgren Spring	MSG004	42 49 16.80	111 28 09.20
		Cattle Spring	MSG005	42 49 21.20	111 27 59.30
		SE Spring	MSG006	42 49 42.60	111 27 59.00
	Ponds	BM Dredge Pond	MSP010	42 49 57.10	111 29 46.20
		BM Upper Elk Pond	MSP011	42 49 22.70	111 28 52.30
		BM Lower Elk Pond	MSP012	42 49 38.93	111 28 51.20
		BM Northeast Pond	MSP013	42 50 06.70	111 28 27.30
		BM Pit #4 Stock Pond	MSP059	42 49 11.40	111 28 56.80
		BM Pit #6 Pond	MSP062	42 49 36.10	111 28 42.00
	Headwater Streams	Ballard Creek, Headwaters	MST067	42 49 22.70	111 29 38.10
		W Fork Ballard Creek, Headwaters	MST068	42 49 27.00	111 29 37.90
		Short Creek, Below BM	MST069	42 49 11.23	111 29 19.75
		N Fork Wooley Valley Creek, Above BM	MST093	42 50 23.60	111 28 34.50
		Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	42 49 55.70	111 28 09.60
		Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	42 49 39.00	111 28 05.00
		Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	42 49 29.30	111 27 43.80

Notes:
Dump Seep, Spring, Pond, and Headwater Stream stations are sampled as part of the groundwater investigation and are used to evaluate both surface water and groundwater quality, however all surface water locations are regulated as surface water.

3.1 GROUNDWATER INVESTIGATION SAMPLING EFFORTS

3.1.1 Domestic and Agricultural Well Sampling

A well inventory was conducted to identify all domestic and agricultural wells within an approximately 3-mile radius of the mines. Information was obtained from bore logs filed with IDWR regarding the construction of the wells and geologic units encountered. Existing mine wells and domestic and agricultural wells identified in the well survey were sampled in 2004. The locations of these stations are shown in Drawings 2 and 3. Analytical data for all stations and sampling events are provided in Appendices B, C, and D. For reference, a comparison of the filtered and unfiltered results for one sampling event has been included in Table 3.3. As potential receptor points, these samples were analyzed for total metals concentrations and compared to the State of Idaho Groundwater Quality Rule. As presented in these tables, only one agricultural well, MAW005, exceeded the Idaho Groundwater Quality Rule for zinc. This windmill-driven well is steel cased and was not adequately purged prior to sampling; therefore, it is likely that the zinc concentration reflects water in the casing in contact with the steel pipe. This well will not be sampled in the future without adequate purging in adherence to the QAPP. As presented in Figure 1, total selenium concentration in all the wells was consistently below the Idaho groundwater quality standard for drinking water by an order of magnitude or more. Boring logs and well completion diagrams were filed with IDWR for some of these locations, and are included in Appendix F and summarized in Table 5.1.

3.1.2 Existing Well Sampling

All production and monitoring wells at the mines have been sampled. The locations of the wells are shown on Drawings 2, 3, and 10. All analytical data for each sampling event are provided in Appendices B, C, and D. Bore logs and well completion diagrams were filed with IDWR for some of these locations and are included in Appendix F and summarized in Table 5.1. A comparison of data from filtered and unfiltered sample data is included as Table 3.3.

As presented in Figures 2 and 3, no elevated total selenium concentrations have been detected in Enoch Valley Mine or Henry Mine wells. At Ballard Mine, elevated total selenium was detected in monitoring well MMW001. This well is on the east side of the West Ballard Pit MMP035. As indicated by cross-section H-H' on Drawing 11, the well is drilled through the phosphoria formation and into the Wells Formation. Well MMW001 may not be properly sealed through the phosphoria formation. Also, high turbidity was observed during sampling of well MMW002, located on the west side of West Ballard Pit MMP035. An effort to clean and rehabilitate well MMW002 was conducted in fall 2006 but was not successful. Replacement wells have been proposed for both MMW001 and MMW002.

Table 3.3
Monitoring and Production Wells - Fall 2005 Filtered and Unfiltered Sample Data Comparison (mg/L)

Station			Selenium				Cadmium				Chromium			
Mine	Name	ID	Unfiltered	Flag	Filtered	Flag	Unfiltered	Flag	Filtered	Flag	Unfiltered	Flag	Filtered	Flag
Henry Mine	Henry N Pit Well N	MMW004-Avg	<0.0010	U	0.0013		<0.083	U	<0.00010	U	<0.083	U	<0.0011	U
		MMW004-R1	<0.0010	U	0.0020		<0.050	U	<0.00010	U	<0.050	U	<0.0011	U
		MMW004-R2	<0.0010	U	0.0010		<0.10	U	<0.00010	U	<0.10	U	<0.0011	U
		MMW004-R3	<0.0010	U	0.0010		<0.10	U	<0.00010	U	<0.10	U	<0.0011	U
	Henry S Pit Well	MPW022	<0.0010	U	<0.0010	U	<0.10	U	<0.00010	U	<0.10	U	<0.0011	U
Ballard Mine	Ballard Pit E Well	MMW001	0.069		0.072		<0.050	U	0.0029		<0.050	U	<0.0011	U
	Ballard Pit W Well	MMW002	0.022		0.022		<0.050	U	<0.00010	U	<0.050	U	<0.0011	U

Station			Nickel				Vanadium				Zinc			
Mine	Name	ID	Unfiltered	Flag	Filtered	Flag	Unfiltered	Flag	Filtered	Flag	Unfiltered	Flag	Filtered	Flag
Henry Mine	Henry N Pit Well N	MMW004-Avg	<0.50	U	<0.00060	U	<0.17	U	<0.0019	U	480		0.039	
		MMW004-R1	<0.30	U	<0.00060	U	<0.10	U	<0.0019		280		0.040	
		MMW004-R2	<0.60	U	<0.00060	U	<0.20	U	<0.0019		620		0.038	
		MMW004-R3	<0.60	U	<0.00060	U	<0.20	U	<0.0019		530		0.040	
	Henry S Pit Well	MPW022	<0.60	U	<0.00060	U	<0.20	U	<0.00020	U	530		0.13	
Ballard Mine	Ballard Pit E Well	MMW001	<0.30	U	0.045		<0.10	U	0.0053		450		0.25	
	Ballard Pit W Well	MMW002	<0.30	U	0.0041		<0.10	U	<0.00020	U	460		0.16	

Notes:
All data has been censored at the reporting limit. Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).
Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.
Data qualifier definitions are:
(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.
(J) - The result is an estimated quantity.
(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NA - Not Applicable

3.1.3 Seep, Spring, and Headwater Stream Sampling

As indicated in Table 4.1, seeps, springs, and headwater streams may act as groundwater monitoring locations. Results of such stations (groundwater expressed at the earth's surface via springs, seeps, or headwater streams) will be used to evaluate both surface water and groundwater quality. The term "surface-expressed groundwater" is used for a descriptive purpose only, describing stations that will be sampled for both the surface water and the groundwater analyte lists, and our use of the phrase is not meant to have any regulatory significance. The locations of these stations are shown in Drawings 2, 3, and 10. Analytical data for all stations and sampling events are provided in Appendices B, C, and D. As presented in Figure 2, elevated total selenium concentrations have been detected at EVM in the south dump seep MDS026 and the headwater stream MST144. At Henry Mine no elevated total selenium concentrations have been detected in any of the surrounding seeps, springs, or headwater streams as shown in Figure 3. As presented in Figure 4, elevated total selenium concentrations have been detected at Ballard Mine in seeps MDS030, MDS031, MDS032, and MDS033; springs MSG003 and MSG006; headwater streams MST067, MST069, MST095, and MST096.

3.1.4 Geochemical Typing of Wells, Seeps, and Springs

An analysis of the major ion concentrations from existing groundwater analytical data has been performed using 2004 groundwater data to evaluate whether water-typing may be used to characterize/identify groundwater flow systems in the vicinity of the mines. Piper diagrams and associated major ion charge balance calculations are included in Appendix E. In general, most groundwater wells fall within the range of calcium-bicarbonate waters. Notably, domestic wells MDW002 and MDW006 and monitoring wells MMW003 and MMW004, located near mapped basalt flows, contained higher contribution of chloride, sodium, and potassium. Also, Agrium production wells MPW006 and Enoch Valley Mine well MPW020 trended toward calcium-sulfate waters. Springs and dump seeps, where no elevated total selenium concentration was observed,were characterized as calcium-bicarbonate, while springs and seeps at Ballard and Enoch Valley, with elevated total selenium concentration, (i.e., MST069, MSG006, MDS030-MDS033) and EVM (MDS025 and MDS026) are more generally characterized as calcium-sulfate waters. Further investigation into this topic will be conducted in Activity 3b-9.

3.2 GROUNDWATER INVESTIGATION NON-SAMPLING EFFORTS

3.2.1 Review of Available Hydrogeologic Information

The review included gathering geologic and cross-sections maps, existing mine maps, and verbal accounts from mine geologists with regard to faults and water bearing zones encountered during mining activities. Information obtained from P4 Production's archived files and from a literature review was compiled to prepare geologic maps and cross-sections of areas of interest, as presented in this document. Additional geologic mapping and information specific to the historic mine sites (specifically Henry and Ballard Mines) was gathered from archived files. Pre- and post-mining topographic maps were found for Henry Mine and were digitized to produce cross-sections included in this report. Also, geologic mapping and cross-sections for Ballard Mine were used. All information has been used to further develop the hydrogeologic conceptual models presented in Section 4.0.

Figure 1
Unfiltered Selenium Concentrations
Agricultural Wells (MAW) and Domestic Wells (MDW)

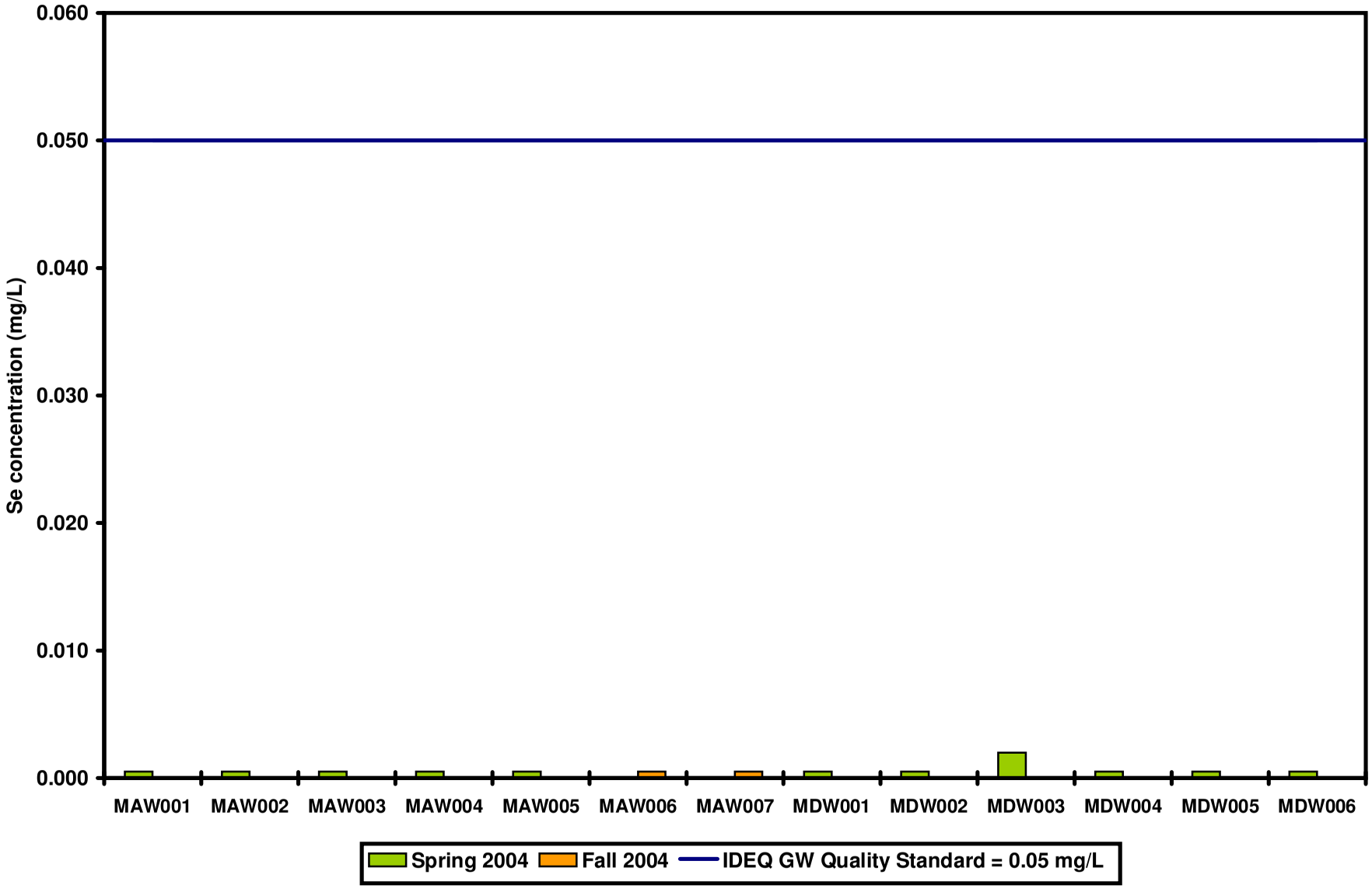


Figure 2
Enoch Valley Mine: Unfiltered Selenium Concentrations
Production Wells (MPW), Dump Seeps (MDS), Springs (MSG), and Headwater Streams (MST)

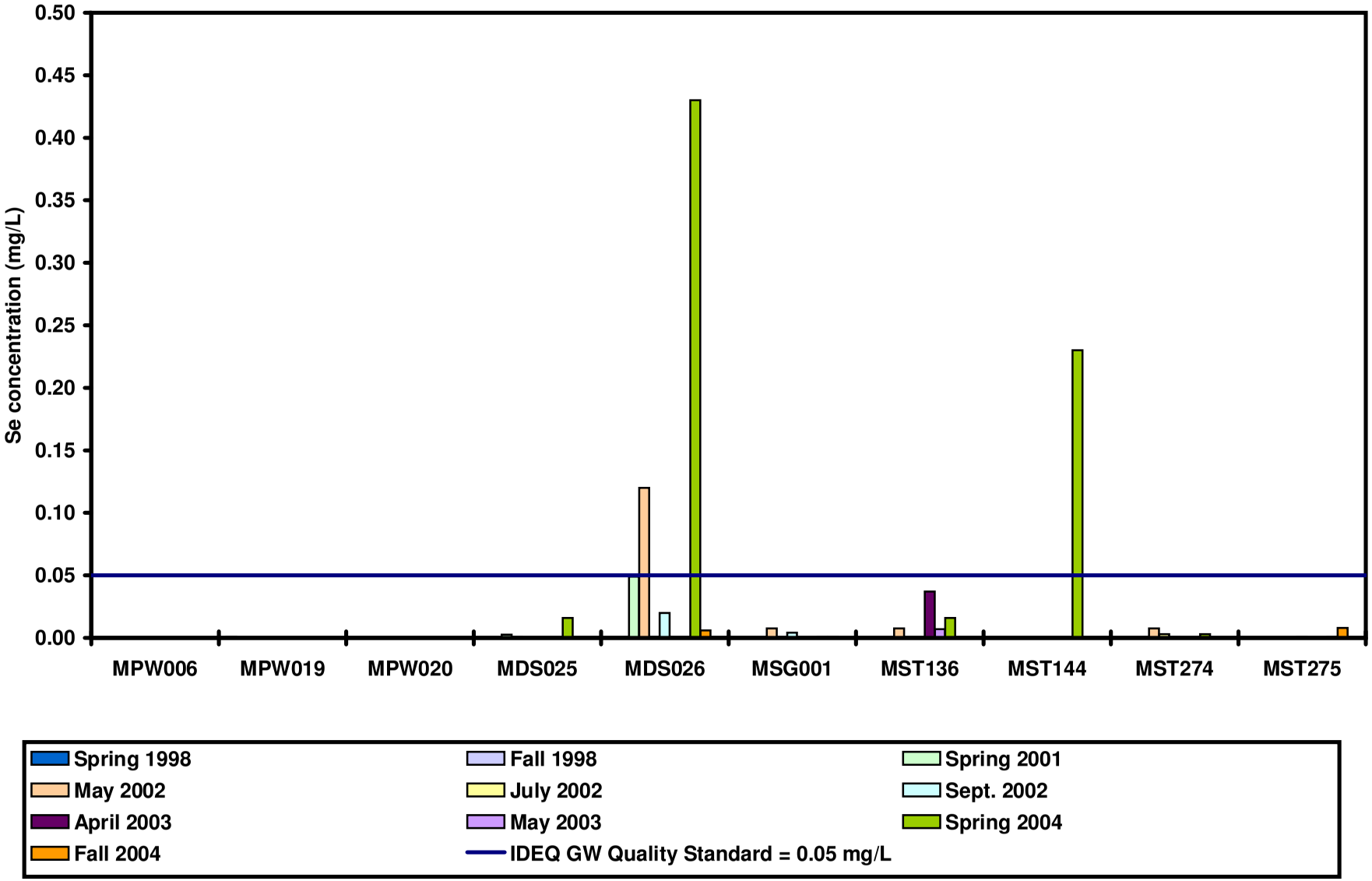


Figure 3
Henry Mine: Unfiltered Selenium Concentrations
Monitoring Wells (MMW), Production Wells (MPW), Dump Seeps (MDS), and Streams (MST)

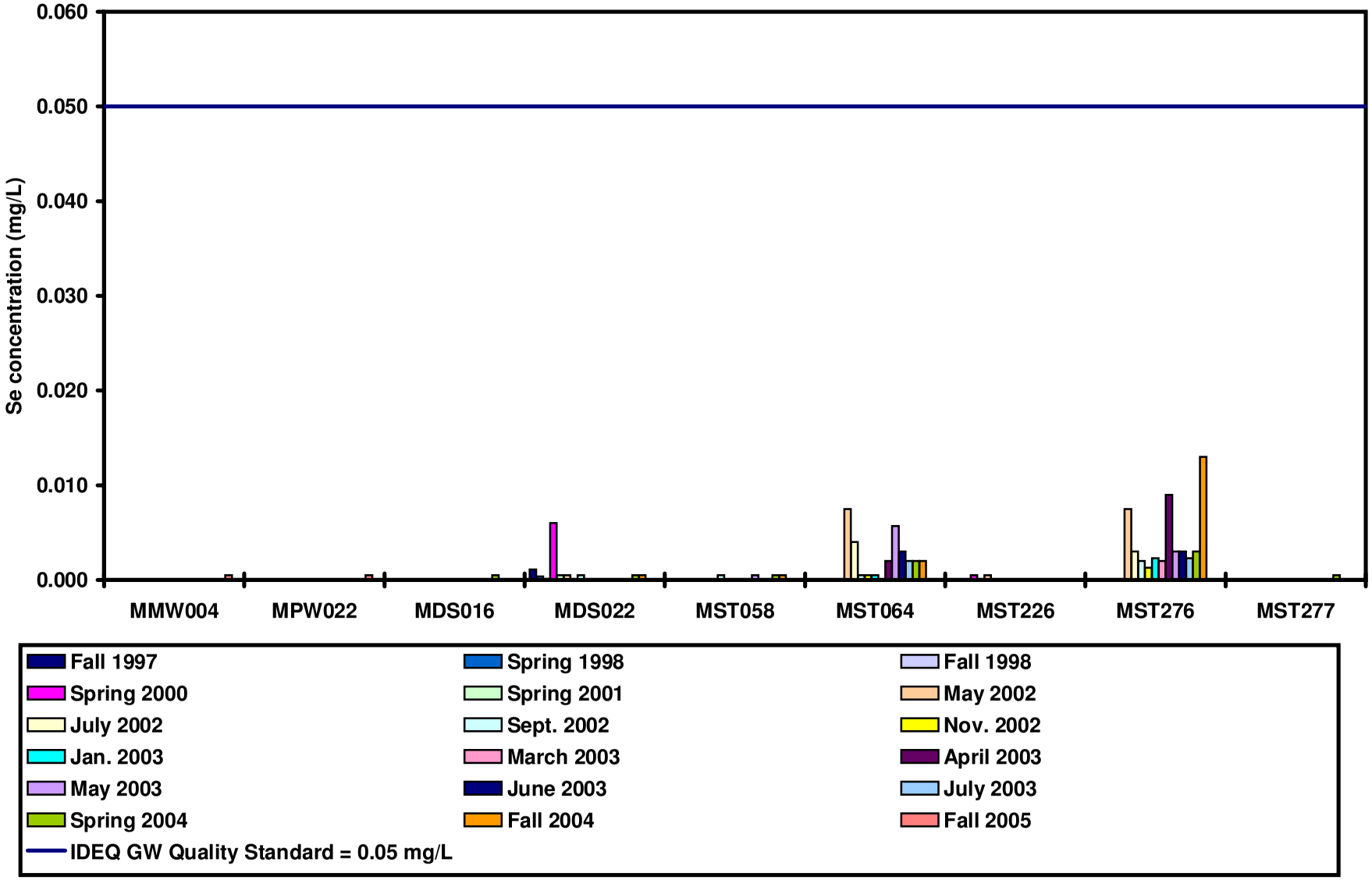
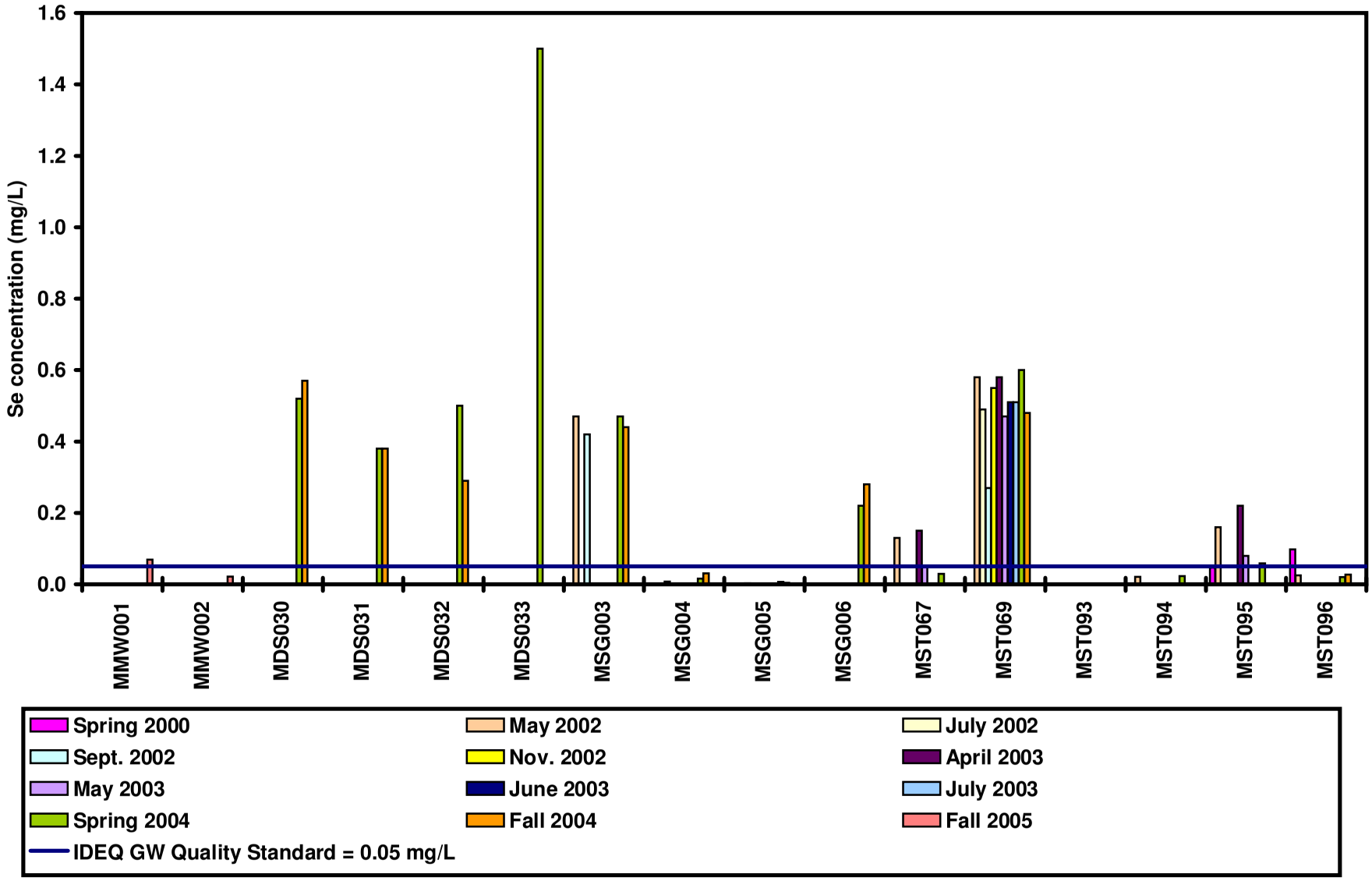


Figure 4
Ballard Mine: Unfiltered Selenium Concentration
Monitoring Wells (MMW), Dump Seeps (MDS), Springs (MSG), and Streams (MST)



3.2.2 Aerial Mapping of Ballard Mine

It was determined that recent topographic information for Ballard Mine was not available; therefore, aerial photography and topographic mapping of Ballard Mine was completed in 2005. This map is incorporated into this document as Drawing 10.

3.2.3 Water balance

This task was listed as Subtask 4a, Section 4.4.1 under Task 4: Soil Investigation in the final site investigation work plans. This task has not been completed and is currently underway. It has been included in this technical memorandum because it will provide information relevant to the groundwater investigation.

A water balance will be developed for the site using regional and local climatic data and site-specific information, as available. The water balance will focus on the waste rock piles at the mines. Components of the water balance will include average annual precipitation, estimates of evaporation and transpiration, as appropriate, and estimates of runoff and seepage based on the characteristics of the waste rock piles. The water balance will be semi-quantitative and will utilize site data as available.

3.2.4 Spring flow characterization

Due to a low spring runoff event, analysis of recession of flow from the springs was not completed during the Phase I investigation. Flow data collection for this task was completed during the 2006 field season. Evaluation of the data will be completed in 2007.

3.2.5 Investigation of Existing Wells

Existing Well Log Compilation and Search: Existing well logs were obtained from Idaho Department of Water Resources (IDWR) for several domestic and agricultural wells in the valleys surrounding the mines. These logs are compiled in Appendix F and summarized in Table 5.1. Additional information concerning the construction of wells MAW008, MMW003, MMW004, MPW006, and MPW023 was pursued in 2005. Based on discussions with the landowner, it was determined that MAW008, located at a farmhouse in a field west of Ballard Mine, was a shallow, hand-dug well in alluvial material. It was determined that the well MPW006 (Agrium production well) consists of two wells that are connected in series to the pumping system. Logs for both these wells (MPW006N and MPW006S) were located and are included in Appendix F. The logs indicate that the wells are 390 and 650 feet deep, respectively, and are drilled into alluvium, mudstone, shale and sandstone/limestone (likely Dinwoody Formation). Well logs for MMW003, MMW004 and MPW023 could not be found.

Downhole Camera Investigation: Downhole camera videos were produced for wells: MMW001, MMW002, MMW003, MMW004, MMW005, and MPW023. Downhole video of well MAW008 was proposed in the Phase II work plan; however recently obtained information revealed the well to be a shallow hand-dug well and not conducive to sampling, therefore, a downhole camera video was not produced. Wells MMW001, MMW002 and MMW005 are cased with PVC, and the purpose of the camera was to verify well condition, total depths, and screened intervals. Wells MMW003, MMW004, and MPW023 are constructed of steel casing at the surface. The quality of the downhole camera images was variable based on water clarity. In some of the wells, particularly MMW003 and MMW004, the presence of yellowish-colored

flocculent floating in the water column obscured the view of the boring walls. In MPW023, entrained sediment blurred the view.

Camera logging of MMW001 and MMW002 confirmed that the wells were in good condition and depths and screened intervals were consistent with their respective well logs. The camera log of MMW005, located adjacent to the Little Blackfoot River, indicated one open interval in the PVC casing from 16 to 17.5 feet depth, and a total depth of 30 feet bgs. Wells MMW003, MMW004, and MPW023 are constructed of steel casing near the surface and continue as open boreholes to their total depths. Well MMW003 contains approximately 25 feet of steel surface casing and has a total depth of 138 feet. Fractured bedrock was visible from approximately 35 feet to the bottom of the borehole, and yellowish-colored flocculent was visible through much of the open interval. Well MMW004 appears to contain steel casing to its total depth of 77 feet, and also contained significant amounts of yellowish-colored flocculent on the casing walls. Well MPW023 contains approximately 160 feet of steel surface casing and continues as an open borehole to a total depth of 310 feet. Light-colored, fractured rock was visible from 160 feet to the bottom of the boring.

3.2.6 Groundwater Level Measurements

Groundwater levels were obtained periodically during 2004 and 2005 field seasons. These data are presented in Table 3.4 below. Water level measurements were not acquired for the existing Enoch Valley Mine groundwater monitoring wells MPW019 and MPW020 or from the Agrium wells MPW006N and MPW006S. These wells have pumps set in them that do not allow access. Effort will be made to obtain water level data from these locations in the future. Water level data-logging equipment may also be employed at existing and proposed wells throughout the investigation.

Wells will be surveyed to obtain accurate elevations so that water level data can be used to determine gradient, model flow paths, and other hydrogeologic modeling. This effort is included as Activity 3b-11.

Table 3.4
2004 and 2005 Water Levels in Groundwater Wells (Feet Below Top of Casing)

Well Name	Well ID	2004		2005			
		May	October	May	June	July	October
Ballard Pit Well East	MMW001	292.96	292.3	289.60	285.22	284.41	287.82
Ballard Pit Well West	MMW002	225.14	226.55	227.30	227.10	225.56	224.05
Henry North Pit Monitoring Well S	MMW003	12.23	51.2	10.82	9.95	12.71	NM
Henry North Pit Monitoring Well N	MMW004	48.93	55.25	45.30	41.55	39.89	45.21
Henry South Pit Dewatering Well	MPW022	NM	77.55	77.53	74.00	74.65	76.34

NM-Not Measured

4.0 MINE-SPECIFIC CONCEPTUAL HYDROGEOLOGIC MODELS

Conceptual hydrogeologic models have been developed for Enoch Valley Mine, Henry Mine, and Ballard Mine. The models use geologic, hydrogeologic, and sampling information to identify potential shallow and deep groundwater flow paths that may be affected at the mine sites. These models will be updated, as indicated by Activity 3b-4, when additional information is gathered and evaluated. A matrix of potential sources, the groundwater flow paths emanating from each, and how they are evaluated is given in Table 4.1. Groundwater monitoring stations include dump seeps, springs, headwater streams, and existing and proposed wells within the vicinity of the mines. Results of such stations (groundwater expressed at the earth's surface via springs, seeps, or headwater streams) will be used to evaluate both surface water and groundwater quality. The term "surface-expressed groundwater" is used for descriptive purpose only, describing stations that will be sampled for both the surface water and the groundwater analyte lists. The phrase is not meant to have any regulatory significance. These locations are shown on Drawings 2 and 3.

4.1 ENOCH VALLEY MINE

4.1.1 Enoch Valley Mine Site History and Description

The Enoch Valley Mine (EVM) began operation in 1989 and was recently mined out in 2004. The mine lease area is approximately 3½ miles long by ½ mile wide and consists of three federal phosphate leases and two State of Idaho leases. It includes 55 acres owned by P4 Production, 838 acres administered by the Idaho Department of Lands (IDL), and 582 acres of US Forest Service (USFS) land as shown in Drawing 2.

The EVM mine plan called for mining to progress from the north and south ends of the property towards the center. Mining began at the north end of the property in 1989. In the Spring of 2000, the active north and south mine pits were finally joined near the middle of the lease (MMP045). At the end of 2001, the total output of phosphate ore was 14.6 million dry net tons (DNT). Phosphate ore removed from Enoch Valley Mine produced approximately 1.2 million tons annually. Active mining was completed at EVM in 2004.

The North and South Dumps are the two main waste rock dumps at EVM (MWD091 and MWD092). Both dumps contain cherty shales and some black shales. The term "black shales" is a descriptive term used to describe one or more of the individual members (Cherty Shale, Rex Chert, and Meade Peak) of the Phosphoria Formation. The EVM North Dump (MWD092) completely backfills approximately 60% of the north pit (MMP045). This area covers approximately 93 acres and is completely reclaimed. The remaining 40% of the north pit (at the southern end) has been partially backfilled. The South Dump (MWD091) has been almost completely reclaimed and covers approximately 308 acres. The total volume of waste rock at EVM was 51.5 million bank cubic yards as of December 31, 2001. Evaluation of excavation and backfill below the water table will be addressed in Activity 3b-8—Review of Available Hydrogeologic Information.

4.1.2 Enoch Valley Mine Site Geology

The topography and site layout of the EVM is shown on Drawing 2. Topography of the EVM site is dominated by the long, low ridgeline of Rasmussen Ridge, which trends northwest to southeast. On the west side of Rasmussen Ridge lays Enoch and Rasmussen Valleys. These valleys drain surface water north to the Little Blackfoot River (via Lone Pine Creek) and south to the Blackfoot River (via

Rasmussen and Angus Creek), respectively. Elevations range from about 6,600 feet to over 7,000 ft AMSL. The phosphate outcrops and pits are located along the west slope of the ridge.

Surficial regional geology of Enoch Valley Mine is presented on Drawing 3. Regional geologic mapping of the program area was conducted in 1927 by the U.S. Geological Survey (USGS) (Mansfield, et al., 1927). Mine features within the program area are included on the regional geologic map presented as Drawing 3. Field observations and boring logs, at the local scale, have been used in updating the mine-specific conceptual hydrogeologic models, cross-section drawings, and in determining locations of proposed wells. Discrepancy between Drawing 3 and other drawings and field observation may exist. Efforts to update all drawings are on-going.

The geology shown is pre-mining and pits and waste rock dumps are drawn in their representative locations. A conceptual cross-section A-A′ through this area is shown on Drawing 4, *Conceptual Geologic Cross Sections of Enoch Valley, Henry and Ballard Mines.* As shown on these drawings, Rasmussen Ridge is composed of bedrock units folded within the Snowdrift Anticline. The Meade Peak member (phosphate ore deposit) outcrops along the west ridge of the anticline and dips to the west, parallel to the ridge slope. The other members of the Phosphoria Formation lie adjacent to this layer and outcrop below the Meade Peak along the ridge. The Wells Formation outcrops and forms the top of Rasmussen Ridge. The Enoch Valley Fault runs parallel to the strike of the anticline and through the Wells Formation just above the Meade Peak outcrop. This normal fault shifted the block of Wells Formation on the northeast above the units on the southwest side of the fault. There is no field evidence that ground water discharge occurs along the trace of the Enoch Valley Fault in the vicinity of the mine. Rasmussen and Enoch Valleys are composed of the Dinwoody and Thaynes Formation, overlain by Quaternary alluvium/colluvium and basalt in areas.

Outlines of the pits and waste rock dumps are shown in plan view in Drawing 3 and conceptually in cross-section on Drawing 4. As shown on these drawings, the EVM pit (MMP045) is oriented along the outcrop of the Meade Peak Member of the Phosphoria Formation. The majority of the pit ends in the Phosphoria Formation with exception of portions of the eastern flank, which is excavated to contact with the Wells Formation. The North Dump (MWD092) is partially backfilled into the pit and extends north onto Dinwoody Formation and alluvium above Enoch Valley. The South Dump (MWD091) is backfilled into the pit onto the Phosphoria and Wells Formations, and extends south and west on Dinwoody Formation and alluvium/colluvium of Rasmussen Valley.

4.1.3 Enoch Valley Mine Conceptual Hydrogeologic Model

Potential groundwater flow paths at EVM are discussed below. These flow paths are controlled by several factors including site topography, hydrogeologic properties of bedrock units, and site geology and structure. The postulated alluvial groundwater flow paths emanating from the EVM area are listed in Table 4.1 and presented in plan view on Drawing 3 Conceptual alluvial and deep groundwater flow paths are shown in cross-section on Drawing 4.

At the EVM site, the ridge top, above the pits, consists primarily of Wells Formation that has a relatively high hydraulic conductivity. Therefore, a significant portion of precipitation and/or snowmelt onto the ridges will infiltrate into the area underlain by Wells Formation to recharge the regional aquifer associated with this formation. Because the mine pits are located near the tops of the ridges, and because of significant infiltration into the Wells Formation above, only a relatively small amount of runoff is predicted to flow to the backfilled pits. No runoff has been observed running to the pits and/or waste rock dumps during storm events in the past. Therefore, the main source of water to the waste rock dumps and backfilled pits consists of direct precipitation and snowmelt. As a result, a relatively limited amount of water is expected to infiltrate through the backfilled EVM mine pits or waste rock dumps.

As shown in Drawing 3, the footprint of the mine pits is mostly located on Phosphoria Formation. Therefore, water infiltrating the backfilled waste rock to the contact with the Phosphoria Formation will be confined by the low transmissivity which is characteristic of these units. The extremely low vertical hydraulic conductivity, particularly of the lower Meade Peak member, impedes the transport of water to the underlying Wells Formation. Therefore, water contacting the Phosphoria Formation via infiltration will generally flow above the Phosphoria and into the Dinwoody or Thaynes Formations and eventually into alluvium of the valleys. In the high-walls of the pits that have been excavated into the Wells Formation, a potential pathway exists for infiltrating water to enter the Wells Formation directly. Due to the relatively higher horizontal (parallel to beds) versus vertical (perpendicular to beds) hydraulic conductivity of sedimentary units, the groundwater flow would be directed generally parallel to bedding and down structural dip within the Wells Formation. The strike of the Wells Formation near the mine is northwest-southeast with a dip to the southwest.

Substantial portions of the EVM waste rock dumps have been placed directly on the Dinwoody Formation and alluvium of the valleys. These formations have moderate to high hydraulic conductivity and reportedly support intermediate groundwater flow systems. The relatively shallow flow paths through these units will be intermediate in distance and will exchange flow with overlying alluvium and interact directly with surface water. Water flowing within these units will generally follow the surficial drainages and alluvial channels of Lone Pine Creek to the north and Rasmussen Creek to the south.

In conclusion, water being transported from and through the EVM waste rock dumps will flow into the Dinwoody Formation and the alluvial deposits within the valleys. Shallow flow from the EVM North Dump (MWD092) will generally move northwest toward Lone Pine Creek and flow from the South EVM Waste Rock Dump (MWD091) will generally be directed southeast toward East Fork Rasmussen Creek and southwest toward Rasmussen Creek, as shown in Drawing 3. There is also some potential for water to move through the backfilled pits and enter the Wells Formation, and flow southwest, down structural dip.

4.2 HENRY MINE

4.2.1 Henry Mine Site History and Description

The Henry Mine, operated by the Monsanto Company from 1969 to 1989, is located in T6S and R42/43E, approximately one mile southeast of the town of Henry, Idaho. The Henry Mine lease area is approximately five-miles long and one-half-mile wide. It includes 840 acres owned by P4 Production, 40 acres administered by the BLM, and 1,200 acres administered by the Idaho Department of Lands (IDL). Of these 2,080 acres, 1,000 were disturbed during mining operations, and 680 acres have successfully been reclaimed to date. The remaining un-reclaimed areas include mine pits and portions of the haul road. The Henry Mine plan called for five mine panels or pits along five miles of phosphate outcrop. Pits I and II were the site of the initial mining, Pit III was the South Henry Continuation, Pit IV was the Center Henry Continuation, and Pit V was the North Henry Continuation (Lee, 2001). The two middle panels at Henry Mine were mined separately, but ultimately joined during mining. The designation of MWD089 as an individual dump was discontinued because during mining, the materials in MWD086 and MWD089 were intermixed from their sources. Therefore the two waste rock dumps are considered to be one continuous dump, designated WDR086.

Phosphate ore removed from Henry Mine was estimated to be one million tons annually during the active mining phase (Lee, 2001), for a total estimate of 18 million tons during the active mining phase. Mining operations were completed at the North Pit (MMP041) in October 1989 (Lee, 2001). Final reclamation

was completed in 1990 and reclamation bonds were relinquished in December of 1993 and November 1995. The volume of waste rock at Henry Mine is approximately 99.6 million bank cubic yards. There are five waste rock dumps (MWD085, MWD086, MWD087, MWD088, and MWD090) associated with these pits (MMP041, MMP042, MMP043, and MMP044) at the site. The surface area of the existing waste rock dumps is estimated at 620 acres. Evaluation of excavation and backfill below the water table as well as a synopsis of the Master's Thesis describing the hydrogeology of Henry Mine (Brooks, 1982) and several additional student research projects throughout the program area will be addressed in Activity 3b-8—Review of Available Hydrogeologic Information.

4.2.2 Henry Mine Site Geology

Topography of Henry Mine, shown in Drawing 2, is dominated by the northwest-southeast trending ridgeline of the Wooley Range. Near the north end of the lease, the Little Blackfoot River cuts across the property and flows northwest into the Blackfoot Reservoir. All surface water from the mine area eventually flows to the Little Blackfoot River via intermittent flow through Long Valley Creek on the west side of the mine area or Lone Pine Creek on the east side, or directly to the Little Blackfoot. Elevations at the site range from 6,200 to 6,800 ft AMSL. Mine pits were developed along the eastern side of this steeply-sloping ridgeline and are located along a five-mile stretch of Phosphoria outcrop. The waste rock dumps are located to the east of the mine pits with exception of the Henry Mine Canyon Fill Dump MWD087, which is located to the west of the center pit.

Surficial regional geology of Henry Mine is presented on Drawing 3. Regional geologic mapping of the program area was conducted in 1927 by the U.S. Geological Survey (USGS) (Mansfield, et al., 1927). Mine features within the program area are included on the regional geologic map presented as Drawing 3. Field observations and boring logs, at the local scale, have been used in updating the mine-specific conceptual hydrogeologic models, cross-section drawings, and in determining locations of proposed wells. Discrepancy between Drawing 3 and other drawings and field observation may exist. Efforts to update all drawings are on-going.

A representative cross-section B-B′ is presented in Drawing 4. As shown, the Wells Formation makes up the top of the western ridge of the Wooley Range (west and above the mine pits) and continues in outcrop to the west into Long Valley. In places, alluvium and basalt flows have been deposited over the older bedrock units of Wells Formation, specifically in the valley through which the Little Blackfoot River divides North Henry Mine from Center Henry Mine. The Meade Peak Member outcrops along the east flank of the western ridgeline of the Wooley Range and dips to the east. Adjacent members of the Phosphoria Formation outcrop further down the ridge below the Meade Peak unit, and some older alluvium has been deposited within a mid-ridge valley. At the southern end of Center Henry Mine, a relict alluvial channel drains west into Long Valley.

Outlines of the pits and waste rock dumps are shown in plan view in Drawing 3 and conceptually in cross-section on Drawing 4. The geology shown is pre-mining and pits and waste rock dumps are drawn in their representative locations. As indicated in the drawings, the mine pits are oriented along the Meade Peak member outcrops. The center pit (MMP042) is backfilled with waste rock deposited on Phosphoria Formation on the east side and Wells Formation on the west side. However, portions of the Henry Mine Dumps are located on alluvium in the mid-ridge valley and on the adjacent Dinwoody Formation. Also, portions of the Henry Mine North Dump (MWD085) and Henry Mine Canyon Fill Dump (MWD087) are located on Wells Formation above Long Valley.

It is generally not possible to completely mine out the extent of the Phosphoria Formation. The Phosphoria Formation is a continuous geologic strata that extends to great depths and over large areas. The depth of mining is limited by economics, not the absence of the Phosphoria Formation, and only in

very rare geologic conditions due to faulting and/or folding would it be possible to mine out a pit so that no Phosphoria would remain in a pit. As mining advances deeper, the pit must extend outward to provide stable pit out-slopes; therefore, more non-ore waste rock must be mined to reach the ore. Eventually, it becomes cost prohibitive to extract ore and mining in the particular location is terminated.

4.2.3 Henry Mine Conceptual Hydrogeologic Model

Similar to the characteristics of EVM, described above, the Wells Formation outcrops at the topographic ridge top, above the mine pits. Due to infiltration into the Wells Formation above, only a relatively small amount of runoff is predicted to flow to the backfilled pits. No runoff has been observed running to the pits and/or waste piles during storm events in the past. Therefore the main source of water to the waste rock dumps and backfilled pits is of direct precipitation and snowmelt. As a result, a relatively limited amount of water is expected to infiltrate through the backfilled Henry mine pits or waste rock dumps.

Similar to EVM, much of the footprint of the Henry mine pits and waste rock dumps are located on Phosphoria Formation which, due to the extremely low vertical hydraulic conductivity of the units, impedes the transport of water to the underlying Wells Formation. Therefore, water contacting the Phosphoria Formation via infiltration will generally flow above the Phosphoria and into the Dinwoody or Thaynes Formations and eventually into alluvium of the valleys. However, water may enter the Wells Formation through the high-walls of the pits that have been excavated into the Wells Formation and from the North Henry Dump (MWD085) and the Henry Mine Canyon Fill Dump (MWD087). Due to the relatively higher horizontal (parallel to beds) versus vertical (perpendicular to beds) hydraulic conductivity of sedimentary units, the groundwater flow would be directed generally parallel to bedding and down structural dip within the Wells Formation. The Wells Formation in the vicinity of the Henry Mine strikes northwest – southeast with a dip to the northeast. Water recharging the Wells Formation would follow flow paths controlled locally by formation strike and dip and on a larger scale by the regional flow to the west.

Henry Mine Pit #1 Waste rock dump (MWD086) on the eastern side of the center pit, and the south dump (MWD090) are placed mostly on alluvium with some on Dinwoody Formation in the mid-ridge valley. Water that infiltrates or runs off these waste rock dumps will enter this shallow groundwater flow system. These flow paths will be intermediate in distance and will exchange flow with overlying alluvium and interact directly with surface water. Water flowing within these units will generally follow the surficial drainages and alluvial channels north toward the basalt that is present along the Little Blackfoot River and northeast toward Lone Pine Creek.

In conclusion, the most significant flow path for groundwater being transported at Henry Mine is from the waste rock dumps into the Quaternary alluvial deposits within the valleys. Shallow flow from these dumps will generally move north toward the Little Blackfoot and northeast toward Lone Pine Creek. Another potential flow path is via water infiltrating through backfilled pits or waste rock and directly into the Wells Formation. Water recharging the Wells Formation would follow flow paths controlled locally by formation strike, northwest-southeast, and dip, northeast and on a larger scale by the regional flow to the west.

4.3 BALLARD MINE

4.3.1 Ballard Mine Site History and Description

The Ballard Mine is a historic phosphate mine located in T7S and R42/43E, which was operated by the Monsanto Company from 1951 to 1969. Ballard Mine was originally leased to the J.R. Simplot Company in December 1948. Simplot never developed the lease and in 1951 the Simplot Company assigned the lease to the Monsanto Chemical Company. A second Ballard Mine federal lease was issued to Monsanto in July 1955 to include additional phosphate ore deposits. During the 18 years of production (1951 - 1969), approximately 10.4 million dry net tons of phosphate rock were mined and removed from the two federal leases. The Ballard Mine lease areas combined are approximately 1.7 miles long and 1.2 miles wide. Within this area, approximately 191 acres were mined for phosphate rock, about 317 acres of land were covered by waste rock dumps and approximately 96 acres were used as service areas for the mine (Lee, 2001). Conversion of phosphate ore to elemental phosphorus occurred at the P4 Production Company plant, north of Soda Springs, Idaho. Approximately 20 million bank cubic yards of waste rock were stripped, and of that amount, two million cubic yards were used to backfill the pits with the remaining 18 million cubic yards hauled to the dumps (Lee, 2001).

Reclamation had started on the earlier pits even before mining operations were completed. In the 1960s and early 1970s, the Ballard Mine waste rock dumps were used for experimental plantings for reclamation. In the early 1980s, a study was conducted by Monsanto on cost-effective reclamation activities that might be completed at Ballard Mine. Some small projects that included highwall reduction, spreading of soil, breaking up of hard floors and subsequent plantings were initiated as part of the study.

4.3.2 Ballard Mine Site Geology

Topography of Ballard Mine (Drawing 10) is dominated by moderately-sloped, north-northwest trending ridges that make up the Fox Hills. Surface water from the northern portions of the Ballard Mine area flows north to Long Valley Creek towards the Little Blackfoot River. Most of the Ballard Mine area drains east to Wooley Valley Creek, a tributary of the Blackfoot River, or south/southwest to intermittent tributaries of the Blackfoot River. Elevations at the site range from 6,400 to 7,100 ft AMSL. The Ballard Mine site has six distinct open mine pits and six distinct waste rock dumps clustered within the ridges and side slopes. Unlike the other two mine sites, the layout of the Ballard Mine area is more complicated because the Phosphoria outcrop is not continuous. Therefore the pits are not located along a continuous strike of Meade Peak Member, but rather are scattered throughout the hills where the Meade Peak outcrops are at or near the surface.

Surficial geology at the Ballard Mine is presented on Drawing 10. The geology shown is pre-mining for features except mine pits and waste rock dumps; outlines of pits and waste rock dumps are drawn in their respective location and conceptually in cross-section C-C′ in Drawing 4. As shown in these drawings, the Ballard Mine area is cut by several north-northwest trending, sub-parallel normal faults including the Slug Valley Normal Fault, which is buried near the site through Wooley Valley. These faults have, in several locations, offset the Phosphoria members and resulted in displacing the Meade Peak member (phosphate ore deposit) towards or away from the surface. In general, the mine pits reflect the locations where the Meade Peak is at or near the ground surface. Surface geology in the area generally consists of an outcrop of Wells Formation (and a small area of the Meade Peak) which has been displaced upwards by two normal faults. To the west and east of these primary faults, Phosphoria and Dinwoody Formations outcrop on the side slopes and into the valleys that have been filled with alluvium. Just west of the mine site, a large basalt flow exists at the surface, covering the underlying geology. The Blackfoot River flows across this basalt flow just downgradient of the Ballard Mine inflows. To the south is a large outcrop of Dinwoody Formation on the adjacent ridge.

The mine pits at Ballard Mine are located adjacent to and bisecting faults that have displaced the Meade Peak member towards the ground surface. Waste rock dumps are backfilled into the pits and are deposited on Phosphoria Formation, Wells Formation, Dinwoody Formation and alluvium in both Wooley Valley and the valleys to the west.

4.3.3 Ballard Mine Conceptual Hydrogeologic Model

The conceptual groundwater flow paths emanating from Ballard Mine area are discussed below. Similar to the other mine sites, water entering the ground from the pits and waste rock piles that are located on the Phosphoria Formation will tend to follow the strike and dip of the formation because of the low hydraulic conductivity of the unit. The low hydraulic conductivity, both with bedding and across bedding, impedes the transport of water across the Phosphoria Formation to the underlying Wells Formation. Furthermore, the extremely low vertical hydraulic conductivity, particularly of the lower Meade Peak member, impedes the transport of water from above and within the Phosphoria units to the underlying Wells Formation.

The Ballard Mine waste rock dumps are reclaimed and covered with topsoil over much of the dumps, which may affect water infiltration. Activity 3b-8 includes study of infiltration through waste rock areas. Information gained will be used to update the mine-specific conceptual hydrogeologic models.

At Ballard Mine portions of the waste rock dumps are located on the Wells Formation. Water draining through these dumps is capable of moving into the Wells Formation. Water recharging the Wells Formation would follow flow paths controlled locally by formation strike and dip and on a larger scale by the regional flow to the west. The strike of the Wells Formation is generally north-south with the dip dependent on location. The waste dumps (MWD080, MWD081) located west of the West Ballard Pit (MMP035) overlie an eastward dipping section of the Wells Formation (see cross-section C-C′ in Drawing 4). The Middle Ballard Pit (MMP036) overlies a westward dipping section of the Wells Formation. The East Ballard Pit, MMP040, overlies a structural syncline with dips both to the east and west.

Portions of all Ballard waste rock dumps are placed on alluvium and Dinwoody Formation on the side slopes and valleys. Water that infiltrates or runs off these waste rock dumps will enter shallow groundwater flow systems. The Mead Peak Member of the Phosphoria Formation has very low hydraulic conductivity but is not impermeable. Very little groundwater is likely to flow from the Dinwoody and across the Phosphoria Fomation into the Wells Formation. These shallow groundwater flow paths will be intermediate in distance and will exchange flow with overlying alluvium and interact directly with surface water. Water flowing within the shallow units will generally follow the surficial drainages and alluvial channels, specifically toward Wooley Valley Creek to the east, to the Blackfoot River tributaries to the southwest, or to Long Valley Creek to the northwest.

In conclusion, water originating at Ballard Mine waste rock areas placed on alluvium and Dinwoody Formation will enter the shallow groundwater flow system within the Quaternary alluvial deposits within the valleys, with flow to the northwest to Long Valley, to the east to Wooley Valley and to the southwest to the Blackfoot River. Water recharging the Wells Formation would follow flow paths controlled locally by formation strike and dip and on a larger scale by the regional flow to the west.

Table 4.1
Groundwater Flow Fields and Associated Sampling Stations[1]

Enoch Valley Mine					
Flow Direction	*Groundwater Monitoring Stations*				
	Headwater Streams	Seeps	Springs	Wells	
				Receptor	Monitor
Northwest to Lone Pine Creek	MST059 MST060 MST061		MSG001	MDW002 MAW001 MAW002	MMW012
Southeast to East Fork Rasmussen Creek	MST274	MDS026		MAW005	MMW007 MMW008
Southwest to Rasmussen Creek	MST136 MST144	MDS025			MMW013
Southwest down structural dip of Wells Formation from eastern ridge	ND	ND	ND	ND	MMW009
Henry Mine					
Flow Direction	*Groundwater Monitoring Stations*				
	Headwater Streams	Seeps	Springs	Wells	
				Receptor	Monitor
Northeast to Lone Pine Creek	MST058 MST064 MST226 MST276	MDS016 MDS022	MSG002	MDW003	MMW010 MMW014
Northwest toward Little Blackfoot River in Basalt	ND	ND	ND	ND	MMW019
Northeast down structural dip of Wells Formation from western ridge	ND	ND	ND	ND	MMW011
Ballard Mine					
Flow Direction	*Groundwater Monitoring Stations*				
	Headwater Streams	Seeps	Springs	Wells	
				Receptor	Monitor
Southwest to Blackfoot River	MST066 MST067 MST068 MST069	ND	ND	MAW008	MMW015A MMW016A
Northwest to Long Valley Creek	MST050	ND	ND	MAW006	MMW017
East to Wooley Valley Creek	MST093 MST094 MST095 MST096	ND	MSG004 MSG005 MSG006	ND	MMW018
East/Southeast down structural dip of Wells Formation near West Ballard Pit (MMP035)	ND	ND	ND	ND	MMW020 MMW021 MMW006

ND - Not determined
1. Provenance of headwater streams, seeps, and springs have not been determined.

5.0 MONITORING WELL INSTALLATION RATIONALE AND SCOPE OF WORK

Monitoring wells will be installed at EVM, Henry Mine, and Ballard Mine in the locations shown on Drawings 2, 3 and 10. Summaries of the proposed well installations and construction details are presented at the conclusion of this section in Tables 5.1, 5.2, and 5.3. The purpose and rationale for the proposed monitoring well locations and targets are described in more detail in the sections below.

This groundwater investigation is being conducted in a phased approach. The information obtained from the monitoring and installation of these new wells will be used to refine the conceptual model and may give rise to new data needs as will be addressed in Activity 3b-4—Update of Conceptual Hydrogeologic Site Model. Additional groundwater investigation needs may warrant installation of additional monitoring wells.

Descriptions of the field methods that will be used to conduct this scope of work are included in Section 6.0, and laboratory analyses are described in Section 7.0. The scope of work consists of the following tasks, described in more detail at the end of this section.

5.1 ENOCH VALLEY MINE

As presented in the EVM conceptual hydrogeologic model, the most significant flow path for water being transported from and through the EVM waste rock dumps is into the alluvial deposits and Dinwoody Formation within the valleys. Flow from the EVM North Dump (MWD092) will generally move northwest toward Lone Pine Creek and flow from the South EVM Waste Rock Dump (MWD091) will generally be directed southeast toward East Fork Rasmussen Creek and southwest toward Rasmussen Creek, as shown in Drawing 3.

Several groundwater monitoring stations exist within the alluvial flow fields surrounding EVM, as indicated in Table 3. An additional four new monitoring wells, MMW007, MMW008, MMW012, and MMW013, will be installed to monitor flows within the alluvium and Dinwoody Formation from the North and South EVM dumps (MWD091 and MWD092). Soil and rock samples from the well borings, groundwater sample analytical data, and water quality field parameter measurements from these wells, will aid in the characterization of groundwater along the shallow flow paths.

Monitoring wells MMW007 and MMW008 will be drilled near the toe and downgradient of the EVM South Waste Rock Dump (MWD091) and will target shallow groundwater within either the alluvium or Dinwoody Formation, depending on where groundwater is encountered. These wells will monitor groundwater flow from the south dump toward the southeast into East Fork Rasmussen Creek. The wells will be downgradient of dump seep MDS026. Monitor well MMW012 will monitor groundwater flow from EVM North Dump (MWD092) into the alluvial flow field of Lone Pine Creek. The well will be upgradient of three headwater stream stations (MST059, MST060 and MST061) and three receptor wells (MAW001, MAW002, and MDW002) within the valley. Monitor well MMW013 will monitor groundwater flow from the center portion of the EVM South Dump (MWD091) into the alluvial flow field of Rasmussen Creek. The well will be downgradient of two headwater stream stations and dump seep MDS025.

> **MMW007:** This well will be located near the toe of EVM South Waste Rock Dump (MWD091), near South Dump Seep, MDS026. A conceptual cross-section showing the proposed location is presented in Drawing 5, *Conceptual Cross-Section for Proposed Well Locations MMW007 and MMW008*. The boring may be drilled through approximately 20 feet of waste rock and into

native alluvium or Dinwoody Formation below. Preferably, MMW007 will be located such that it will be completed in the alluvium; however, depending on groundwater depth, it may be completed in the Dinwoody Formation below. Steel surface casing will be installed through the waste rock (if encountered) and organic soil horizon to isolate the potential seleniferous material from the lower portions of the borehole during drilling. The well will be screened in the underlying native formation at first groundwater with sufficient yield to provide water samples using standard low-stress sampling methods. The total depth of the well is anticipated to be approximately 100 feet below ground surface (bgs).

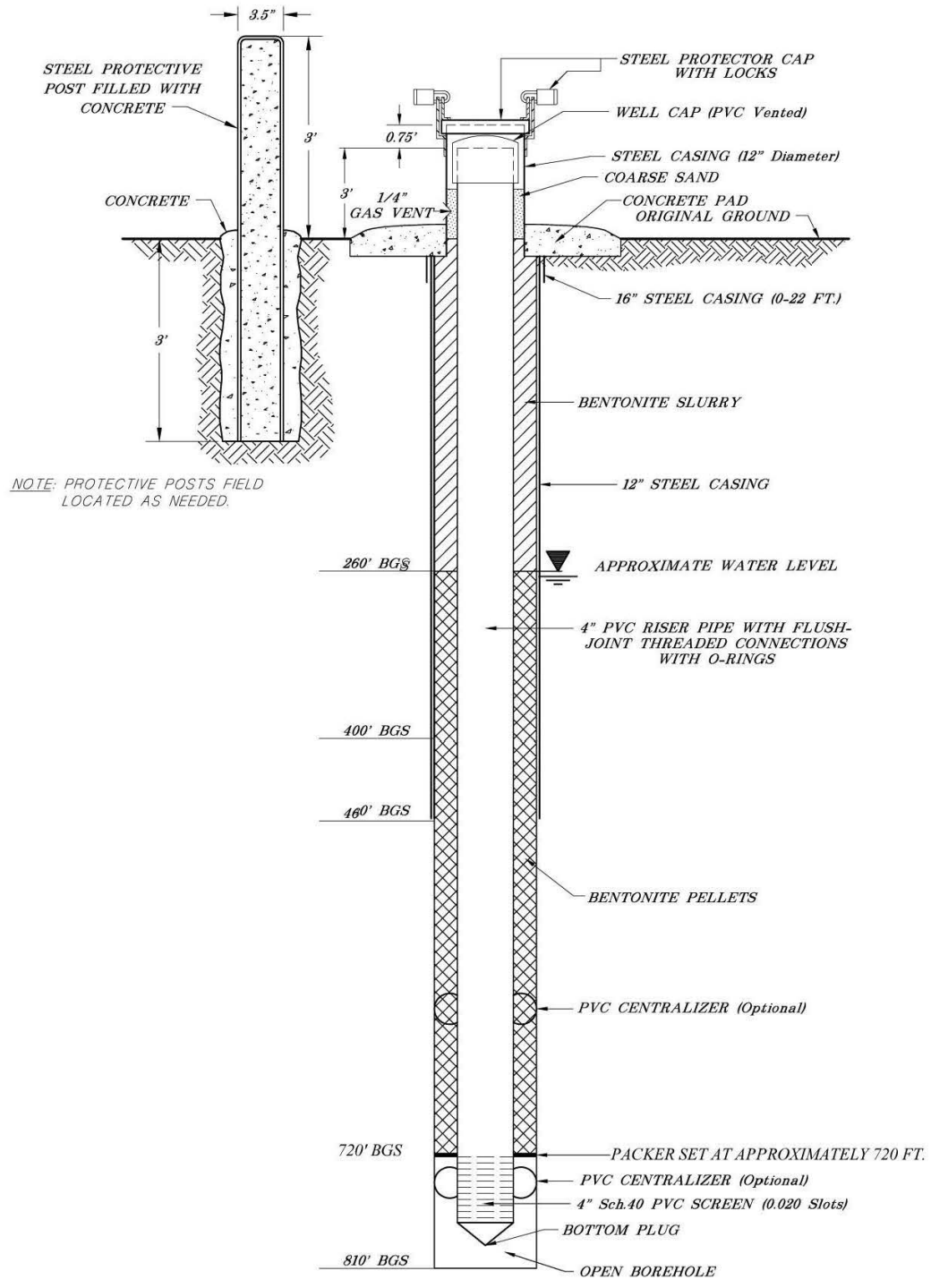
MMW008: This well will be located downgradient of the toe of the EVM South Waste Rock Dump (MWD091), downgradient of dump seep MDS026 and approximately 700 feet southeast and downgradient of well MMW007. The well will monitor groundwater flow from the south dump toward the southeast into East Fork Rasmussen Creek. The boring will be drilled in native alluvium or Dinwoody Formation and the well will be screened in first groundwater with sufficient yield to provide water samples using standard low-stress sampling methods. It is anticipated that the well will be drilled approximately 100 feet bgs. It is presumed that surface topography and the presence of an alluvial channel will dictate groundwater gradient and flow direction in the unconfined groundwater system from this area. Therefore, there is a high probability that MMW008 has been sited in the downgradient flow direction from the EVM South Dump (MWD091) and well MMW007.

MMW012: This well will be located near the western edge of the EVM North Waste Rock Dump (MWD092). The well will monitor groundwater flow in the Lone Pine Creek alluvial flow field. The boring will be drilled in native alluvium and screened in first groundwater with sufficient yield to provide water samples using standard low-stress sampling methods. The depth is anticipated to be approximately 30 feet bgs.

MMW013: This well will be located in the alluvial flow field of Rasmussen Creek near the center of the EVM South Waste Rock Dump (MWD091). The well will be downgradient of dump seep MDS025. The boring will be drilled in native alluvium and screened in first groundwater with sufficient yield to provide water samples using standard low-stress sampling methods. The depth is anticipated to be approximately 30 feet bgs.

The conceptual model of EVM suggests that there is also potential for water to move through the backfilled pits and enter the Wells Formation, flowing primarily down structural dip to the southwest. Monitor well MMW009 will be installed within an existing production well converting it to a monitoring well. The well will target the Wells Formation down dip and downgradient of the backfilled EVM Pit (MMP045) and South Waste Rock Dump (MWD091). A conceptual cross-section, showing this well location is presented in Drawing 4*, Enoch Valley Mine Conceptual Cross-Section A-A'*. The well is described below in more detail.

MMW009: The location for MMW009 was selected for two reasons. First, the site is down dip and down gradient from mine-impacted areas overlying the Wells Formation. Second, a borehole exists that can be completed as a monitor well within the upper stratigraphic section of the Wells Formation.



REV. No.	REVISIONS	REV. DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
	Issued for Draft Tech Memo	10/05	P.Anderson	K.Conrath	P.Anderson

MWH

PROJECT No.: 1010076.011602
AutoCAD FILE: Well Diagram MW009
SCALE: As Shown
FIGURE No: 5

P4 PRODUCTION
Southeast Idaho Mine - Specific Selenium Program

PROPOSED WELL CONSTRUCTION DIAGRAM FOR EVM WELL MW009

It is proposed that well MMW009 be completed by modifying the existing boring of EVM production well, MPW020, which has most recently been used by Degerstrom for road maintenance but is currently not in use. The well log, obtained from IDWR records, is included in Appendix F. Well MPW020 currently consists of 12" steel casing to a depth of 460 feet bgs and open borehole to 810 feet bgs. The well log indicates Phosphoria Formation to a depth of 720 feet, overlying Wells Formation from 720 feet to the bottom. The driller's report log indicates a water-bearing zone in the limestone from 720 –726 feet bgs, and that the boring is "losing water" at 800-810 feet bgs. It is proposed that the MPW020 boring be converted to a monitoring well, MMW009, for the Wells Formation by installing 4-inch diameter PVC casing to approximately 730 feet bgs, and maintaining the open interval from 720 – 725 feet within the Wells Formation. Geophysical logging of the open borehole will be performed prior to setting the well to evaluate the signature of the Phosphoria Formation and confirm the contact depth with the Wells Formation, and potentially to identify and isolate a more specific interval for monitoring. The well construction details will be modified according to the results of the logging. The remainder of the MPW020 boring will be sealed by installing a packer above the open interval, targeted at 720 feet bgs, and sealing the remainder of the borehole with bentonite slurry to the surface. A well construction diagram for MMW009 is provided in Figure 5, *Proposed Well Construction Diagram for EVM Well MMW009.*

5.2 HENRY MINE

As presented in the Henry Mine conceptual hydrogeologic model, the most significant flow path for groundwater being transported at Henry Mine is from the waste rock dumps into the Quaternary alluvial deposits within the valleys. Shallow flow from these dumps will generally move north toward the Little Blackfoot and northeast toward Lone Pine Creek.

Water flowing from North Henry Dump (MWD085) will generally flow southeast and be monitored by three wells, MMW004, MMW011, and MMW019. The Canyon Fill Dump (MWD087) has a very limited recharge area on the southwest side of the ridge divide and will have limited infiltration and pore water flux. This is not considered a significant flow pathway. Flow in the remaining Canyon fill area will be directed back toward the mine. Other flow paths are being monitored, and this phase of investigation will also include further evaluation of recently identified thesis work to refine the model at the Henry mine.

Several groundwater monitoring stations exist within the alluvial flow field of Lone Pine Creek, as indicated in Table 4.1. All monitoring wells (except those abandoned), including Henry Mine monitoring well MMW004 will be sampled following new well installation as discussed in Section 5.7. Two additional new monitoring wells, MMW010 and MMW014, will be installed to monitor flows within the alluvium from Center Pit #1 Overburden Dump (MWD086) and the South Pit Overburden Dump (MWD090). One well, MMW019, will be installed to monitor flow in the basalt that is present along the Little Blackfoot River. The proposed wells are described below in more detail. Soil and rock samples from the well borings, groundwater sample analytical data, and water quality field parameter measurements from these wells, will aid in the characterization of groundwater along the shallow flow path.

MMW010: This well will be drilled near the existing production well, MPW023 and on the northwestern side of stock pond MSP014. The well will target shallow groundwater within the alluvium or Dinwoody Formation downgradient of Henry Mine Center Pit Waste Rock Dump (MWD086). Based on pre-mining topographic maps, the well will be located along a mapped drainage and associated alluvial channel. The location of this well is shown in plan view with

post-mining topography on Drawing 6, *Geology and Cross Section Location Map for Proposed Well MMW010 Henry Mine*. A conceptual cross-section showing this location is presented in Drawing 7, *Conceptual Cross-Section for Proposed Well Location MMW010 Henry Mine.*

The existing well, MPW023, was originally used as a dewatering well during mining and has most recently been used to fill the adjacent pond for stock watering. Based on the downhole camera logs, well MPW023 consists of 6" steel casing to a depth of 160 feet bgs, and open borehole to 310 feet bgs; the water level in the well was at 32 feet bgs, indicating a large saturated interval. There is no well log for this boring, however, it is presumed based on site geology that this well is open to the Dinwoody Formation. This well is located in an appropriate location for monitoring the Center Henry Pit and waste rock (MWD086); however, the open interval is excessive for use as a monitoring point. Therefore, it is proposed that well MMW010 be installed in the vicinity of MPW023.

It is anticipated that well MMW010 will be drilled approximately 100 feet bgs, and constructed with a 20-foot screened interval. It is possible that the well will be located on waste rock, and if so, the steel surface casing will be installed through the waste rock and underlying organic soil horizon to isolate these units. Geophysical logging will be performed both in MPW023 and in the new boring prior to setting the well to evaluate the signature of the Dinwoody Formation and to confirm the appropriate depth for placing the well screen. The well construction depths in the new boring will be modified according to the results of the logging.

MMW014: This well will be located near the northeastern edge of the Henry Mine Southern Waste Rock Dump (MWD090) and monitor groundwater flow in the Lone Pine Creek alluvial flow field. The well will be downgradient of dump seep MDS022 and spring MSG002. The boring will be drilled in native alluvium and screened in first groundwater with sufficient yield to provide water samples using standard low-stress sampling methods. The depth is anticipated to be approximately 30 feet bgs.

MMW019: This well will be installed on the north side of the Center Pit #2 Overburden Dump (MWD088) to monitor flow from this dump into the basalt along the Little Blackfoot River. The boring will be drilled in native alluvium and screened in first groundwater with sufficient yield to provide water samples using standard low-stress sampling methods. The depth is anticipated to be approximately 10 feet bgs.

The conceptual model for Henry Mine indicates there is a potential for water to infiltrate through the backfilled pit (MMP043) or waste rock (MWD088) and enter the Wells Formation. Water moving within the Wells Formation will follow structural dip to the northeast. Monitor well MMW011 will be installed to monitor this flow path. The proposed well is described below in more detail.

MMW011. A second well, MMW011, will be installed northwest of the Henry Mine Pit (MMP043) to monitor groundwater within the Wells Formation in a potentially affected flow path from the backfilled pit. The location of the well is shown in plan view with post-mining topography on Drawing 8, *Geology and Cross Section Location Map for Proposed Well MMW011 Henry Mine,* and a conceptual cross-section showing this location is presented in Drawing 9, *Conceptual Cross-Section for Proposed Well Location MMW011 Henry Mine*.

The location for proposed well MMW011 was selected based on the following criteria: 1) penetrate the uppermost stratigraphic section of the Wells Formation where it is saturated; 2) if possible, locate the well where waste material or the Phosphoria Formation is not penetrated by the well before reaching the Wells Formation; and 3) locating the well at a site reasonably

accessible for a drilling rig. The well was not located high on the ridge (near section B-B') because the upper stratigraphic section would not be saturated. The well was not located within the mine-impacted area or east of the mine because of the desire not to penetrate waste material or the Phosphoria Formation. The site selected for MMW011 allows sampling of the upper stratigraphic section of the Wells Formation at a site where groundwater can move along strike and dip from under the mine-impacted area (pits and waste dumps).

5.3 BALLARD MINE

As discussed in the conceptual hydrogeologic model for Ballard Mine, water originating in the waste rock areas at Ballard Mine will flow through the Quaternary alluvial deposits within the valleys. Flow from the eastern overburden areas, MWD082 and MWD084, will generally move east toward Wooley Valley Creek; flow from overburden areas, MWD081, MWD083, MWD093 will be southwest toward the Blackfoot River; and flow from overburden area MWD080 will be northwest toward Long Valley Creek.

Several groundwater monitoring stations exist within the alluvial flow fields surrounding Ballard Mine, as indicated in Table 4.1. An additional four new monitoring wells, MMW15A and MMW16A, MMW017, and MMW018 will be installed to monitor flows within these alluvial flow fields. Soil and rock samples from the well borings, groundwater sample analytical data, and water quality field parameter measurements from these wells, will aid in the characterization of groundwater along the shallow flow paths.

MMW15A and MMW16A: These wells will be located southwest of overburden dumps MWD080, MWD081, MWD083 on the southwestern side of Ballard Mine. The wells will be installed near headwater stream stations MST068 and MST069. Whetstone Associates installed these wells in fall 2006. Well construction details have not been obtained at this time.

MMW017: This well will be located west of overburden dump MWD080 on the northwestern side of Ballard Mine. The well will monitor flow in the alluvial flow field of Long Valley Creek. The boring will be drilled in native alluvium and screened in first groundwater with sufficient yield to provide water samples using standard low-stress sampling methods. The depth is anticipated to be approximately 30 feet bgs.

MMW018: This well will be located near an existing intermittent creek channel flowing out of overburden dump MWD082 on the southeastern side of Ballard Mine. The well will be upgradient of headwater stream station MST095 and monitor flow in the alluvial flow field of Wooley Valley Creek. The boring will be drilled in native alluvium and screened in first groundwater with sufficient yield to provide water samples using standard low-stress sampling methods. The depth is anticipated to be approximately 30 feet bgs.

At Ballard Mine, the potential flow path through the Wells Formation near the West Ballard Pit (MMP035) will be further investigated. Water recharging the Wells Formation would follow flow paths controlled locally by formation strike and dip and on a larger scale by the regional flow to the west. The strike of the Wells Formation at the Ballard Mine is generally north-south with the dip dependent on location. The waste dumps located west of the West Ballard Pit overlie an eastward dipping section of the Wells Formation (see cross-section C-C´ in Drawing 4). The Middle Ballard Pit (MMP036) overlies a westward dipping section of the Wells Formation. The conceptual model of Ballard Mine suggests there is potential for water to move through the dumps and enter the Wells Formation. Groundwater flow likely is in the southern direction following a combination of the structural strike and dip.

MMW020 and MMW021: Monitor well MMW001, on the east side of West Ballard Pit (MMP035) and monitor well MMW002, on the west side, will be replaced with wells MMW020 and MMW021, respectively. Monitor well MMW001 is most likely not properly sealed through the phosphoria formation. Efforts to develop monitor well MMW002 were unsuccessful and the well continues to be turbid. The new wells will be constructed using 4-inch PVC casing and completed in the Wells Formation.

Monitor well MMW006 will be installed at the southern end of the west pit, MMP035. The well will monitor groundwater flow downgradient of proposed wells MMW020 and MMW021, which are also completed in the Wells Formation. The proposed well is described below in more detail.

MMW006: This well will be drilled on the south end of the Ballard West Pit (MMP035) and will target groundwater in the upper stratigraphic section of the Wells Formation, similar to proposed wells MMW020 and MMW021. The location of these wells are shown in plan view with post-mining topography on Drawing 10, *Ballard Mine Detail and Selenium Concentrations,* and conceptual cross-sections showing this location is presented in Drawing 11, *Conceptual Cross-Section for Proposed Well Location MMW006, MMW020 and MMW021 Ballard Mine*. As discussed in Section 3.1.2, with regard to groundwater monitoring, elevated total selenium concentration was detected in Ballard Mine monitoring well MMW001, screened in Wells Formation. The proposed well, MMW006, has been sited at the south end of Ballard Mine West Pit, MMP035, and will be completed at the depth of first water within the Wells Formation. The total depth of the well is anticipated to be between 300 and 350 feet bgs, based on the well logs and water levels of MMW001 and MMW002. The well will be constructed using 4-inch PVC casing with a 20- to 40-foot screen, depending on the water-bearing zones encountered during drilling. The primary purpose of well, MMW006 is to verify the groundwater flow direction and assess groundwater conditions downgradient of proposed wells MMW020 and MMW021 which will replace MMW001 and MMW002. This assumes that groundwater flow in the area is controlled by a combination of strike and dip and toward topographically lower areas. The location of the new well will be within the footprint of the pit and surrounded by waste rock; therefore, potential impact from the waste rock may be expected. However, the compartmentalized geology at Ballard Mine requires that the new well be placed near the existing wells (MMW001 and MMW002) to ensure that the wells are hydraulically connected (a possible fault zone to the south of the West Ballard Pit (MMP035) confines the placement of the new well to the south).

Table 5.1
Existing and Proposed Monitoring Wells

Mine or Well Type	Well ID[c]	Well Location / Name	Completion Date	Total Depth (fbtoc)	Casing Depth (fbls)	Depth Water Encountered (fbls)	Perforation Intervals (fbls, log description)	Formation	Water Level Spring, Fall (fbtoc)	Unfiltered Selenium Ave/Range (mg/L)
Agricultural Wells	MAW001[g]	School Bus Well	ND	ND	ND	No log	ND	ND	ND	0.00050
	MAW002	(b) (6) Field Well	1969	154	153	142-153	14-146, clay, coarse sand	Alluvium[f]	17.6[b]	0.00050
	MAW003	(b) (6) Field Well	1987	180	180	25-40, 150-155	20-30 gravel, clay, 160-180 hard rock	Thaynes[f]	10[b]	0.00050
	MAW004[g]	(b) (6) Field Well	ND	ND	ND	No log	ND	ND	ND	0.00050
	MAW005	(b) (6) Windmill Field Well	1990	280	239	220-235, 245-260, 271-280	159-199 clay, 199-239 hard, broken limestone	Dinwoody, Wells[f]	220[b]	0.00050
	MAW006	(b) (6) Field Well West	1988	120	109	27-33, 63-69, 87-102	89-109, hard lava	Basalt[f]	27[b]	0.00050
	MAW007	(b) (6) Field Well North	1988	120	119	53-57, 93-120	59-119 sand stone, clay	Alluvium[f]	60[b]	0.00050
Domestic Wells	MDW001	(b) (6) House Well	1988	160	160	142-150, 150-160	70-110 clay , gravel; 139-160 hard lava, hard, broken limestone	Travertine[f]	13[b]	0.00050
	MDW002	(b) (6) House Well	1987	180	159	25-40, 150-155	20-30 clay, grave1; 160-180 hard rock	Alluvium, Thaynes[f]	10[b]	0.00050
	MDW003[g]	(b) (6) House Well	ND	ND	ND	No log	ND	ND	ND	0.0020
	MDW004[g]	(b) (6) House Well	ND	ND	ND	No log	ND	ND	ND	0.00050
	MDW005	Cedar Bay RV Park Well	1969	46	46	8-14, 28-46	40-45, white loose rock	Alluvium, Travertine[f]	6[b]	0.00050
	MDW006[g]	(b) House Well	ND	ND	ND	No log	ND	ND	ND	0.00050
Enoch Valley Mine	MPW006N (A)	Southeast corner of EVM South Dump (MWD092) (Agrium Production wells)	1993	650	650	420-460, 520-560	280-380, gravel; 520-580, sand/sandstone	Thaynes	267[b]	0.00035
	MPW006S (B)	Southeast corner of EVM South Dump (MWD092)(Agrium Production wells)	1992	390	390	45-48, 80-100, 350-390	80-90, gravel; 350-385, black shale/interbedded limestone	Thaynes, Dinwoody	32[b]	0.00035
	MPW019	EVM shop/office	1990	255	235	189-255	175-235, clay/hard rock/broken rock	ND	137[b]	0.00059 / 0.00035-0.00082
	MPW020	Southwest, down structural dip, from eastern ridge of EVM pit MMP045	1990	810	461	440-510, 720-726	401-461, cherty shales/phosphate/broken limestone/sandy limestone (losing water at 800-810)	Phosphoria, Wells	260[b]	0.00035
	MMW007	South of EVM South Dump (MWD092); near edge of dump footprint	...	*100*	...	...	...	*Alluvium or Dinwoody*	...	...
	MMW008	South of EVM South Dump (MWD092); south and downgradient of MMW007	...	*100*	...	...	...	*Alluvium or Dinwoody*	...	...
	MMW009	MPW020 boring	...	*810*	...	...	...	*Wells*	...	...
	MMW012	Northwest of EVM North Dump (MWD091) in Lone Pine Creek alluvial flow field	...	*30*	...	...	...	*Alluvium*	...	...
	MMW013	Southwest of EVM in Rasmussen Creek alluvial flow field	...	*30*	...	...	...	*Alluvium*	...	...

Table 5.1 continued
Existing and Proposed Monitoring Wells

Mine or Well Type	Well ID[c]	Well Location / Name	Completion Date	Total Depth (fbtoc)	Casing Depth (fbls)	Depth Water Encountered (fbls)	Perforation Intervals (fbls, log description)	Formation	Water Level Spring, Fall (fbtoc)	Unfiltered Selenium Ave/Range (mg/L)
Henry Mine	MMW003	South of Henry Mine north pit (MMP043)	ND	140	34	No log	No screen	ND	8.27, 51.2	0.032[e]
	MMW004	North of Henry Mine north pit (MMP043)	ND	77	55	No log	No screen	ND	35.41, 45.21	0.00050
	MPW022	South Henry Pit dewatering well	1980	165	Steel to 151	122-125	No screen	ND	72.23, 76.34	0.00050
	MPW023	Center Henry Pit dewatering well	ND	312	160	No log	No screen	ND	32.72, 40.8	0.00050[e]
	MMW010	Southeast of Center Henry Pit (MMP042); near MPW023	...	*150*	...	...	...	*Alluvium or Dinwoody*	...	...
	MMW011	Northwest of Center Henry Pit (MMP042); south of Little Blackfoot River	...	*150*	...	...	...	*Wells*	...	...
	MMW014	Southeast of Henry Mine Center Pit (MMP042) in Lone Pine Creek alluvial flow field	...	*30*	...	...	...	*Alluvium*	...	...
	MMW019	North of Henry Mine Center Pit (MMP042)	...	*10*	...	...	...	*Basalt*	...	...
Ballard Mine	MMW001	East side of West Ballard pit (MMP035)	1992	450	Steel to 271[d]; PVC to 450	170-190, 212-265	Steel casing perforation 191-271 ,phosphate; PVC screen 420-450, hard limestone	Phosphoria and Wells	268.87, 287.8	0.069
	MMW002	West side of West Ballard pit (MMP035)	1992	350	Steel to 20; PVC to 348	270-282, 286-330	288-308 med. Limestone; 328-348 hard limestone	Wells	221.53, 223.8	0.022
	MMW006	South of West Ballard Pit (MMP035); south of waste rock dumps (MWD093)	...	*350*	...	...	...	*Wells*	...	...
	MMW15A	Southwest of Ballard Mine in alluvial flow field to Blackfoot R.	...	*30*	...	...	...	*Alluvium*	...	...
	MMW16A	Southwest of Ballard Mine in alluvial flow field to Blackfoot R.	...	*30*	...	...	...	*Alluvium*	...	...
	MMW017	Northwest of Ballard Mine into Long Valley Creek alluvial flow field	...	*30*	...	...	...	*Alluvium*	...	...
	MMW018	East of Ballard Mine in Wooley Valley alluvial flow field	...	*30*	...	...	...	*Alluvium*	...	...
	MMW020	East side of West Ballard pit (MMP035), Wells Fm	...	*450*	...	...	...	*Wells*	...	...
	MMW021	West side of West Ballard pit (MMP035), Wells Fm	...	*350*	...	...	...	*Wells*	...	...

Notes:
[a] Wells MPW006N (A) and MPW006S (B) are pumped into one line and are not sampled individually.
[b] Static water level (fbls) noted on well log.
[c] Italicized well ID indicates a proposed well. Target formation and estimated total depth are reported.
[d] MMW001 steel casing is perforated from 191-271 fbls within Phosphoria Formation. The perforated steel area is in contact with gravel pack from 191' to 210' and bentonite seal from 210' to 271'.
[e] Filtered Se result reported. Unfiltered Se data is not available for the sampling station.
[f] Formation was interpreted from logs and geologic maps, so some wells may be open to multiple formations.
[g] Well logs were not found for these agricultural and domestic wells, so construction information is limited.
fbls - feet below land surface
fbtoc - feet below top of casing
ND - Not Determined

Table 5.2
Well Construction Details – New Borings (all depths in feet)

New Well Identification	Location of New Well	Estimated Drilling Depth	Estimated Bottom of Boring	Estimated Bottom of Well	Surface Casing		Well Casing		Well Screen		10-20 Sand		#60 Sand		Hydrated Bentonite Pellets		Bentonite Slurry	
					Material	Depth from Surface	Material	Depth from Surface	Material	Length	From	To	From	To	From	To	From	To
ENOCH VALLEY MINE																		
MMW007	South of EVM South Dump; near edge of dump footprint	100	100	100	6" Steel	40	4" PVC	100	4" PVC	20	100	75	75	70	70	60	60	0
MMW008	South of EVM South Dump; south and downgradient of MMW007	100	100	100	6" Steel	20	4" PVC	100	4" PVC	20	100	75	75	70	70	60	60	0
MMW012	Western edge of EVM North Waste Rock Dump	30	30	30	6" Steel	8-10	4" PVC	15	4" PVC	15	30	12	12	11	---	---	11	0
MMW013	Near center of EVM South WRD; south of MDS025	30	30	30	6" Steel	8-10	4" PVC	15	4" PVC	15	30	12	12	11	---	---	11	0
HENRY MINE																		
MMW010	Southeast of Center Henry Pit; near MPW023.	150	150	150	6" Steel	20	4" PVC	150	4" PVC	20	150	125	125	120	120	110	110	0
MMW011	Northwest of Center Henry Pit; south of Little Blackfoot River.	150	150	15300	6" Steel	20	4" PVC	150	4" PVC	20	150	125	125	120	120	110	110	0
MMW014	Northeast edge of HM Southern WRD (MWD090); downgradient of MDS022 and MSG002	30	30	30	6" Steel	8-10	4" PVC	15	4" PVC	15	30	12	12	11	---	---	11	0
MMW019	North side of HM Center Pit #2 (MWD088)	10	10	10	---	---	4" PVC	5	4" PVC	5	10	3	3	2.5	---	---	2.5	0
BALLARD MINE																		
MMW006	South of West Ballard Pit; south of Waste Rock Dumps	350	350	350	6" Steel	20	4" PVC	350	4" PVC	20	350	325	325	320	320	310	310	0

Table 5.3
Well Construction Details – Existing Boring (all depths in feet)

New Well Identification	Location of New Well	Estimated Drilling Depth	Estimated Bottom of Boring	Estimated Bottom of Well	Surface Casing		Well Casing		Well Screen		Packer Depth	Bentonite Pellets		Bentonite Slurry	
					Material	Depth from Surface	Material	Depth from Surface	Material	Length		From	To	From	To
ENOCH VALLEY MINE															
MMW009 (MPW020)	MPW020 Boring	NA	810	810	12" Steel	460	4" PVC	725	Open	725-810	725	725	WL	WL	0

N/A Not Applicable
WL Water Level

5.4 BOREHOLE GEOPHYSICS

Borehole geophysical logging will be performed in all new monitoring well borings and existing wells with open boreholes. Geophysical logs will likely include natural gamma measurements, induced polarization (IP), resistivity (R) and self potential (SP) as well as, caliper, water temperature, and water resistivity. Descriptions of these techniques are provided in Section 6.0, Field Methods. These techniques will be useful in both existing and new borings for identifying the stratigraphic units and the changes in lithology through the boring. In particular, the natural gamma log measures variations in the natural radioactivity originating from changes in concentrations of the trace elements uranium (U) and thorium (Th) as well as changes in concentration of the major rock forming element potassium (K). Therefore, the gamma log can typically distinguish between shales and sandstones/limestones due to the low potassium content of most sandstones/limestones compared to shales. This logging will be useful for distinguishing between the Phosphoria Formation (shales) and the Wells Formation (limestone/sandstone). Where the stratigraphy of certain boreholes is generally known (i.e., MPW022, Phosphoria Formation, and MPW020, Phosphoria and Park City/Wells Formation), the geophysical logs may be used to identify a general signature for the known units. Geophysical logging of new borings may help identify the stratigraphic units and the variations in lithology and contacts between units. Specifically:

MPW020/MMW009 – Geophysical logging may identify the contact between the Phosphoria Formation and the Wells Formation. This logging will also be useful for identifying the general signature of the Phosphoria and Wells Formations. The Wells Formation will then be screened by the new well, MMW009, and the overlying Phosphoria Formation will be sealed to the surface.

MPW022 – Geophysical logging may be used to identify the general signature of the Phosphoria Formation.

MPW023 – Geophysical logging may identify the general signature of the Dinwoody Formation, and possibly identify whether the borehole penetrates the underlying Phosphoria Formation.

MMW003 – Geophysical logging may identify the formations penetrated by the borehole – i.e., whether the borehole is entirely within basalt and Phosphoria Formation, or whether the Wells Formation is encountered.

MMW006 – Geophysical logging may be used to confirm that this new well boring is within the Wells Formation.

MMW007 – Geophysical logging may be used to identify the signature within the alluvium or Dinwoody Formation.

MMW008 – Geophysical logging may be used to identify the signature within the alluvium or Dinwoody Formation.

MMW010 – Geophysical logging may be used to identify the signature within the alluvium or Dinwoody Formation.

MMW011 – Geophysical logging may be used to confirm that this new well boring is within the Wells Formation

5.5 WELL ABANDONMENT

Up to four wells may be abandoned during monitoring well installation field activities, as discussed below. The specified monitoring wells will be abandoned in accordance with Idaho Department of Water Resources (IDWR) rules and regulations (specifically IDAPA 37.03.09.12a).

MMW003: Water level readings indicate that this well may be open to both basalt and Phosphoria Formation. Specifically, in spring 2004 the water level in the well approximately 11 feet bgs and in fall 2004 the water level in the well was approximately 50 feet bgs. Only dissolved selenium concentration data is available for this well; however, the dissolved selenium concentration in spring 2004 was 0.005 mg/L while in fall 2004 it was elevated to 0.058 mg/L. This seasonal change in selenium concentrations may reflect two separate flow systems. It is proposed that MMW003 be abandoned and replaced with wells MMW019 (basalt) and MMW011 (Wells Fm.).

MMW005: It was determined, based on the downhole camera investigation, that MMW005 is not a useful groundwater monitoring point and will be abandoned. This well is located within the floodplain of the Little Blackfoot River near center Henry Mine. Based on the downhole camera investigation, it was determined that this well was screened from 16 to 17.5 feet bgs, and therefore collects near-surface water during high water periods. This well does not represent a useful groundwater monitoring point.

MMW001 and MMW002: Monitor well MMW001, on the east side of West Ballard Pit (MMP035) and monitor well MMW002, on the west side, will be replaced with wells MMW020 and MMW021, respectively. Monitor well MMW001 is most likely not properly sealed through the phosphoria formation. Efforts to develop monitor well MMW002 were unsuccessful and the well continues to be turbid. The new wells will be constructed using 4-inch PVC casing and completed in the Wells Formation.

5.6 AQUIFER MATERIAL TESTING

Aquifer material (soil/rock) samples will be collected from drill cuttings during drilling of new borings. Two samples from each boring will be sent to the laboratory for chemical analyses. Samples will be selected from the depth interval where water is first encountered in the borehole, and the sample at the bottom of the borehole. In the borehole for MMW007, a sample will be collected in native ground just below the contact of the waste rock (if encountered) and the native surface. Samples will be analyzed for total metals and total organic carbon. Sample collection procedures are described in Section 6.0 and laboratory testing is detailed in Section 7.0. The purpose of aquifer material testing is to obtain the concentrations of total metals and total organic carbon present in the aquifer solids.

5.7 GROUNDWATER MONITORING

Following new well installation all monitoring wells, including existing monitoring wells, will be sampled. Low stress sampling techniques will be used where possible. Low flow sampling may not be possible in existing wells if dedicated pumps are already installed, or if the required sampling equipment cannot access the well. Samples will be analyzed for the parameters listed in Table 7.1, *Groundwater Monitoring Analytes* (Section 7.1). In addition to the groundwater parameters that are typically analyzed, these groundwater samples may also be analyzed for the speciated selenium compounds, selenate and selenite.

5.9 MONITORING WELL SURVEY DATA

Following installation of the new monitoring wells, the following survey data will be collected by a Licensed Idaho Surveyor at the sites and placed on the topographic maps.

New/Existing Wells: Horizontal coordinates, elevation of the top of PVC well casing, elevation of the top of the steel surface casing, and approximate ground surface elevations for the following:

- EVM: MMW007, MMW008, MMW009 (MPW020), MMW012, MMW013, and MPW019
- Henry Mine: MMW003, MMW004, MMW010, MMW011, MMW014, MMW019, MPW022, and MPW023
- Ballard Mine: MMW001, MMW002, MMW006, MMW15A, MMW16A, MMW017, and MMW018

5.9 SUBMITTALS

The following will be prepared and submitted to IDEQ for distribution to the various regulatory agencies:

- Boring logs and well construction diagrams;
- Geophysical logs;
- Monitoring well abandonment forms;
- Groundwater sample collection forms;
- Groundwater analytical data;
- Soil sampling forms;
- Soil analytical data;
- Survey data;
- Geologic maps and cross sections

6.0 FIELD METHODS

This well installation work plan consists of drilling, installation, and development of new groundwater monitoring wells; borehole geophysics; soil and groundwater sampling and analysis; abandonment of existing groundwater wells; and surveying. The procedures regarding the above listed activities are outlined below, and standard operating procedures (SOPs) for selected activities are included in Appendix G and H. All sampling activities conducted for this investigation will be in accordance with Field Sampling Plan (PgmFSP) and Quality Assurance Plan (PgmQAP), which were submitted to the Agencies for review and approved with the 2004 SI Work Plan in March 2004.

6.1 DRILLING

A Field Engineer/Geologist will supervise the drilling operations. The Field Engineer/Geologist will maintain a drill log noting lithology, sampling interval, and other pertinent information. It is anticipated that samples will be collected approximately every 10 feet (where possible) in the unsaturated zone from the cuttings, or with a split spoon sampler, if necessary. During drilling in the saturated zone or through rock that cannot be sampled with a split spoon sampler, the Field Engineer/Geologist will collect samples from the cuttings. Cuttings are collected for lithologic characterization and analytical testing. All groundwater monitoring wells installed during this investigation will be permitted through the Idaho Department of Water Resources (IDWR) and will be constructed according to their guidelines. A more detailed description of drilling methods is outlined in Appendix G.

6.2 GEOPHYSICAL LOGGING

A subcontractor, to be determined, will conduct Geophysical logging of the boreholes. Borehole geophysical logging will be performed in all new monitoring well borings and existing wells with open boreholes. Geophysical logs will likely include natural gamma measurements, induced polarization (IP), resistivity (R) and self potential (SP), as well as, caliper, water temperature, and water resistivity measurements.

Gamma-ray measurements detect variations in the natural radioactivity originating from changes in concentrations of the trace elements uranium (U) and thorium (Th) as well as changes in concentration in an isotope of the major rock forming element potassium (K). Since the concentrations of these naturally occurring radioelements vary between different rock types, natural gamma-ray logging provides an important tool for lithologic mapping and stratigraphic correlation. Gamma-ray logs are important for detecting alteration zones, and for providing information on rock types. For example, in sedimentary rocks, sandstones can often be easily distinguished from shales due to the low potassium content of the sandstones compared to the shales. In sedimentary rocks, the potassium isotope is, in general, the principal source of natural gamma radiation, primarily originating from clay minerals.

The Induced Polarization (IP) tool consists of an assembly of electrodes, usually including a current electrode and two potential (measurement) electrodes. A square wave current with an 'off' time between positive and negative parts of the waveform is transmitted (waveforms may be from 1 second to 8 seconds duration). Potential measurements made at selected times in the waveform can be related to the IP effect (chargeability of the rocks), the resistivity (R) of the rocks, and to self-potentials (SP) generated in the rocks. The transmitter is a constant current source located at the surface.

In time domain IP measurements, the ratio of the secondary voltage measured during the current off-time to the primary voltage measured during the current on-time is related to the electrical polarizability of the rock and is called chargeability. A high chargeability response is an indication of the presence of metallic sulfides and oxides or cation-rich clays.

The electrical resistivity (R) of rocks depends on several factors including the presence of conductive minerals such as base metal sulfides or oxides and graphite in the rock. Most rocks without these minerals are usually poor conductors and their resistivities are governed primarily by their porosity, degree of fracturing, salinity of the pore water, the degree of saturation of the pore spaces, and to a lesser extent by the intrinsic minerals that constitute the rock. Some alteration processes such as silicification and carbonatization tend to reduce the porosity and hence increase the resistivity of the rock. In igneous and metamorphic rocks, the resistivity log is useful mainly in mapping conductive minerals and fracture zones. In sedimentary rocks, the resistivity log is frequently used in lithologic mapping because changes in lithology are often associated with changes in porosity.

SP anomalies are mainly an indication of the presence of graphite and/or high concentrations of base metal sulfides including pyrite. Large self potentials observed within and around sulfide and graphite bodies are mainly caused by electrochemical processes. Low resistivity anomalies correlating with SP and IP anomalies are, therefore, good indications of the presence of conductive minerals. SP anomalies can be also generated by fluid flow in porous media.

Measurement of caliper will provide fracture characteristics in uncased sections. Water temperature can help in identification of vertical flow within the borehole. Water resistivity might be useful in identification of different water sources.

6.3 WELL INSTALLATION, ABANDONMENT AND DEVELOPMENT

A Field Engineer/Geologist will monitor all well installation procedures performed by the drilling company and record dates and times of events. In general, wells will be installed by lowering PVC casing down the borehole to specified depths. Screened intervals will be dependent on the water bearing units encountered. The sand pack will be tremied down hole until the depth is a total of 5 to 10 feet above the top of the screened interval (depending upon the geology and water units encountered). Bentonite pellets will be placed above the sand pack to form a seal. Bentonite pellets will be used if this zone is below water in the casing; otherwise, bentonite slurry may be used. The remainder of the annular space will be grouted with bentonite grout mixture or bentonite slurry. All wells will have steel surface casing to isolate surface material and organic-rich soil horizons. Surface completions will include a stick-up of approximately 2.5 feet above ground. All surface casings will be fitted with a locking cap and locked with a P4 Production lock.

Once the wells have been installed, the Field Engineer/Geologist will monitor development performed by a pump crew. The goal of monitoring well development is to remove fines and drilling fluid residue from the gravel pack and the natural formation in the vicinity of the screened interval, this will ensure good communication between the aquifer and the well. The well development process is comprised of: (1) application of sufficient energy in a monitoring well to create groundwater flow reversals (surging) in and out of the well and the gravel pack to release and draw fines into the well; and (2) pumping or bailing to draw drilling fluids out of the borehole and adjacent natural formation along with fines that have been surged into the well.

Development will be accomplished by surging and bailing/pumping. A bailer will be used to clean out any fines that have settled on the bottom of the well. Next, a surge block will be used to agitate the water, causing

it to move in and out of the screen. This will draw in fines from the gravel pack breaking up any bridges that may have occurred during the placement of the gravel pack. After surging for a few minutes, the bailer will be lowered again to clean out any fines brought into the casing from surging. This cycle will continue until minimal fines are being pulled out with the bailer. At this point, a submersible pump will be lowered down the well. Pumping will begin at a low flow rate and will gradually be increased. The discharge flow rate will be increased (if possible) until the well is pumping at its maximum yield without draw down beneath the pump. Pumping will continue until the water is clear of sediment and field parameters are consistent. A more detailed description of well installation and development is provided in Appendix G.

6.4 AQUIFER MATERIAL TESTING

Aquifer material (soil/rock) samples will be collected from drill cuttings during drilling of new borings. Samples will be collected for the purpose of archiving from cuttings in composited 10-ft intervals, at changes in lithology, or more frequently based on field conditions. Material will be collected, double bagged, and labeled with the boring location and name, depth interval, date and time, project information and sampler initials. Two samples will be collected from each boring for laboratory analysis. These samples will include the depth interval where water is first encountered in the borehole, and the sample at the bottom of the borehole. Samples will be placed on ice and sent to the analytical laboratory for analysis; all other samples will be archived on site. All soil samples will be collected as described in the 2004 SI Work Plan Quality Assurance Plan (PgmQAP) that was submitted to the agencies in March 2004.

6.5 GROUNDWATER SAMPLING

6.5.1 Static Water Level Measurement

Measurement of the static water level is performed using a 500-foot electronic water level indicator. The same measuring point on the casing is used to ensure the measurements are consistent. For MWH field studies, the wellhead reference point will be at the top of casing (PVC) - north side. Static water level measurements will be taken in all new wells before sampling, and in surrounding site wells.

6.5.2 Groundwater Sample Collection

Low-stress sampling techniques, in accordance with EPA protocol, will be used for sampling wells, where possible. Low-stress sampling may not be possible in existing wells if dedicated pumps are already installed, or if the required sampling equipment cannot access the well. Detailed sampling protocol is included in Appendix H. The sampling protocol states requirements for water level stabilization and parameter stabilization. The following parameters are monitored during sample collection: turbidity, dissolved oxygen, specific conductance, temperature, pH, and ORP/Eh. Bladder pumps for low-stress sampling will be set at least 20 feet (if possible) below the air-water interface in the well, and pumped through tubing to the surface. The wells will be purged in accordance with USEPA protocols, such that water from the formation will be transported from the aquifer to the surface with minimal agitation. Samples will be field-filtered (for dissolved analysis) using dedicated 0.45 um filters, and bottles will be filled with little headspace remaining. Groundwater sampling and shipping protocol will be consistent with the 2004 SI Work Plan PgmQAP (March 2004) and according to SOP-NW-5.3, Collection of Groundwater Quality Samples, which is located in Appendix B of the PgmQAP.

For sample collection for selenium speciation analyses, the sample bottles will be filled with nitrogen gas and the sampled groundwater will displace the nitrogen gas during filling to reduce contact with the atmosphere

during this sampling step. Samples will be flash frozen and shipped on dry ice via overnight delivery to the analytical laboratory for analysis. Additionally, one duplicate sample from each well will be field spiked with a laboratory-supplied selenite spike to provide quality assurance/quality control evaluation to both field and laboratory procedures. Also, a second duplicate sample will be preserved with EDTA, which complexes the dissolved iron in the sample, thereby eliminating the potential for iron to co-precipitate with dissolved selenium following sampling.

7.0 LABORATORY ANALYSES

The following sections describe analytical laboratory testing that will be performed on groundwater and solid samples.

7.1 GROUNDWATER ANALYSES

Table 7.1 presents the groundwater analytes, associated methods, estimated detection limits (EDL), reporting units, and estimated holding times. ACZ Laboratories will perform all other analyses including dissolved selenium. ACZ Laboratories will perform all analyses except selenium speciation, which will be analyzed by Applied Speciation and Consulting. University of Idaho Laboratory will perform the analyses on field duplicate samples.

ACZ Laboratories, Inc.
30400 Downhill Drive
Steamboat Springs, CO 80487
Phone: (800) 334-5493

University of Idaho
Holm Research Center
2222 W 6th St
Moscow, ID 83844
Phone: 208-885-7081

Applied Speciation and Consulting, LLC
953 Industry Drive
Tukwila, WA 98188
Phone: (206)219-3779

Table 7.1 Groundwater Monitoring Analyses				
Parameter	**Method**	**EDL**	**Reporting Units**	**Holding Time (days)**
alkalinity, total	SM2320B	2	mg/L	14
aluminum	M200.7 ICP	0.03	mg/L	180
antimony*	M200.8 ICP/MS	0.0004	mg/L	180
arsenic*	M200.8 ICP/MS	0.0001	mg/L	180
barium*	M200.7 ICP	0.0001	mg/L	180
beryllium*	M200.7 ICP	0.0001	mg/L	180
boron*	M200.7 ICP	0.025	mg/L	180
cadmium	M200.8 ICP/MS	0.0001	mg/L	180
calcium	M200.7 ICP	0.2	mg/L	180
chloride	M300.0	0.5	mg/L	28
chromium*	M200.8 ICP/MS	0.0001	mg/L	180
cobalt*	M200.7 ICP	0.01	mg/L	180
copper*	M200.7 ICP	0.01	mg/L	180
fluoride*	M300.0	0.5	mg/L	28
gross alpha*	M900.0	2	pCi/L	180
gross beta*	M900.0	4	pCi/L	180
hardness	Calculation	1.5	mg/L	-
iron	M200.7 ICP	0.01	mg/L	180
ferrous iron, dissolved (Field)	HACH	0.01	mg/L	-
ferric iron, dissolved	Calculation	0.01	mg/L	-
lead*	M200.8 ICP/MS	0.0001	mg/L	180
manganese	M200.8 ICP/MS	0.0005	mg/L	180
magnesium*	M200.7 ICP	0.2	mg/L	180
mercury*	M245.1	0.0002	mg/L	28
molybdenum*	M200.7 ICP	0.01	mg/L	180
nickel	M200.8 ICP/MS	0.0006	mg/L	180
nitrogen (as nitrate and nitrite)	M 353.2	0.02	mg/L	28
nitrogen (total Kjedahl)	M 351.2	0.1	mg/L	28
orthophosphate	M 365.1	0.005	mg/L	28
pH	M150.1	0.1	pH	-
potassium	M200.7 ICP	0.3	mg/L	180
selenium	SM3114 B, AA-Hydride	0.001	mg/L	180
selenite	IC-ICP/MS	0.01	µg/L	1
selenate	IC-ICP/MS	0.01	µg/L	1
silver*	M200.7 ICP	0.01	mg/L	180
sodium	M200.7 ICP	0.3	mg/L	180
sulfate	M300.0	0.5	mg/L	28
thallium*	M200.8 ICP/MS	0.0001	mg/L	180
total dissolved solids*	M160.1	10	mg/L	7
total suspended solids*	M160.2	10	mg/L	7
uranium*	M200.8 ICP/MS	0.0001	mg/L	180
vanadium	M200.8 ICP/MS	0.0002	mg/L	180
zinc	M200.8 ICP/MS	0.002	mg/L	180

* Analytes included as a screening for one groundwater sampling event.
Methods are for media (non-blank) samples. Equipment and field blanks will be analyzed for unfiltered results. For regulatory compliance, all media samples will be analyzed for unfiltered metals.
EDL – Estimated Detection Limit; the laboratory analytical limit does not reflect possible sample-specific elevation of the reporting limit due to dilution, contamination or other issues identified during the data validation process.

7.2 AQUIFER SOLIDS ANALYSES

7.2.1 Total Metals Analyses

Aquifer solid material will be collected during drilling and analyzed for total metals concentrations, paste pH, and total organic carbon (TOC). Table 7.2, *Aquifer Solids Analyses*, presents the analyte list with the associated method, estimated detection limits (EDL), reporting units, and estimated holding times.

Table 7.2
Aquifer Solids Analyses

Parameter	Method	EDL	Reporting Units	Holding Time
paste pH	USDA No 60 (21A)	0.01	units	
total organic carbon (TOC)	ASTM D4129-88	0.02	%	
aluminum	M3050B / M6010B ICP	3.0	mg/kg	6 months
cadmium	M3050B / M6010B ICP	0.5	mg/kg	6 months
chromium	M3050B / M6010B ICP	1.0	mg/kg	6 months
iron	M3050B / M6010B ICP	1.0	mg/kg	6 months
manganese	M3050B / M6010B ICP	0.5	mg/kg	6 months
nickel	M3050B / M6010B ICP	1.0	mg/kg	6 months
selenium	M3050B / SM3114B	0.1	mg/kg	6 months
vanadium	M3050B / M6010B ICP	0.5	mg/kg	6 months
zinc	M3050B / M6010B ICP	1.0	mg/kg	6 months

8.0 SCHEDULE

The following activities will be conducted in support of the groundwater investigation:

2007 Activities

1. New monitoring well installations;
2. Proposed monitoring well abandonment;
3. Survey new and existing monitoring well locations;
4. Groundwater sampling after new well installations;
5. Data submittal – one month after data validation is complete.

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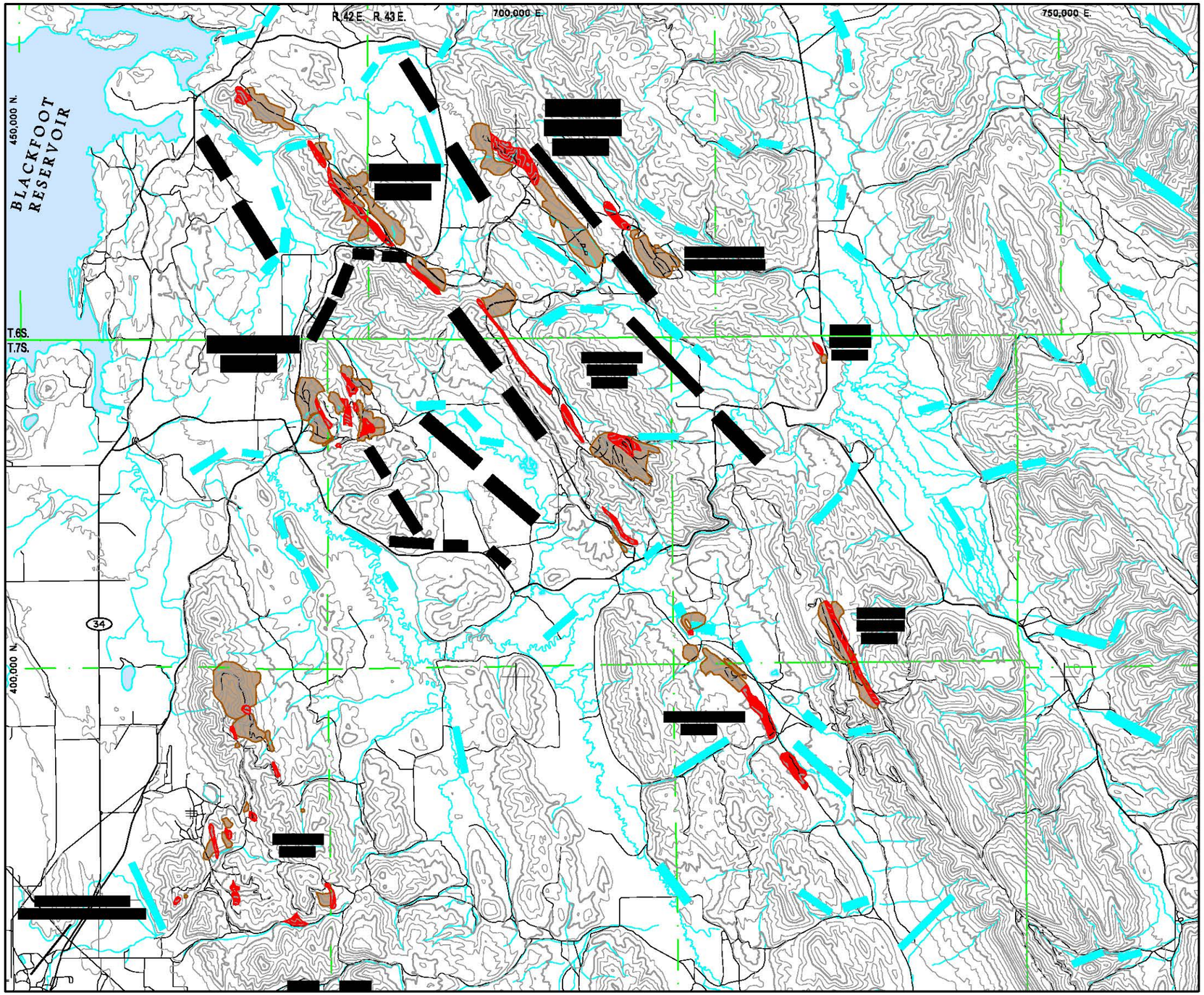
Appendix A
Drawings



LEGEND

- CONTOURS
- CREEKS/RIVERS
- LAKES
- ROADS
- TOWNSHIP AND RANGE
- MINE PIT LOCATION
- WASTE ROCK DUMP LOCATION

MAP KEY

N

SCALE

0 5,000 10,000

Feet

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	Issued for Tech Memo Ver5	01/07	D.Breene	S.Farnes	
1	Issued for Draft Tech Memo	10/06	P.Anderson	K.Conrath	C.Foulk
0	Issued for Work Plan	1/04	P.Anderson	N.Gonzales	P.Anderson

P4 PRODUCTION
Southeast Idaho Mine - Specific Selenium Program

PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
SITE LOCATION MAP

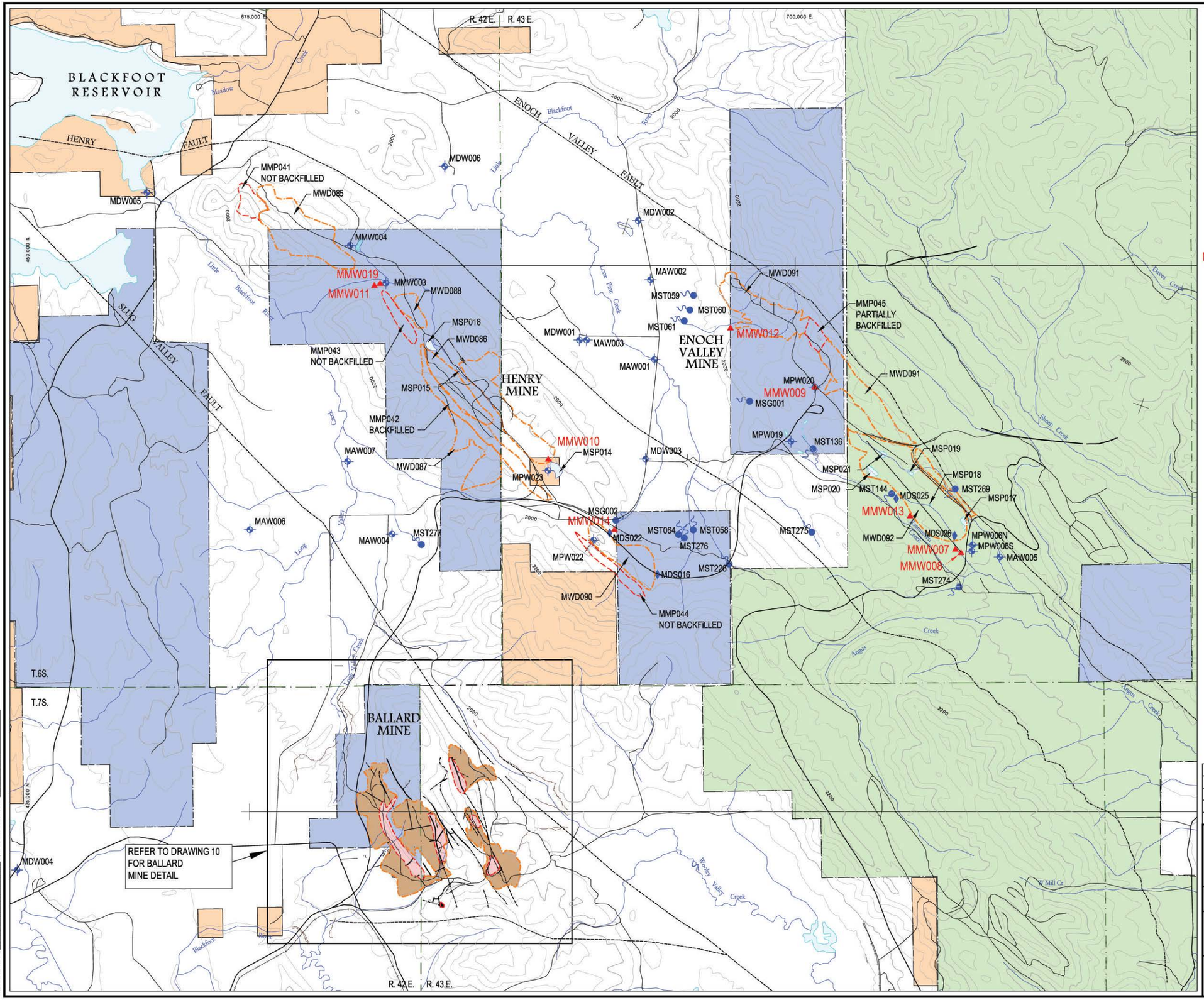
MWH

Sheet 1 Of 1 Sheets

SCALE: As Shown

DRAWING No. 1

AutoCAD FILE: Dwg 1 Site Location Map PROJECT NUMBER: 1010076.018602



LEGEND

- CONTOURS (IN METERS)
- CREEKS/RIVERS
- PONDS
- HIGHWAY
- ROADS
- RAILROAD
- TOWNSHIP AND RANGE
- MINE PIT LOCATION (APPROXIMATE)
- WASTE ROCK PILE LOCATION (APPROXIMATE)
- FAULT
- INFERRED FAULT
- FAULT CONCEALED BY SURFACE DEPOSITS
- MMW010 ▲ PROPOSED GROUNDWATER WELL MONITORING LOCATION
- MPW023 GROUNDWATER WELL MONITORING LOCATION
- MDS022 WASTE ROCK DUMP SEEP
- MSG002 SPRING STATION
- MST064 HEADWATER STREAM STATION
- NATIONAL FOREST
- BUREAU OF LAND MANAGEMENT
- STATE OF IDAHO
- PRIVATE LAND

NOTES:

MAW = AGRICULTURAL WELL
MDW = DOMESTIC WELL
MMW = MONITORING WELL
MPW = PRODUCTION WELL
MDS = DUMP SEEP
MST = SPRING FED STREAM LOCATION
MMP = MINE PIT
MWD = WASTE ROCK DUMP
MSP = POND
MSG = SPRING

MAP KEY

SCALE
0 2000' 4000'

CONTOUR INTERVAL: 40 Meters
USGS 1:100,000 SODA SPRINGS TOPOGRAPHIC BASE (1982)

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
4	Issued for Tech Memo Ver5	01/07	D.Brame	C.Fowler	C.Foulk
3	Issued for Draft Tech Memo Ver4A	11/06	D.Brame	S.Farnam	
2	Issued for Draft Tech Memo Ver4	08/06	D.Brame	C.Fowler	
1	Issued for Draft Tech Memo Rev.2	03/06	D.Brame	C.Fowler	C.Foulk

P4 PRODUCTION
Southeast Idaho Mine - Specific Selenium Program

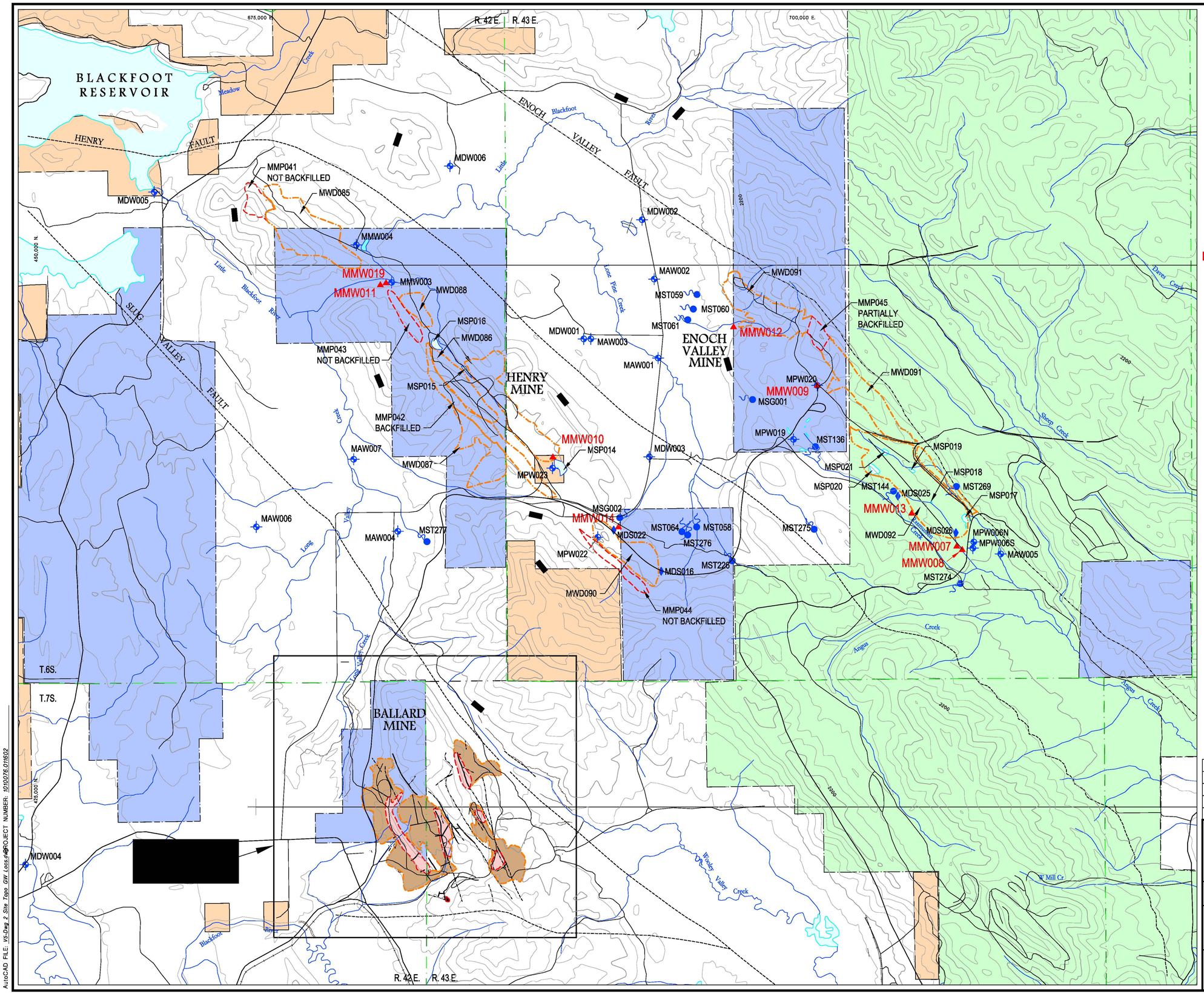
PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
SITE TOPOGRAPHY AND GROUNDWATER MONITORING LOCATIONS

MWH

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 2

AutoCAD FILE: V5-Dwg 2 Site Topo GW Locs.dwg PROJECT NUMBER: 1010076.01/502



LEGEND

- CONTOURS (IN METERS)
- CREEKS/RIVERS
- PONDS
- HIGHWAY
- ROADS
- RAILROAD
- TOWNSHIP AND RANGE
- MINE PIT LOCATION (APPROXIMATE)
- WASTE ROCK PILE LOCATION (APPROXIMATE)
- FAULT
- INFERRED FAULT
- FAULT CONCEALED BY SURFACE DEPOSITS
- MMW010 — PROPOSED GROUNDWATER WELL MONITORING LOCATION
- MPW023 — GROUNDWATER WELL MONITORING LOCATION
- MDS022 — WASTE ROCK DUMP SEEP
- MSG002 — SPRING STATION
- MST064 — HEADWATER STREAM STATION
- NATIONAL FOREST
- BUREAU OF LAND MANAGEMENT
- STATE OF IDAHO
- PRIVATE LAND

NOTES:

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MDW = DOMESTIC WELL
MMW = MONITORING WELL
MPW = PRODUCTION WELL
MDS = DUMP SEEP
MST = SPRING FED STREAM LOCATION
MMP = MINE PIT
MWD = WASTE ROCK DUMP
MSP = POND
MSG = SPRING

STATE OF IDAHO
STUDY AREA

MAP KEY

N

SCALE
0 2000' 4000'

CONTOUR INTERVAL: 40 Meters
USGS 1:100,000 SODA SPRINGS
TOPOGRAPHIC BASE (1982)

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
4	Issued for Tech Memo Ver5	01/07	D.Brame	C.Fowler	C.Foulk
3	Issued for Draft Tech Memo Ver4A	11/06	D.Brame	S.Farnam	
2	Issued for Draft Tech Memo Ver4	08/06	D.Brame	C.Fowler	
1	Issued for Draft Tech Memo Rev.2	03/06	D.Brame	C.Fowler	C.Foulk

P4 PRODUCTION
Southeast Idaho Mine - Specific Selenium Program

PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
SITE TOPOGRAPHY AND GROUNDWATER MONITORING LOCATIONS

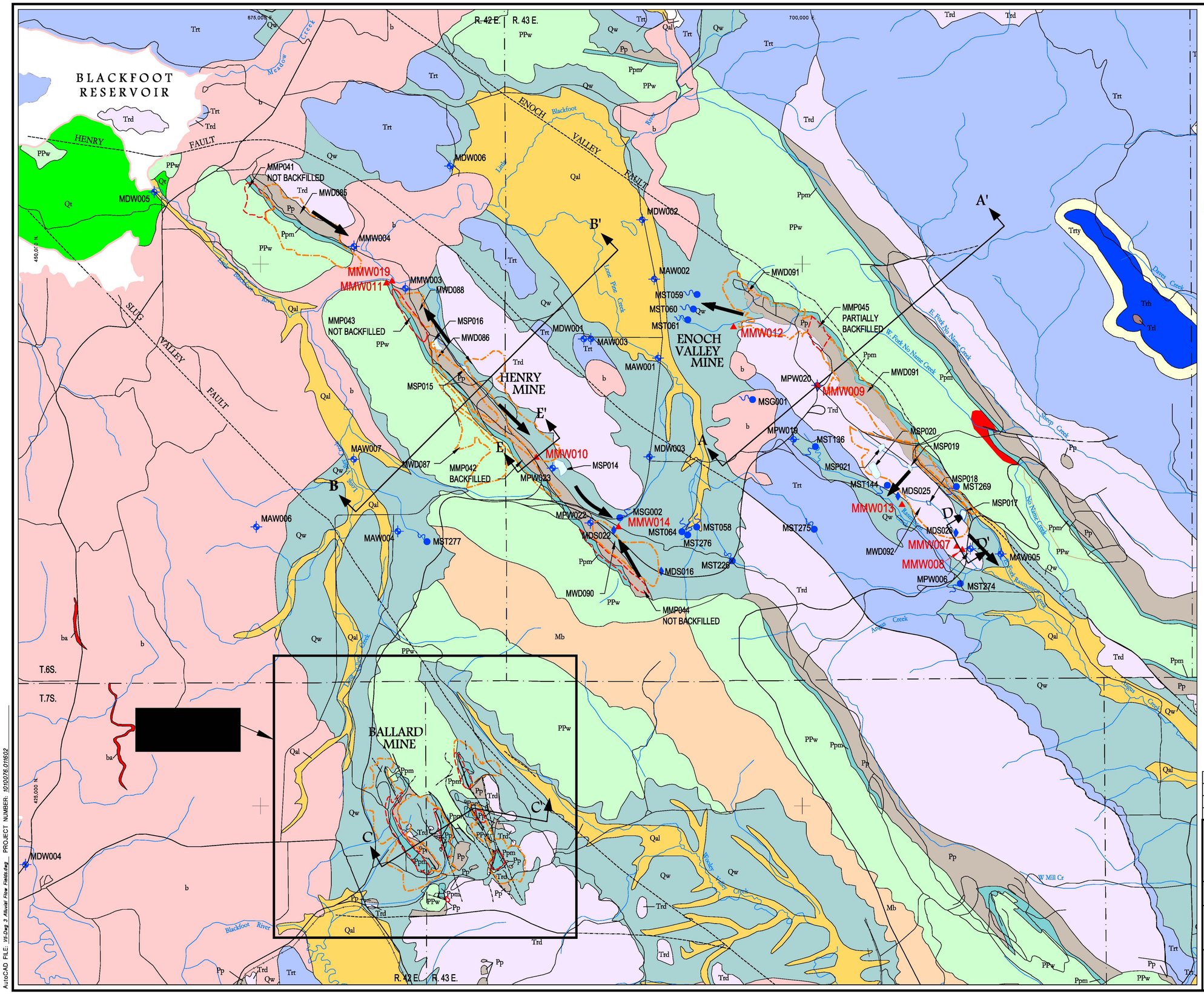
MWH

Sheet 1 Of 1 Sheets

SCALE: As Shown

DRAWING No. 2

AutoCAD FILE: V5-Dwg 2 Site Topo GW Locs.dwg PROJECT NUMBER: 1010076.011602



LEGEND

- CREEKS/RIVERS
- PONDS
- HIGHWAY
- ROADS
- RAILROAD
- TOWNSHIP AND RANGE
- FAULT LINE
- INFERRED FAULT
- FAULT CONCEALED BY SURFACE DEPOSITS
- MINE PIT LOCATION (APPROXIMATE)
- WASTE ROCK PILE LOCATION (APPROXIMATE)
- MMW010 — PROPOSED GROUNDWATER WELL MONITORING LOCATION
- MPW023 — GROUNDWATER WELL MONITORING LOCATION
- MDS022 — WASTE ROCK DUMP SEEP
- MSG002 — SPRING STATION
- MST064 — HEADWATER STREAM STATION
- POSTULATED ALLUVIAL FLOW PATH
- A A' — CROSS-SECTION LOCATION

GEOLOGIC KEY

b	BASALT
ba	BASALTIC ASH (TUFF)
Qal	ALLUVIUM
Qt	TRAVERTINE
Qw	HILL WASH AND OLDER ALLUVIUM
Trd	DEADMAN LIMESTONE
Trh	HIGHAM GRIT
Trt	THAYNES FORMATION
Try	TIMOTHY SANDSTONE (THAYNES MEMBER)
Trd	DINWOODY FORMATION (WOODSIDE SHALE)
Pp	PHOSPHORIA FORMATION
Ppm	MEADE PEAK MEMBER
PPw	WELLS FORMATION
Mb	BRAZER LIMESTONE

GEOLOGIC MAPPING BY MANSFIELD, ETAL., 1927, USGS PROFESSIONAL PAPER 152. REGIONAL GEOLOGY IS SHOWN TO PROVIDE REGIONAL GEOLOGIC FRAMEWORK AND MAY NOT BE ACCURATE FOR LOCAL SCALE. FOR MINE AREAS, MINE SITE GEOLOGY SHOULD BE CONSIDERED MORE ACCURATE AND MAY INCLUDE LOCAL GEOLOGIC DEPOSITS NOT MAPPED AT THE REGIONAL SCALE.

NOTES:
- MAW = AGRICULTURAL WELL
- MDW = DOMESTIC WELL
- MMW = MONITORING WELL
- MPW = PRODUCTION WELL
- MDS = DUMP SEEP
- MST = SPRING FED STREAM LOCATION
- MMP = MINE PIT
- MWD = WASTE ROCK DUMP
- MSP = POND
- MSG = SPRING

STATE OF IDAHO — STUDY AREA — MAP KEY

SCALE: 0 2000 4000 Feet

N

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	Issued for Tech Memo Ver5	01/07	D.Brame	C.Fowler	C.Foulk
1	Issued for Draft Tech Memo Ver4A	11/06	D.Brame	S.Farnam	
0	Issued For Draft Tech Memo Ver4	08/06	D.Brame	S.Farnam	

P4 PRODUCTION
Southeast Idaho Mine-Specific Selenium Program

PROJECT: **Monitoring Well Installation Tech Memo**

DRAWING TITLE: **SURFICIAL GEOLOGY, ALLUVIAL FLOW FIELDS AND GROUNDWATER MONITORING LOCATIONS**

MWH

Sheet 1 Of 1 Sheets

SCALE: As Shown

DRAWING No. 3

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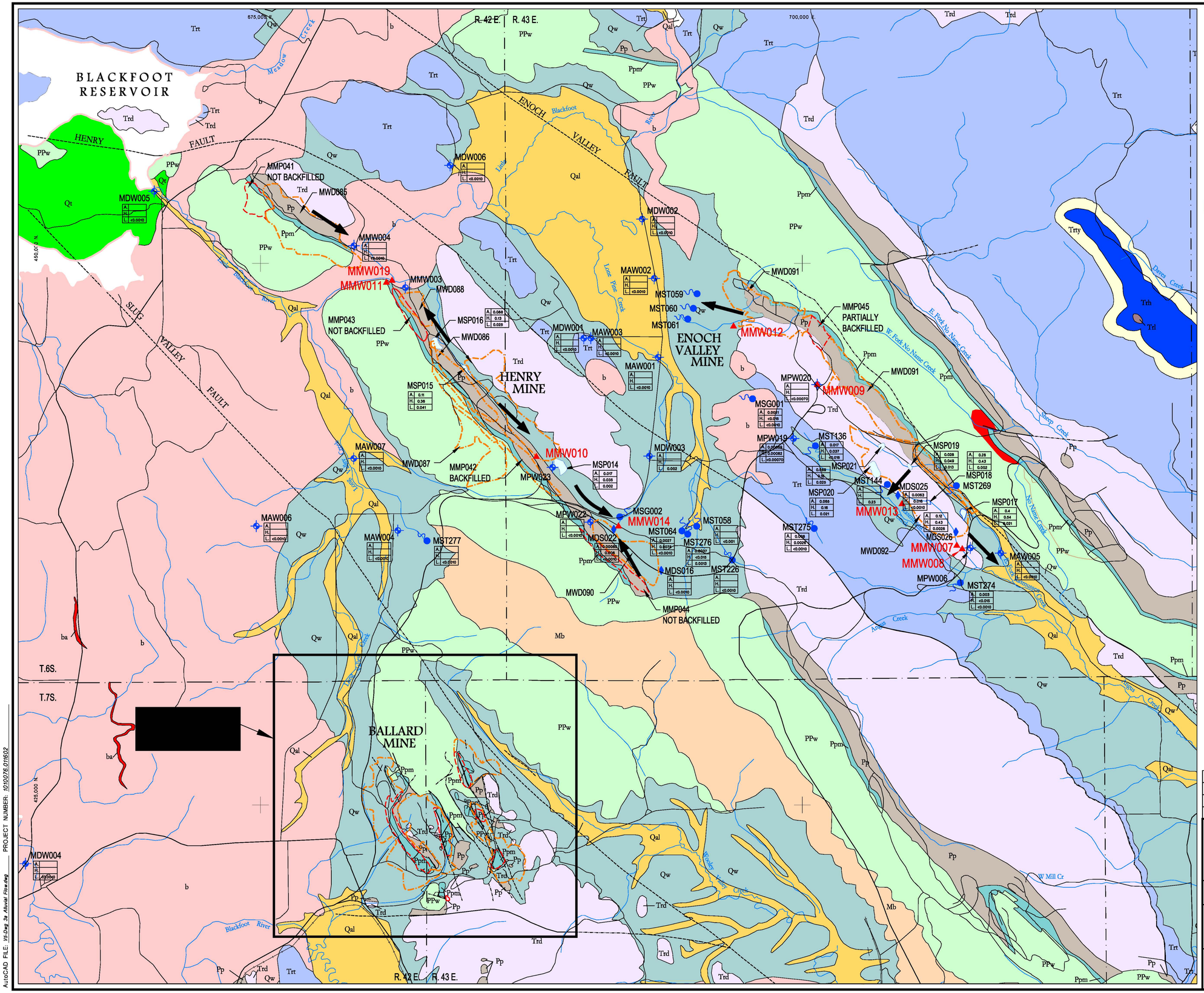


LEGEND

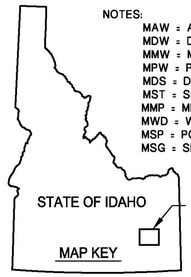
- CREEKS/RIVERS
- PONDS
- HIGHWAY
- ROADS
- RAILROAD
- TOWNSHIP AND RANGE
- FAULT LINE
- INFERRED FAULT
- FAULT CONCEALED BY SURFACE DEPOSITS
- MINE PIT LOCATION (APPROXIMATE)
- WASTE ROCK PILE LOCATION (APPROXIMATE)
- MMW010 ▲ PROPOSED GROUNDWATER WELL MONITORING LOCATION
- MPW023 GROUNDWATER WELL MONITORING LOCATION
- MDS022 WASTE ROCK DUMP SEEP
- MSG002 SPRING STATION
- MST064 HEADWATER STREAM STATION
- POSTULATED ALLUVIAL FLOW PATH
- AVERAGE / HIGH / LOW — UNFILTERED SELENIUM CONCENTRATIONS (mg/L) (SINGLE SAMPLE RESULTS ARE SHOWN IN LOW BOX)

GEOLOGIC KEY

b	BASALT
ba	BASALTIC ASH (TUFF)
Qal	ALLUVIUM
Qt	TRAVERTINE
Qw	HILL WASH AND OLDER ALLUVIUM
Trd	DEADMAN LIMESTONE
Trh	HIGHAM GRIT
Trt	THAYNES FORMATION
Try	TIMOTHY SANDSTONE (THAYNES MEMBER)
Trd	DINWOODY FORMATION (WOODSIDE SHALE)
Pp	PHOSPHORIA FORMATION
Ppm	MEADE PEAK MEMBER
PPw	WELLS FORMATION
Mb	BRAZER LIMESTONE

GEOLOGIC MAPPING BY MANSFIELD, ETAL., 1927, USGS PROFESSIONAL PAPER 152. REGIONAL GEOLOGY IS SHOWN TO PROVIDE REGIONAL GEOLOGIC FRAMEWORK AND MAY NOT BE ACCURATE FOR LOCAL SCALE. FOR MINE AREAS, MINE SITE GEOLOGY SHOULD BE CONSIDERED MORE ACCURATE AND MAY INCLUDE LOCAL GEOLOGIC DEPOSITS NOT MAPPED AT THE REGIONAL SCALE.

NOTES:
- MAW = AGRICULTURAL WELL
- MDW = DOMESTIC WELL
- MMW = MONITORING WELL
- MPW = PRODUCTION WELL
- MDS = DUMP SEEP
- MST = SPRING FED STREAM LOCATION
- MMP = MINE PIT
- MWD = WASTE ROCK DUMP
- MSP = POND
- MSG = SPRING



SCALE 0 2000 4000 Feet

N

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
2	Issued for Tech Memo Ver5	01/07	D.Brame	C.Fowler	C.Foulk
1	Issued for Draft Tech Memeo Ver4A	11/06	D.Brame	S.Farnam	
0	Issued for Draft Tech Memo Ver4	08/06	D.Brame	S.Farnam	

P4 PRODUCTION
Southeast Idaho Mine-Specific Selenium Program

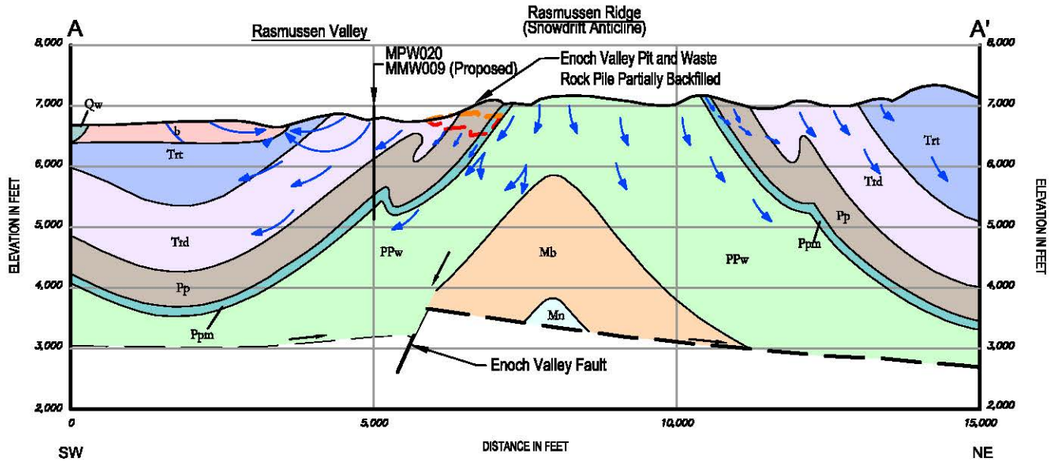
PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
SURFICIAL GEOLOGY & GROUNDWATER MONITORING LOCATIONS WITH SELENIUM CONCENTRATIONS

MWH

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 3

AutoCAD FILE: V5-Dwg_3a_Alluvial_Flow.dwg PROJECT NUMBER: 1010076.01602

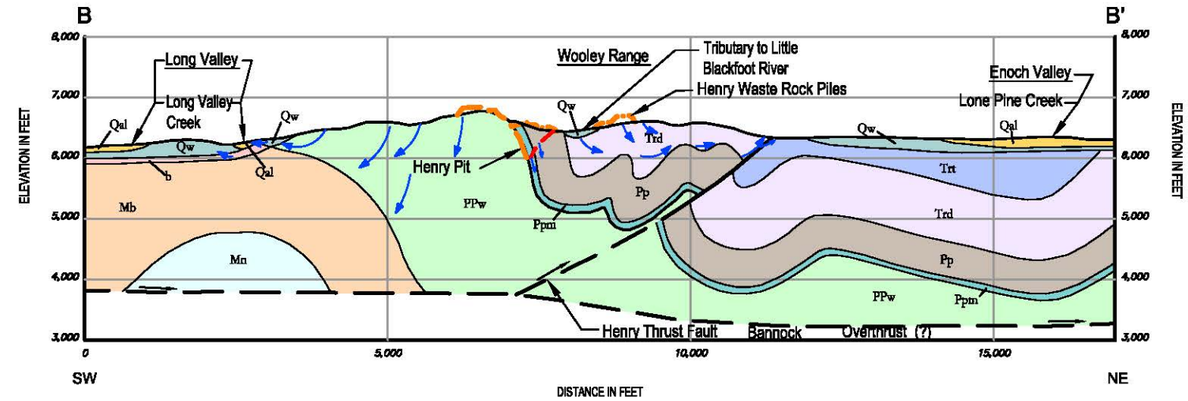


ENOCH VALLEY MINE CONCEPTUAL CROSS-SECTION A-A'

SCALE IS APPROXIMATE

HORIZONTAL SCALE
0 1250' 2500'

VERTICAL SCALE
0 1250' 2500'

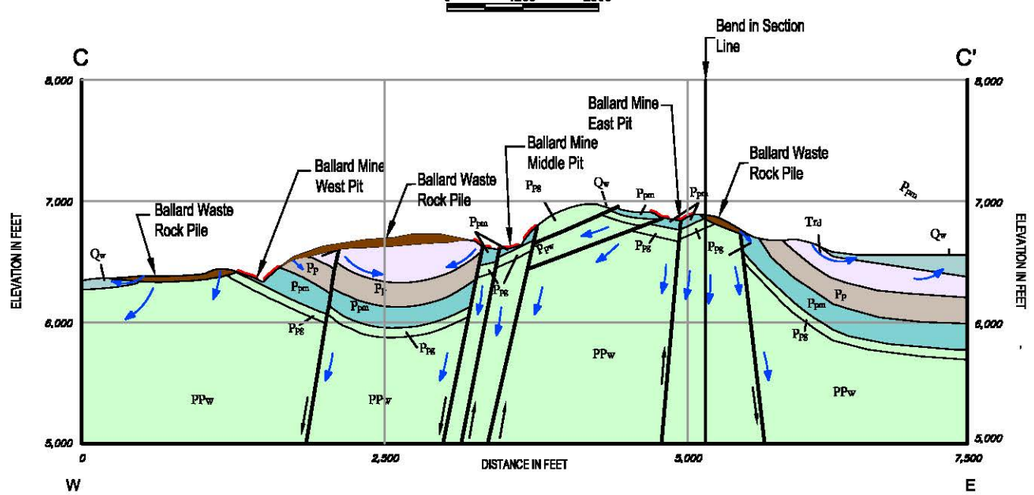


HENRY MINE CONCEPTUAL CROSS-SECTION B-B'

SCALE IS APPROXIMATE

HORIZONTAL SCALE
0 1250' 2500'

VERTICAL SCALE
0 1250' 2500'



BALLARD MINE CONCEPTUAL CROSS-SECTION C-C'

SCALE IS APPROXIMATE

HORIZONTAL SCALE
0 625' 1250'

VERTICAL SCALE
0 625' 1250'

LEGEND

- b — BASALT
- Qal — ALLUVIUM
- Qw — HILL WASH AND OLDER ALLUVIUM
- Trt — THAYNES FORMATION
- Trd — DINWOODY FORMATION (WOODSIDE SHALE)
- Pp / Ppm — PHOSPHORIA FORMATION MEADE PEAK MEMBER
- PPw — WELLS FORMATION
- Mb — BRAZER LIMESTONE
- Mn — MADISON LIMESTONE
- FAULT (DASHED WHERE INFERRED)
- MINE PIT LOCATION (CONCEPTUAL)
- WASTE ROCK PILE LOCATION (CONCEPTUAL)
- CONCEPTUAL GROUNDWATER FLOW PATH (SIZE OF ARROW CORRELATES TO APPROXIMATE MAGNITUDE OF HYDRAULIC CONDUCTIVITY)

NOTE:
1. GEOLOGIC CROSS-SECTIONS BASED ON MANSFIELD, ET AL., 1927 USGS PROFESSIONAL PAPER 152.

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
1	Issued for Tech Memo Ver3	01/07	D.Brame	C.Fowler	C.Foulk
0	Issued for Draft Tech Memo Rev.2	03/06	D.Brame	C.Fowler	C.Foulk

P4 PRODUCTION
Southeast Idaho Mine - Specific Selenium Program

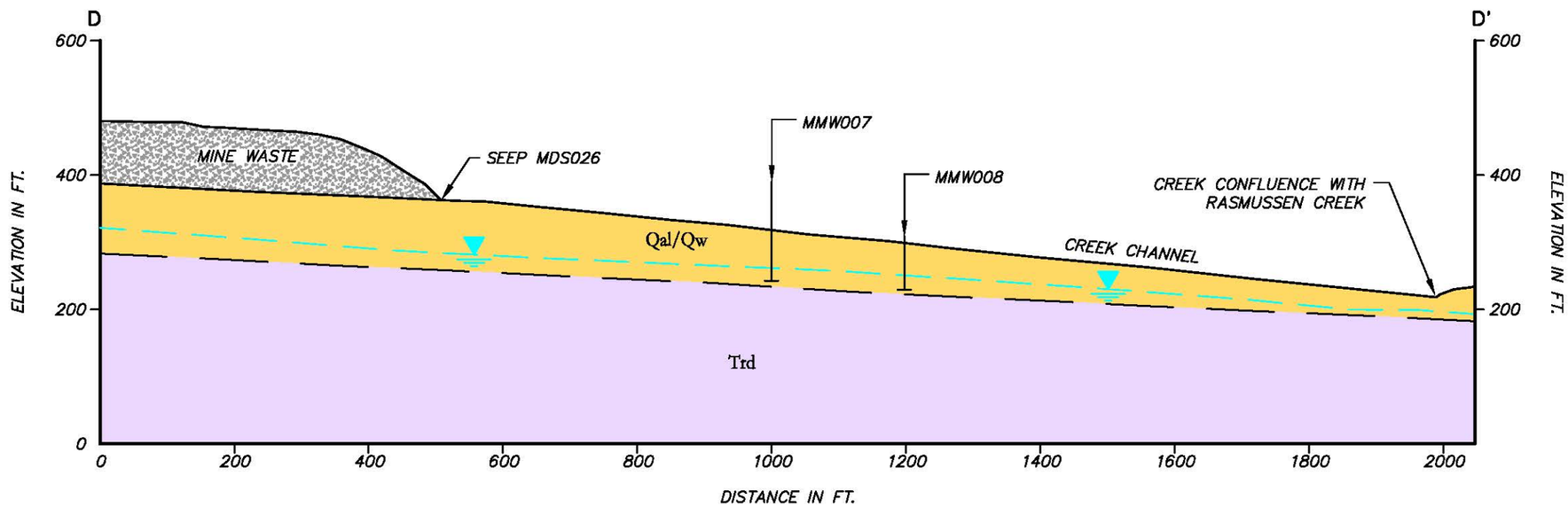
PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
CONCEPTUAL GEOLOGIC CROSS-SECTIONS OF ENOCH VALLEY, HENRY, AND BALLARD MINES

MWH

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 4

AutoCAD FILE: V2-Dwg 4 Conceptual Sections.dwg PROJECT NUMBER:



CONCEPTUAL CROSS-SECTION D-D'

HORIZONTAL SCALE
0 100' 200'

VERTICAL SCALE
0 100' 200'

LEGEND

Qal	ALLUVIUM
Trd	DINWOODY FORMATION (WOODSIDE SHALE)
	MAPPED CONTACT
	INFERRED CONTACT
	WATER LEVEL

NOTE: 1. THE NARROW ALLUVIAL DEPOSIT AT THIS LOCATION IS NOT SHOWN AT THE REGIONAL SCALE ON DRAWING 3.
2. CROSS SECTION LOCATION IS SHOWN ON DRAWING 3.

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
1	Issued for Tech Memo Ver5	01/07	D.Brame	C.Fowler	C.Foulk
0	Issued for Tech Memo	10/05	P.Anderson	K.Conrath	C.Foulk

P4 PRODUCTION
Southeast Idaho Mine - Specific Selenium Program

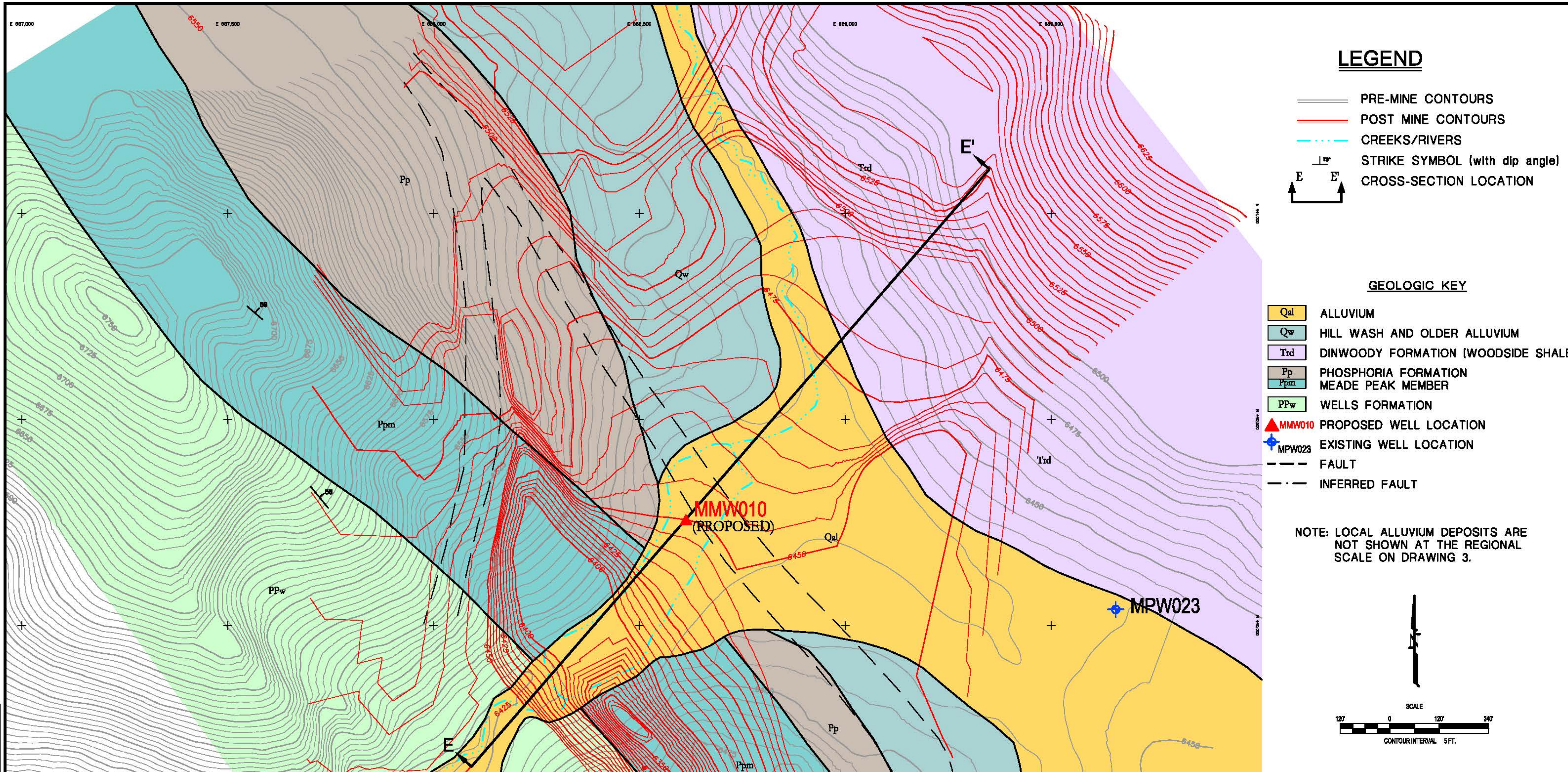
PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
CONCEPTUAL CROSS-SECTION FOR PROPOSED WELL LOCATIONS MMW007 AND MMW008 ENOCH VALLEY MINE

MWH

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 5

AutoCAD FILE: V5-Dwg 6 Conc Secs EVM.dwg PROJECT NUMBER: 1010078.011602



REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
1	Issued for Tech Memo Ver5	07/07	D.Brame	C.Fowler	C.Foulk
0	Issued for Tech Memo	10/06	P.Anderson	K.Conrath	C.Foulk

P4 PRODUCTION
Southeast Idaho Mine - Specific Selenium Program

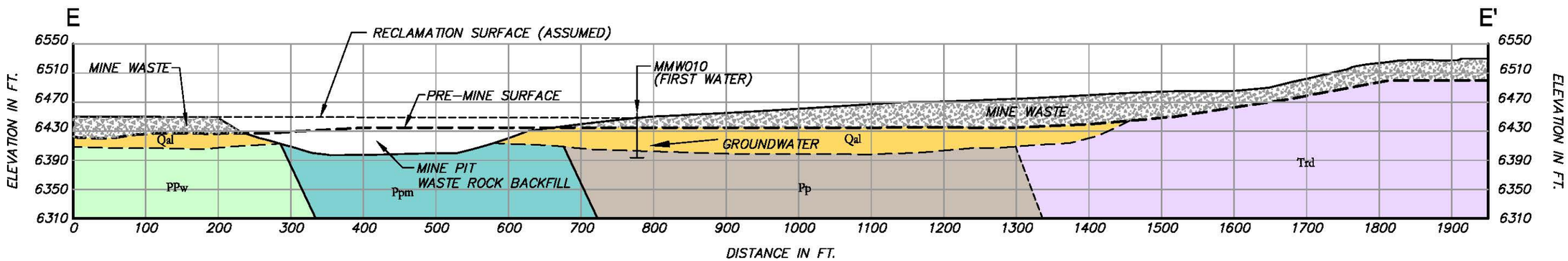
PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
GEOLOGY AND CROSS-SECTION LOCATION MAP FOR PROPOSED WELL MMW010 HENRY MINE

MWH

Sheet 1 Of 1 Sheets
SCALE: As Shown
DRAWING No. 6

AutoCAD FILE: V5-Dwg 6-7 Geo Henry.dwg PROJECT NUMBER: 1010078.011602



CROSS-SECTION E-E'

HORIZONTAL SCALE
0 75' 150'

VERTICAL SCALE
0 75' 150'

LEGEND

Qal	ALLUVIUM
Trd	DINWOODY FORMATION (WOODSIDE SHALE)
Pp	PHOSPHORIA FORMATION
Ppm	MEADE PEAK MEMBER
Ppw	WELLS FORMATION

——— MAPPED CONTACT

— — — — MAPPED CONTACT

NOTE: SEE DRAWING 6 FOR SECTION LOCATION, AND DRAWING 3 FOR REGIONAL REFERENCE.

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
1	Issued for Tech Memo Ver3	01/07	D.Brame	C.Fowler	C.Foulk
0	Issued for Tech Memo	10/06	P.Anderson	K.Cavraik	C.Foulk

P4 PRODUCTION
Southeast Idaho Mine - Specific Selenium Program

PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
CONCEPTUAL CROSS-SECTION FOR PROPOSED WELL LOCATION MMW010 HENRY MINE

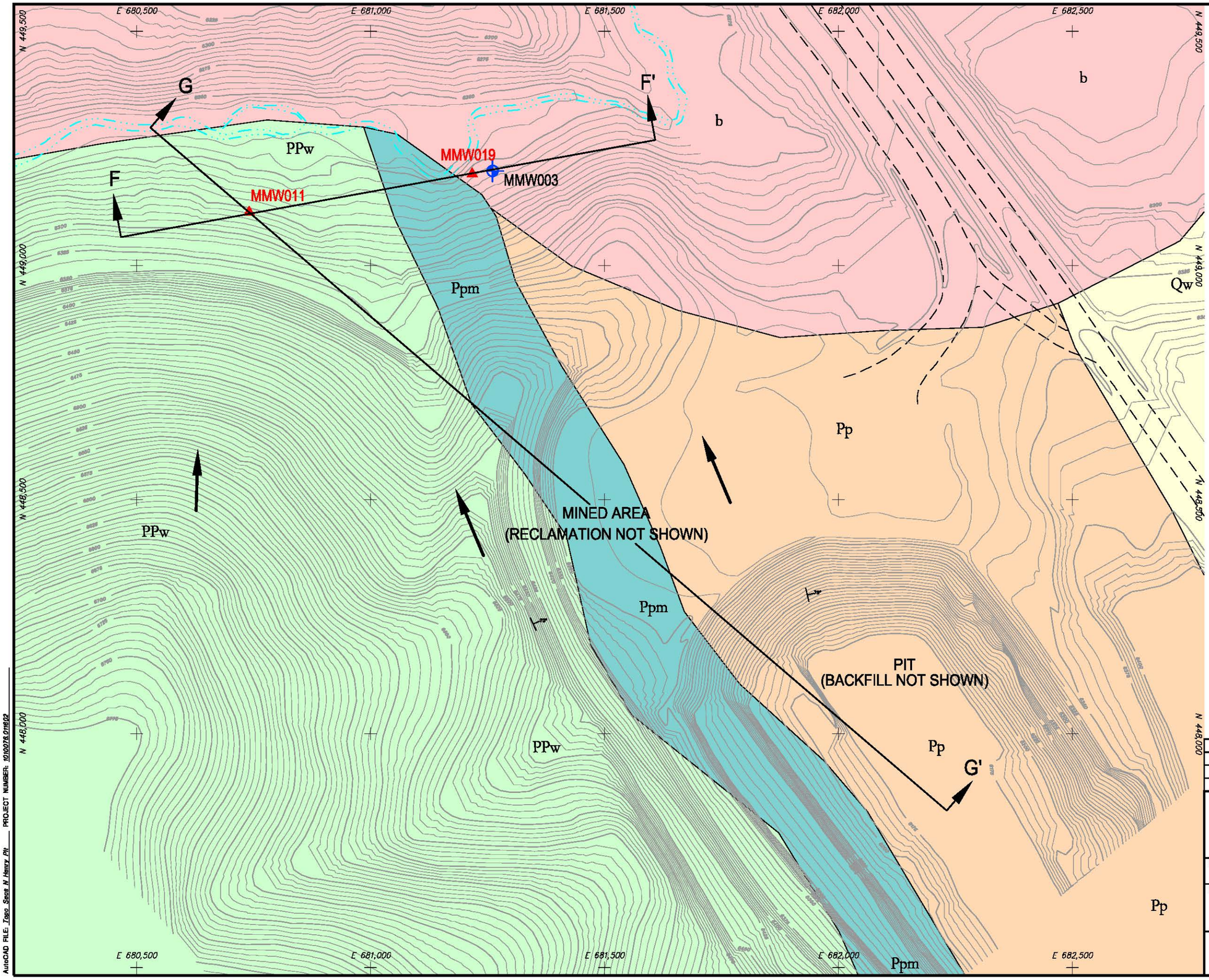
MWH

Sheet 1 Of 1 Sheets

SCALE: As Shown

DRAWING No. 7

AutoCAD FILE: V5-Dwg 6-7 Geo Henry.dwg PROJECT NUMBER: 1010078.01H02



LEGEND

- TOPOGRAPHIC CONTOUR
- ROAD
- GEOLOGIC UNIT CONTACT
- 73° STRIKE SYMBOL (with dip angle)
- MMW003 MONITORING WELL
- MMW011 MONITORING WELL (Proposed)
- PREDICTED GROUNDWATER FLOW DIRECTION
- A A' CROSS-SECTION LOCATION

GEOLOGIC KEY

- b BASALT
- Pp / Ppm PHOSPHORIA FORMATION MEADE PEAK MEMBER
- PPw WELLS FORMATION
- Qw HILL WASH AND OLDER ALLUVIUM

N

SCALE

100' 0 100' 200'

CONTOUR INTERVAL 5 FT.

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
1	Issued for Tech Memo Ver3	01/07	D.Brame	C.Fowler	C.Foulk
0	Issued for Tech Memo	10/06	P.Anderson	K.Cavrath	C.Foulk

P4 PRODUCTION
Southeast Idaho Mine - Specific Selenium Program

PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
GEOLOGY AND CROSS-SECTION LOCATION MAP FOR PROPOSED WELL MMW011 HENRY MINE SITE

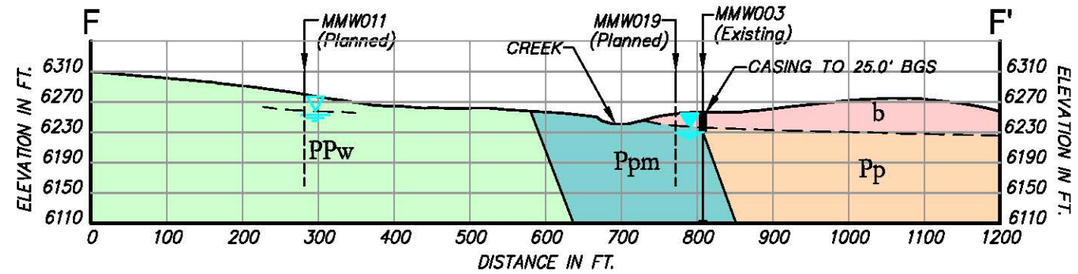
MWH

Sheet 1 Of 1 Sheets

SCALE: As Shown

DRAWING No. 8

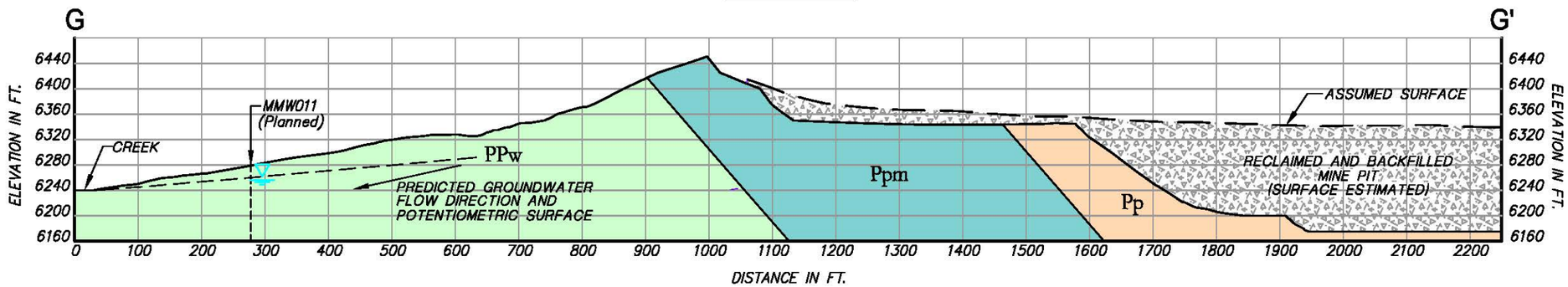
AutoCAD FILE: Topo_Secs N Henry Pit PROJECT NUMBER: 1010076.01H02



CROSS-SECTION F-F'

HORIZONTAL SCALE
0 50' 100'

VERTICAL SCALE
0 50' 100'



CROSS-SECTION G-G'

HORIZONTAL SCALE
0 50' 100'

VERTICAL SCALE
0 50' 100'

LEGEND

WATER LEVEL (MEASURED)

WATER LEVEL (PREDICTED)

GEOLOGIC KEY

b	BASALT
Pp	PHOSPHORIA FORMATION
Ppm	MEADE PEAK MEMBER
PPw	WELLS FORMATION

MAPPED CONTACT

INFERRED CONTACT

NOTE: SEE DRAWING 8 FOR SECTION LOCATIONS.

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
1	Issued for Tech Memo Ver3	01/07	D.Brame	C.Fowler	C.Foulk
0	Issued for Technical Memorandum	10/05	P.Anderson	K.Carroll	C.Foulk

P4 PRODUCTION
Southeast Idaho Mine - Specific Selenium Program

PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
CONCEPTUAL CROSS-SECTIONS FOR PPOPOSED WELL LOCATION MMW011 HENRY MINE

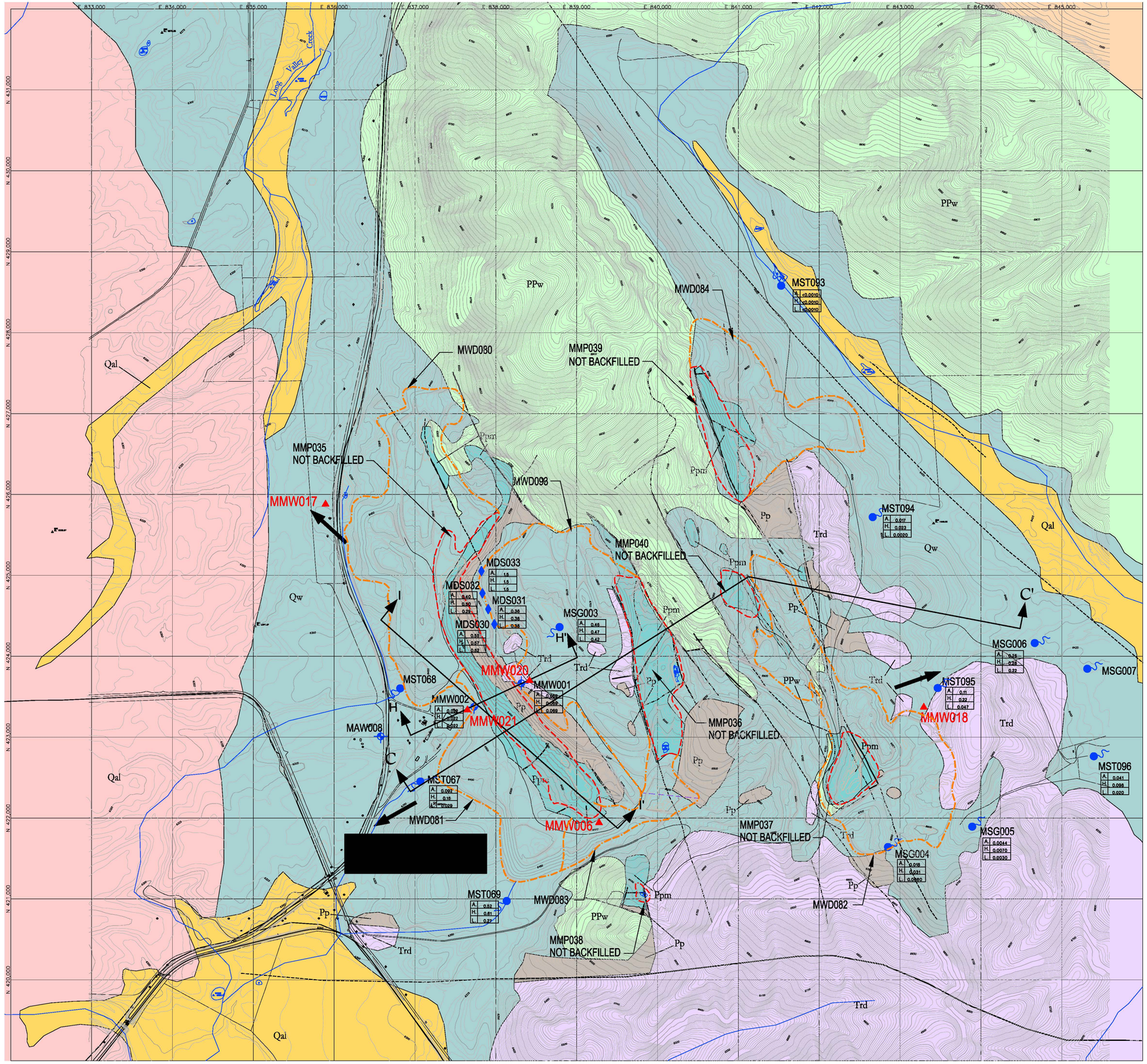
MWH

Sheet 1 Of 1 Sheets

SCALE: As Shown

DRAWING No. 9

AutoCAD FILE: Topo_Secs North Henry.dwg PROJECT NUMBER: 1010078.01602



LEGEND

- CONTOURS
- CREEKS/RIVERS
- HIGHWAY
- ROADS
- MINE PIT LOCATION (APPROXIMATE)
- WASTE ROCK PILE LOCATION (APPROXIMATE)
- MINE PIT LOCATION
- FAULT
- INFERRED FAULT
- FAULT CONCEALED BY SURFACE DEPOSITS
- MMW010 ▲ PROPOSED GROUNDWATER WELL MONITORING LOCATION
- MPW023 GROUNDWATER WELL MONITORING LOCATION
- MMDS022 WASTE ROCK DUMP SEEP
- MSG002 SPRING STATION
- MST064 HEADWATER STREAM STATION
- POSTULATED ALLUVIAL FLOW PATH
- NATIONAL FOREST
- BUREAU OF LAND MANAGEMENT
- AVERAGE / HIGH / LOW — UNFILTERED SELENIUM CONCENTRATIONS (mg/L) (COMPLETE DATA TABLES PROVIDED IN APPENDICES B-C)

GEOLOGIC KEY

- b — BASALT
- Qal — ALLUVIUM
- Qw — HILL WASH AND OLDER ALLUVIUM
- Trd — DINWOODY FORMATION (WOODSIDE SHALE)
- Pp — PHOSPHORIA FORMATION
- Ppm — MEADE PEAK MEMBER
- PPw — WELLS FORMATION
- Mb — BRAZER LIMESTONE

NOTES:

1. MAW = AGRICULTURAL WELL
   MDW = DOMESTIC WELL
   MMW = MONITORING WELL
   MPW = PRODUCTION WELL
   MDS = DUMP SEEP
   MST = SPRING FED STREAM LOCATION
   MMP = MINE PIT
   MWD = WASTE ROCK DUMP
   MSP = POND
   MSG = SPRING
2. GEOLOGIC MAPPING BY MANSFIELD, ET AL., 1927 USGS PROFESSIONAL PAPER 152.

MAP KEY

N

SCALE

600' 0 600' 1200'

CONTOUR INTERVAL 10 FT.

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
3	Issued for Tech Memo Ver5	01/07	D.Brame	C.Fowler	C.Foulk
2	Issued for Draft Tech Memo Ver4	08/06	D.Brame	S.Farnam	
1	Issued for Draft Tech Memo Rev2	03/06	D.Brame	C.Fowler	C.Foulk
0	Issued for Draft Tech Memo	10/05	P.Anderson	K.Conrath	C.Foulk

P4 PRODUCTION
Southeast Idaho Mine-Specific Selenium Program

PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
BALLARD MINE DETAIL & SELENIUM CONCENTRATIONS

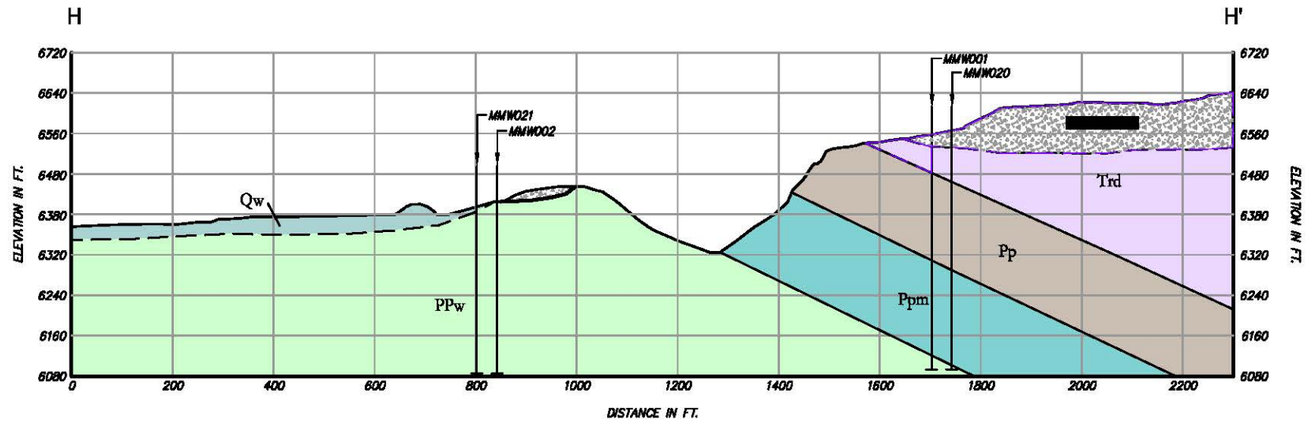
MWH

Sheet 1 Of 1 Sheets

SCALE: As Shown

DRAWING No. 10

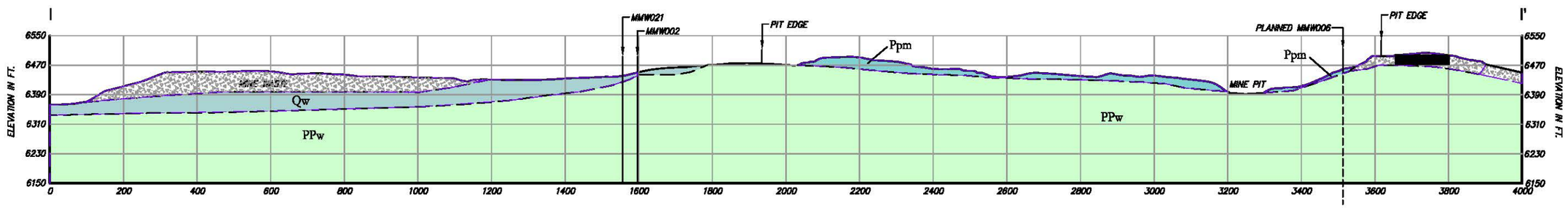
AutoCAD FILE: V5-Dwg_10_Ballard.dwg PROJECT NUMBER: 1010076.016/02



CROSS-SECTION H-H'

HORIZONTAL SCALE 0 150' 300'

VERTICAL SCALE 0 150' 300'



CROSS-SECTION I-I'

HORIZONTAL SCALE 0 150' 300'

VERTICAL SCALE 0 150' 300'

LEGEND

- Trd — DINWOODY FORMATION (WOODSIDE SHALE)
- Pp — PHOSPHORIA FORMATION
- Ppm — MEADE PEAK MEMBER
- PPw — WELLS FORMATION
- ——— MAPPED CONTACT
- — — — INFERRED CONTACT

NOTE: SEE DRAWING 10 FOR LOCATION OF SECTIONS.

REV. No.	REVISIONS	DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY
1	Issued for Tech Memo Ver3	01/07	D.Brame	C.Fowler	C.Foulk
0	Issued for Draft Tech Memo	10/05	P.Anderson	K.Conrath	C.Foulk

P4 PRODUCTION
Southeast Idaho Mine - Specific Selenium Program

PROJECT:
Monitoring Well Installation Tech Memo

DRAWING TITLE:
CONCEPTUAL CROSS-SECTION FOR PROPOSED WELL LOCATIONS MMW006, MMW020 AND MMW021 BALLARD MINE

MWH

Sheet 1 Of 1 Sheets

SCALE: As Shown

DRAWING No. 11

AutoCAD FILE: V5-Dwg 11 Ballard.dwg PROJECT NUMBER: 1010078.01802

Appendix B
Unfiltered Results[†]

[†] All data has been censored at the reporting limit.

Appendix B: Unfiltered Results[†]

Table 1: Domestic and Agricultural Wells – Unfiltered Results

Table 2: Monitoring and Production Wells – Unfiltered Results – COPC

Table 3: Monitoring and Production Wells – Unfiltered Results – Screening Analytes

Table 4: Seeps, Springs, and Headwater Streams – Unfiltered Results – COPC

Table 5: Seeps, Springs, and Headwater Streams – Unfiltered Results – Screening Analytes

Table 6: Ponds – Unfiltered Results – COPC

Table 7: Ponds – Unfiltered Results – Screening Analytes

[†] All data has been censored at the reporting limit.

Table 1
Domestic and Agricultural Wells - Unfiltered Results (mg/L)†

Station		Selenium				Cadmium				Chromium			
		2004				2004				2004			
Well Name	Well ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
School Bus Well	MAW001-Avg	<0.0010	U	NS		<0.00020	U	NS		0.00087		NS	
	MAW001	NA		NS		NA		NS		NA		NS	
	MAW001-R1	<0.0010	U	NS		<0.00020	U	NS		0.00090		NS	
	MAW001-R2	<0.0010	U	NS		<0.00020	U	NS		0.0010		NS	
	MAW001-R3	<0.0010	U	NS		<0.00020	U	NS		0.00070		NS	
(b) (6) Field Well	MAW002	<0.0010	U	NS		<0.00020	U	NS		<0.00020	U	NS	
(b) (6) Field Well	MAW003	<0.0010	U	NS		0.00040		NS		0.0044		NS	
(b) (6) Field Well	MAW004	<0.0010	U	NS		<0.00020	U	NS		0.00020		NS	
(b) (6) Windmill Field Well	MAW005	<0.0010	U	NS		0.0016		NS		0.0048		NS	
(b) (6) Field Well West	MAW006	NS		<0.0010	U	NS		<0.00020	U	NS		0.0031	
(b) (6) Field Well North	MAW007	NS		<0.0010	U	NS		<0.00010	U	NS		0.00070	
(b) (6) House Well	MDW001	<0.0010	U	NS		<0.00020	U	NS		0.00040		NS	
(b) (6) House Well	MDW002	<0.0010	U	NS		<0.00020	U	NS		0.00060		NS	
(b) (6) House Well	MDW003	0.0020		NS		<0.00020	U	NS		0.00070		NS	
(b) (6) House Well	MDW004	<0.0010	U	NS		<0.00020	U	NS		0.0017		NS	
Cedar Bay RV Park Well	MDW005	<0.0010	U	NS		<0.00020	U	NS		0.00040		NS	
(b) (6) House Well	MDW006	<0.0010	U	NS		<0.00020	U	NS		0.00090		NS	

Station		Nickel				Vanadium				Zinc			
		2004				2004				2004			
Well Name	Well ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
School Bus Well	MAW001-Avg	<0.0025	U	NS		0.00073		NS		<0.16	U	NS	
	MAW001	NA		NS		NA		NS		NA		NS	
	MAW001-R1	<0.0025	U	NS		0.00070		NS		<0.16	U	NS	
	MAW001-R2	<0.0025	U	NS		0.00090		NS		<0.16	U	NS	
	MAW001-R3	<0.0025	U	NS		NA		NS		<0.16	U	NS	
(b) (6) Field Well	MAW002	<0.0025	U	NS		<0.0010	U	NS		<0.16	U	NS	
(b) (6) Field Well	MAW003	0.0028		NS		0.0070		NS		0.30		NS	
(b) (6) Field Well	MAW004	0.0049		NS		0.00070		NS		<0.16	U	NS	
(b) (6) Windmill Field Well	MAW005	0.0038		NS		0.0024		NS		21		NS	
(b) (6) Field Well West	MAW006	NS		0.0049		NS		0.011		NS		0.036	
(b) (6) Field Well North	MAW007	NS		0.0029		NS		0.00090		NS		0.087	
(b) (6) House Well	MDW001	<0.0025	U	NS		0.00040		NS		<0.16	U	NS	
(b) (6) House Well	MDW002	<0.0025	U	NS		0.0041		NS		<0.16	U	NS	
(b) (6) House Well	MDW003	<0.0025	U	NS		0.00070		NS		<0.16	U	NS	
(b) (6) House Well	MDW004	<0.0025	U	NS		0.0018		NS		<0.16	U	NS	
Cedar Bay RV Park Well	MDW005	<0.0025	U	NS		0.00040		NS		<0.16	U	NS	
(b) (6) House Well	MDW006	<0.0025	U	NS		0.0028		NS		<0.16	U	NS	

Station		Total Alkalinity			
		2004			
Well Name	Well ID	Spring	Flag	Fall	Flag
School Bus Well	MAW001-Avg	170		NS	
	MAW001	NA		NS	
	MAW001-R1	180		NS	
	MAW001-R2	180		NS	
	MAW001-R3	150		NS	
(b) (6) Field Well	MAW002	250		NS	
(b) (6) Field Well	MAW003	110		NS	
(b) (6) Field Well	MAW004	700		NS	
(b) (6) Windmill Field Well	MAW005	150		NS	
(b) (6) Field Well West	MAW006	NS		120	
(b) (6) Field Well North	MAW007	NS		240	
(b) (6) House Well	MDW001	190		NS	
(b) (6) House Well	MDW002	150		NS	
(b) (6) House Well	MDW003	190		NS	
(b) (6) House Well	MDW004	150		NS	
Cedar Bay RV Park Well	MDW005	460		NS	
(b) (6) House Well	MDW006	150		NS	

Notes:
† All data has been censored at the reporting limit.
Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).
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(J) - The result is an estimated quantity.
(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 2
Monitoring and Production Wells - Unfiltered Results - COPC (mg/L)†

Station			Selenium						Cadmium					
			1998[a]				2005		1998[a]				2005	
Mine	Name	ID	Spring	Flag	Fall	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Fall	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	<0.00070	U	<0.00070	U	NS		0.0021		<0.0020	U	NS	
	EVM Shop Well	MPW019	0.00082		<0.00070	U	NS		<0.0020	U	<0.0020	U	NS	
	Degerstrom Well at EVM	MPW020	<0.00070	U	<0.00070	U	NS		0.0033		<0.0020	U	NS	
Henry Mine	Henry North Pit Well S	MMW003	NS		NS		NS		NS		NS		NS	
	Henry North Pit Well N	MMW004-Avg	NS		NS		<0.0010	U	NS		NS		<0.083	U
		MMW004	NS		NS		NA		NS		NS		NA	
		MMW004-R1	NS		NS		<0.0010	U	NS		NS		<0.050	U
		MMW004-R2	NS		NS		<0.0010	U	NS		NS		<0.10	U
		MMW004-R3	NS		NS		<0.0010	U	NS		NS		<0.10	U
	Henry South Pit Well	MPW022	NS		NS		<0.0010	U	NS		NS		<0.10	U
	Henry Center Pit Well	MPW023	NS		NS		NS		NS		NS		NS	
Ballard Mine	Ballard Pit East Well	MMW001	NS		NS		0.069		NS		NS		<0.050	U
	Ballard Pit West Well	MMW002	NS		NS		0.022		NS		NS		<0.050	U

Station			Chromium		Nickel					
			2005		1998[a]				2005	
Mine	Name	ID	Fall	Flag	Spring	Flag	Fall	Flag	Fall	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	NS		<0.010	U	<0.010	U	NS	
	EVM Shop Well	MPW019	NS		<0.010	U	<0.010	U	NS	
	Degerstrom Well at EVM	MPW020	NS		0.17		0.12		NS	
Henry Mine	Henry North Pit Well S	MMW003	NS		NS		NS		NS	
	Henry North Pit Well N	MMW004-Avg	<0.083	U	NS		NS		<0.50	U
		MMW004	NA		NS		NS		NA	
		MMW004-R1	<0.050	U	NS		NS		<0.30	U
		MMW004-R2	<0.10	U	NS		NS		<0.60	U
		MMW004-R3	<0.10	U	NS		NS		<0.60	U
	Henry South Pit Well	MPW022	<0.10	U	NS		NS		<0.60	U
	Henry Center Pit Well	MPW023	NS		NS		NS		NS	
Ballard Mine	Ballard Pit East Well	MMW001	<0.050	U	NS		NS		<0.30	U
	Ballard Pit West Well	MMW002	<0.050	U	NS		NS		<0.30	U

Station			Vanadium						Zinc					
			1998[a]				2005		1998[a]				2005	
Mine	Name	ID	Spring	Flag	Fall	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Fall	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	0.021		0.0077		NS		0.14		0.068		NS	
	EVM Shop Well	MPW019	0.011		<0.0043	U	NS		0.051		0.073		NS	
	Degerstrom Well at EVM	MPW020	0.0092		<0.0043	U	NS		0.99		0.71		NS	
Henry Mine	Henry North Pit Well S	MMW003	NS		NS		NS		NS		NS		NS	
	Henry North Pit Well N	MMW004-Avg	NS		NS		<0.17	U	NS		NS		480	
		MMW004	NS		NS		NA		NS		NS		NA	
		MMW004-R1	NS		NS		<0.10	U	NS		NS		280	
		MMW004-R2	NS		NS		<0.20	U	NS		NS		620	
		MMW004-R3	NS		NS		<0.20	U	NS		NS		530	
	Henry South Pit Well	MPW022	NS		NS		<0.20	U	NS		NS		550	
	Henry Center Pit Well	MPW023	NS		NS		NS		NS		NS		NS	
Ballard Mine	Ballard Pit East Well	MMW001	NS		NS		<0.10	U	NS		NS		450	
	Ballard Pit West Well	MMW002	NS		NS		<0.10	U	NS		NS		460	

Notes:
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[a] Data from 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1998.
Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).
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(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
COPC - Constituent of Potential Concern
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 3
Monitoring and Production Wells - Unfiltered Results - Screening Analytes (mg/L)†

Station			Calcium				Iron						Magnesium				Manganese						Nitrate/Nitrite as N			
			1998[a]				1998[a]				2005		1998[a]				1998[a]				2005		2005			
Mine	Name	ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	48		46		0.0046		0.095		NS		17		18		0.28		0.21		NS		NS		NS	
	EVM Shop Well	MPW019	73		63		0.0073		0.22		NS		9.3		9.0		0.040		0.032		NS		0.060		NS	
	Degerstrom Well at EVM	MPW020	60		59		<0.0015	U	0.089		NS		15		17		0.17		0.11		NS		NS		NS	
Henry Mine	Henry North Pit Well S	MMW003	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		0.12		NS	
	Henry North Pit Well N	MMW004-Avg	NS		NS		NS		NS		0.63		NS		NS		NS		NS		<0.43	U	1.4		1.4	
		MMW004	NS		NS		NS		NS		NA		NS		NS		NS		NS		NA		1.4		NA	
		MMW004-R1	NS		NS		NS		NS		0.70		NS		NS		NS		NS		<0.30	U	NA		1.4	
		MMW004-R2	NS		NS		NS		NS		0.50		NS		NS		NS		NS		<0.50	U	NA		1.3	
		MMW004-R3	NS		NS		NS		NS		0.70		NS		NS		NS		NS		<0.50	U	NA		1.4	
	Henry South Pit Well	MPW022	NS		NS		NS		NS		8.1		NS		NS		NS		NS		<0.50	U	0.10		<0.020	U
	Henry Center Pit Well	MPW023	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		<0.020	U	NS	
Ballard Mine	Ballard Pit East Well	MMW001	NS		NS		NS		NS		<0.24	U	NS		NS		NS		NS		<0.30	U	0.33		0.69	
	Ballard Pit West Well	MMW002	NS		NS		NS		NS		1.0		NS		NS		NS		NS		<0.30	U	0.040		<0.020	U

Table 3 continued
Monitoring and Production Wells - Unfiltered Results - Screening Analytes (mg/L)†

Station			Potassium				Sodium				Total Alkalinity											
			1998[a]				1998[a]				1998[a]				2004				2005			
Mine	Name	ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	2.0		1.8		13		14		180		200		160		170		NS		NS	
	EVM Shop Well	MPW019	1.4		0.88		6.5		6.2		200		190		220		220		190		NS	
	Degerstrom Well at EVM	MPW020	1.1		1.2		4.7		4.5		160		190		NS		94		NS		NS	
Henry Mine	Henry North Pit Well S	MMW003	NS		NS		NS		NS		NS		NS		120		160		150		NS	
	Henry North Pit Well N	MMW004-Avg	NS		NS		NS		NS		NS		NS		140		130		160		170	
		MMW004	NS		NS		NS		NS		NS		NS		NA		130		160		NA	
		MMW004-R1	NS		NS		NS		NS		NS		NS		140		NA		NA		170	
		MMW004-R2	NS		NS		NS		NS		NS		NS		140		NA		NA		170	
		MMW004-R3	NS		NS		NS		NS		NS		NS		140		NA		NA		170	
	Henry South Pit Well	MPW022	NS		NS		NS		NS		NS		NS		NS		200		180		180	
	Henry Center Pit Well	MPW023	NS		NS		NS		NS		NS		NS		NS		190		180		NS	
Ballard Mine	Ballard Pit East Well	MMW001-Avg	NS		NS		NS		NS		NS		NS		270		270		240		260	
		MMW001	NS		NS		NS		NS		NS		NS		270		NA		240		260	
		MMW001-R1	NS		NS		NS		NS		NS		NS		NA		270		NA		NA	
		MMW001-R2	NS		NS		NS		NS		NS		NS		NA		270		NA		NA	
		MMW001-R3	NS		NS		NS		NS		NS		NS		NA		270		NA		NA	
	Ballard Pit West Well	MMW002-Avg	NS		NS		NS		NS		NS		NS		300		310		280		290	
		MMW002	NS		NS		NS		NS		NS		NS		300		NA		280		290	
		MMW002-R1	NS		NS		NS		NS		NS		NS		NA		310		NA		NA	
		MMW002-R2	NS		NS		NS		NS		NS		NS		NA		310		NA		NA	
		MMW002-R3	NS		NS		NS		NS		NS		NS		NA		320		NA		NA	

Notes:
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[a] Data from 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1998.
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RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 4
Seeps, Springs, and Headwater Streams - Unfiltered Results - COPC (mg/L)†

Station			Selenium																	
			1997[a]		1998[a]				2000		2001		2002							
Mine	Station Name	Station ID	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS		NS		NS		NS		0.0026	J	<0.0010	U	NS		Dry		NS	
	EVM S Dump Seep	MDS026	NS		NS		NS		NS		0.049	J	0.12		NS		0.020	J	NS	
	Hedin Spring	MSG001	NS		NS		NS		NS		NS		<0.015	U	NS		0.0042	J	NS	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		NS		NS		Dry		NS		Dry		NS	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		NS		NS		Dry		NS		Dry		NS	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		NS		NS		Dry		NS		Dry		NS	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS		NS		NS		NA		NS		<0.015	U	Dry		Dry		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NS		NS		NS		NA		NS		Dry		NS		Dry		NS	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		NS		NS		Dry		NS		NA		NS	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		NS		NS		NS		<0.015	U	0.0030		<0.0010	UJ	NS	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		NS		NS		NS		Dry		NS		<0.0010	UJ	NS	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		NS		NS		Dry		NS		Dry		NS	
	S Pit Overburden Limestone Drain	MDS022-Avg	0.0011		0.00038		<0.00020	U	0.0060		<0.0010	U	<0.0010	U	NS		<0.0010	UJ	NS	
		MDS022	0.0011		0.00038		<0.00020	U	0.0060		<0.0010	U	NA		NS		<0.0010	UJ	NS	
		MDS022-R1	NA		NA		NA		NA		NA		<0.0010	U	NS		NA		NS	
		MDS022-R2	NA		NA		NA		NA		NA		<0.0010	U	NS		NA		NS	
		MDS022-R3	NA		NA		NA		NA		NA		<0.0010	U	NS		NA		NS	
	Taylor Spring	MSG002	NS		NS		NS		NS		NS		Dry		NS		Dry		NS	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		NS		NS		NS		NS		<0.0010	UJ	NS	
	W Fork Lone Pine Creek Above Tributary	MST064	NS		NS		NS		NS		NS		<0.015	U	0.0040		<0.0010	UJ	<0.0010	U
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS		NS		NS		<0.0010	U	NS		<0.0010	U	NS		Dry		NS	
	Tributary Above W Fork Lone Pine Creek	MST276	NS		NS		NS		NS		NS		<0.015	U	0.0030		0.0020	J	0.0013	
	Lone Pine Creek, Spring Fed Tributary	MST277	NS		NS		NS		NS		NS		NS		NS		NS		NS	
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		NS		NS		NS	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		NS		NS		NS	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		NS		NS		NS	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		NS		NS		NS	
	Garden Hose Spring	MSG003	NS		NS		NS		NS		0.44	J	0.47		NS		0.42	J	NS	
	Holmgren Spring	MSG004	NS		NS		NS		NS		NS		NS		NS		0.0080	J	NS	
	Cattle Spring	MSG005	NS		NS		NS		NS		NS		NS		NS		0.0030	J	NS	
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		NS		NS		NS	
	Ballard Creek, Headwaters	MST067	NS		NS		NS		NS		NS		0.13		Dry		Dry		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		NS		NS		Dry		NS		Dry		NS	
	Short Creek, Below BM	MST069-Avg	NS		NS		NS		NS		NS		0.58		0.49		0.27	J	0.55	
		MST069	NS		NS		NS		NS		NS		NA		0.49		0.27	J	0.55	
		MST069-R1	NS		NS		NS		NS		NS		0.57		NA		NA		NA	
		MST069-R2	NS		NS		NS		NS		NS		0.61		NA		NA		NA	
		MST069-R3	NS		NS		NS		NS		NS		0.56		NA		NA		NA	
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		NS		NS		NS		<0.0010	U	NS		Dry		NS	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS		NS		NS		Dry		NS		0.021		Dry		Dry		Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS		NS		NS		0.047		NS		0.16		Dry		Dry		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS		NS		NS		0.098		NS		0.025		Dry		Dry		Dry	

Table 4 continued
Seeps, Springs, and Headwater Streams - Unfiltered Results - COPC (mg/L)†

Station			Selenium															
			2003												2004			
Mine	Station Name	Station ID	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS		NS		NS		NS		NS		NS		0.016		Dry	
	EVM S Dump Seep	MDS026	NS		NS		NS		NS		NS		NS		0.43		0.0060	
	Hedin Spring	MSG001-Avg	NS		NS		NS		NS		NS		NS		<0.0010	U	<0.0010	U
		MSG001	NS		NS		NS		NS		NS		NS		<0.0010	U	NA	
		MSG001-R1	NS		NS		NS		NS		NS		NS		NA		<0.0010	U
		MSG001-R2	NS		NS		NS		NS		NS		NS		NA		<0.0010	U
		MSG001-R3	NS		NS		NS		NS		NS		NS		NA		<0.0010	U
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	Dry		Dry		0.037		0.0070		Dry		Dry		0.016		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NS		NS		NS		NS		NS		NS		0.23		Dry	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		NS		NS		NS		NS		0.0030		<0.0010	U
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		NS		NS		NS		NS		<0.0010	U	0.0080	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		NS		NS		NS		<0.0010	U	Dry	
	S Pit Overburden Limestone Drain	MDS022	NS		NS		NS		NS		NS		NS		<0.0010	U	<0.0010	U
	Taylor Spring	MSG002	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		<0.0010	U	NS		NS		<0.0010	U	<0.0010	U
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	<0.0010	U	NA		0.0020		0.0057		0.0030		0.0020		0.0020		0.0020	
		MST064	<0.0010	U	NA		0.0020		0.0057		0.0030		0.0020		0.0020		NA	
		MST064-R1	NA		NA		NA		NA		NA		NA		NA		0.0020	
		MST064-R2	NA		NA		NA		NA		NA		NA		NA		0.0020	
		MST064-R3	NA		NA		NA		NA		NA		NA		NA		0.0020	
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Tributary Above W Fork Lone Pine Creek	MST276	0.0023		0.0020		0.0090		0.0030		0.0030		0.0023		0.0030		0.013	
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		NS		NS		<0.0010	U	Dry	
		MST277	NS		NS		NS		NS		NS		NS		NA		Dry	
		MST277-R1	NS		NS		NS		NS		NS		NS		<0.0010	U	Dry	
		MST277-R2	NS		NS		NS		NS		NS		NS		<0.0010	U	Dry	
		MST277-R3	NS		NS		NS		NS		NS		NS		<0.0010	U	Dry	

Table 4 continued
Seeps, Springs, and Headwater Streams - Unfiltered Results - COPC (mg/L)†

Station			Selenium															
			2003												2004			
Mine	Station Name	Station ID	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		0.52		0.57	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		0.38		0.38	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		0.50		0.29	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		1.5		Dry	
	Garden Hose Spring	MSG003	NS		NS		NS		NS		NS		NS		0.47		0.44	
	Holmgren Spring	MSG004	NS		NS		NS		NS		NS		NS		0.016		0.031	
	Cattle Spring	MSG005-Avg	NS		NS		NS		NS		NS		NS		0.0070		0.0040	
		MSG005	NS		NS		NS		NS		NS		NS		0.0070		NA	
		MSG005-R1	NS		NS		NS		NS		NS		NS		NA		0.0040	
		MSG005-R2	NS		NS		NS		NS		NS		NS		NA		0.0040	
		MSG005-R3	NS		NS		NS		NS		NS		NS		NA		0.0040	
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		0.22		0.28	
	Ballard Creek, Headwaters	MST067	Dry		Dry		0.15		0.052		Dry		Dry		0.029		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Short Creek, Below BM	MST069	Dry		Dry		0.58		0.47		0.51		0.51		0.60		0.48	
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		NS		NS		NS		NS		<0.0010	U	Dry	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry		Dry		0.0020		Dry		Dry		Dry		0.023		Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	Dry		Dry		0.22		0.080		Dry		Dry		0.059		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	Dry		Dry		Dry		Dry		Dry		Dry		0.020		0.027	

Notes:
† All data has been censored at the reporting limit.
[a] Data from 1997 and 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1997 and 1998.
Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).
Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.
Data qualifier definitions are:
(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.
(J) - The result is an estimated quantity.
(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
COPC - Constituent of Potential Concern
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 5
Seeps, Springs, and Headwater Streams - Unfiltered Results - Screening Analytes (mg/L)†

Station			Mercury		Nitrate/Nitrite as N		Phosphorus		Total Alkalinity									
			2001		2001		2001		2000		2002				2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	<0.00050	U	<0.10	U	1.7		NS		150		Dry		180		Dry	
	EVM S Dump Seep	MDS026	<0.00050	U	0.18	J	0.28		NS		310		290		330		300	
	Hedin Spring	MSG001-Avg	NS		NS		NS		NS		200		190		200		200	
		MSG001	NS		NS		NS		NS		200		190		200		NA	
		MSG001-R1	NS		NS		NS		NS		NA		NA		NA		190	
		MSG001-R2	NS		NS		NS		NS		NA		NA		NA		200	
		MSG001-R3	NS		NS		NS		NS		NA		NA		NA		200	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		NS		Dry		Dry		Dry		Dry	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		NS		Dry		Dry		Dry		Dry	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		NS		Dry		Dry		Dry		Dry	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS		NS		NS		NA		61		Dry		60		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NS		NS		NS		NA		Dry		Dry		110		Dry	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		NS		Dry		Dry		Dry		Dry	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		NS		NS		150		170		150		180	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		NS		NS		Dry		NA		59		630	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		NS		Dry		Dry		270		Dry	
	S Pit Overburden Limestone Drain	MDS022-Avg	<0.00050	U	<0.10	U	0.22		NS		360		530		410		570	
		MDS022	<0.00050	U	<0.10	U	0.22		NS		NA		530		410		570	
		MDS022-R1	NA		NA		NA		NS		390		NA		NA		NA	
		MDS022-R2	NA		NA		NA		NS		340		NA		NA		NA	
		MDS022-R3	NA		NA		NA		NS		340		NA		NA		NA	
	Taylor Spring	MSG002	NS		NS		NS		NS		Dry		Dry		Dry		Dry	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		NS		NS		NA		220		310	
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS		NS		NS		NS		240		230		220		250	
		MST064	NS		NS		NS		NS		240		230		220		NA	
		MST064-R1	NS		NS		NS		NS		NA		NA		NA		250	
		MST064-R2	NS		NS		NS		NS		NA		NA		NA		250	
		MST064-R3	NS		NS		NS		NS		NA		NA		NA		250	
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS		NS		NS		87		NA		Dry		Dry		Dry	
	Tributary Above W Fork Lone Pine Creek	MST276	NS		NS		NS		NS		79		210		190		230	
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		NS		NS		280		Dry	
		MST277	NS		NS		NS		NS		NS		NS		NA		Dry	
		MST277-R1	NS		NS		NS		NS		NS		NS		290		Dry	
		MST277-R2	NS		NS		NS		NS		NS		NS		280		Dry	
		MST277-R3	NS		NS		NS		NS		NS		NS		280		Dry	

Table 5 continued
Seeps, Springs, and Headwater Streams - Unfiltered Results - Screening Analytes (mg/L)†

Station			Mercury		Nitrate/Nitrite as N		Phosphorus		Total Alkalinity									
			2001		2001		2001		2000		2002				2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		320		300	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		240		230	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		180		320	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		290		Dry	
	Garden Hose Spring	MSG003	<0.00050	U	5.0	J	0.031		NS		220		270		280		270	
	Holmgren Spring	MSG004	NS		NS		NS		NS		NS		260		230		250	
	Cattle Spring	MSG005-Avg	NS		NS		NS		NS		NS		260		260		270	
		MSG005	NS		NS		NS		NS		NS		260		260		NA	
		MSG005-R1	NS		NS		NS		NS		NS		NA		NA		280	
		MSG005-R2	NS		NS		NS		NS		NS		NA		NA		270	
		MSG005-R3	NS		NS		NS		NS		NS		NA		NA		270	
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		230		250	
	Ballard Creek, Headwaters	MST067	NS		NS		NS		NS		240		Dry		250		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		NS		Dry		Dry		Dry		Dry	
	Short Creek, Below BM	MST069-Avg	NS		NS		NS		NS		180		270		110		300	
		MST069	NS		NS		NS		NS		NA		270		110		300	
		MST069-R1	NS		NS		NS		NS		220		NA		NA		NA	
		MST069-R2	NS		NS		NS		NS		170		NA		NA		NA	
		MST069-R3	NS		NS		NS		NS		170		NA		NA		NA	
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		NS		NS		78		Dry		98		Dry	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS		NS		NS		Dry		130		Dry		160		Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS		NS		NS		160		140		Dry		220		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS		NS		NS		180		190		Dry		190		230	

Notes:

† All data has been censored at the reporting limit.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

Data qualifier definitions are:

(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.

(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 6
Ponds - Unfiltered Results - COPC (mg/L)†

Station			Selenium																									
			1997[a]		1998[a]		2001		2002								2003										2004	
	Name	ID	Fall	Flag	Spring	Flag	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	Jan.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	0.0091		NS		0.22	J	0.44		NS		0.021	J	NS		NS		NS		NS		NS		NS		0.52	
		MSP017	0.0091		NS		0.22	J	0.44		NS		0.021	J	NS		NS		NS		NS		NS		NS		NA	
		MSP017-R1	NA		NS		NA		NA		NS		NA		NS		NS		NS		NS		NS		NS		0.49	
		MSP017-R2	NA		NS		NA		NA		NS		NA		NS		NS		NS		NS		NS		NS		0.53	
		MSP017-R3	NA		NS		NA		NA		NS		NA		NS		NS		NS		NS		NS		NS		0.54	
	EVM Keyhole Pond	MSP018	NS		NS		0.20	J	0.30		0.13		0.032	J	0.023		0.0020		0.30		0.26		0.19		0.090		0.43	
	EVM Bat Cave Pond	MSP019	0.016		NS		0.025	J	0.025		NS		0.013	J	NS		NS		NS		NS		NS		NS		0.049	
	EVM West Pond	MSP020	0.021		NS		0.037	J	0.16		NS		0.025	J	NS		NS		NS		NS		NS		NS		0.090	
	EVM Stock Pond	MSP021-Avg	0.026		NS		0.11	J	0.15		NS		0.038	J	NS		NS		NS		NS		NS		NS		0.18	
		MSP021	NA		NS		0.11	J	NA		NS		0.038	J	NS		NS		NS		NS		NS		NS		0.18	
		MSP021-R1	0.028		NS		NA		0.16		NS		NA		NS		NS		NS		NS		NS		NS		NA	
		MSP021-R2	0.025		NS		NA		0.14		NS		NA		NS		NS		NS		NS		NS		NS		NA	
		MSP021-R2-D	0.025		NS		NA		NA		NS		NA		NS		NS		NS		NS		NS		NS		NA	
		MSP021-R3	0.025		NS		NA		0.14		NS		NA		NS		NS		NS		NS		NS		NS		NA	
	EVM Tipple Pond	MSP022	0.071		NS		0.040	J	0.043		NS		0.029	J	NS		NS		NS		NS		NS		NS		0.041	
	EVM Haul Road Pond	MSP023	0.0022		NS		0.024	J	0.037		NS		0.069	J	NS		NS		NS		NS		NS		NS		0.041	
	EVM Shop Pond	MSP031	0.0051		NS		0.0025	J	<0.015	U	NS		0.012	J	NS		NS		NS		NS		NS		NS		<0.0010	U
Henry Mine	HM Henry Pond	MSP014	0.0067		NS		0.0042	J	0.035		NS		0.0020	J	NS		NS		NS		NS		NS		NS		0.035	
	HM Smith Pond	MSP015-Avg	0.042		NS		0.13	J	0.36		NS		0.088	J	NS		NS		NS		NS		NS		NS		0.15	
		MSP015	NA		NS		0.13	J	0.36		NS		0.088	J	NS		NS		NS		NS		NS		NS		0.15	
		MSP015-R1	0.044		NS		NA		NA		NA		NA		NA		NS		NS		NS		NS		NS		NA	
		MSP015-R2	0.041		NS		NA		NA		NA		NA		NA		NS		NS		NS		NS		NS		NA	
		MSP015-R2-D	0.041		NS		NA		NA		NA		NA		NA		NS		NS		NS		NS		NS		NA	
		MSP015-R3	0.041		NS		NA		NA		NA		NA		NA		NS		NS		NS		NS		NS		NA	
	HM Center Henry Pond	MSP016-Avg	0.025		NS		0.060	J	0.18		NS		0.024	J	NS		NS		NS		NS		NS		NS		0.12	
		MSP016	0.025		NS		0.062	J	0.18		NS		NA		NS		NS		NS		NS		NS		NS		NA	
		MSP016-D	NA		NS		0.058	J	NA		NS		NA		NS		NS		NS		NS		NS		NS		NA	
		MSP016-R1	NA		NS		NA		NA		NS		0.024		NS		NS		NS		NS		NS		NS		0.12	
		MSP016-R2	NA		NS		NA		NA		NS		0.024		NS		NS		NS		NS		NS		NS		0.12	
		MSP016-R3	NA		NS		NA		NA		NS		0.023		NS		NS		NS		NS		NS		NS		0.13	
	HM South Pit Pond	MSP055	NS		NS		0.67	J	0.22		0.43		NS		NS		NS		0.54		0.64		0.55		0.28		0.97	
Ballard Mine	BM Dredge Pond	MSP010-Avg	0.15		NS		0.58	J	0.67		0.11		0.86	J	NS		NS		0.63		0.44		0.099		0.10		0.63	
		MSP010	0.15		NS		0.58	J	NA		NA		0.86	J	NS		NS		NA		NA		NS		0.10		0.63	
		MSP010-R1	NA		NA		NA		0.67		0.11		NA		NS		NS		0.60		0.43		NA		NA		NA	
		MSP010-R2	NA		NA		NA		0.67		0.11		NA		NS		NS		0.65		0.44		NA		NA		NA	
		MSP010-R3	NA		NA		NA		0.68		0.11		NA		NS		NS		0.64		0.45		NA		NA		NA	
	BM Upper Elk Pond	MSP011-Avg	NS		0.11		0.094	J	0.094		NS		NS		NS		NS		NS		NS		NS		NS		0.048	
		MSP011	NS		0.11		0.094	J	0.094		NS		NS		NS		NS		NS		NS		NS		NS		0.048	
		MSP011-R1	NS		NA		NA		NA		NS		NS		NS		NS		NS		NS		NS		NS		NA	
		MSP011-R2	NS		NA		NA		NA		NS		NS		NS		NS		NS		NS		NS		NS		NA	
		MSP011-R3	NS		NA		NA		NA		NS		NS		NS		NS		NS		NS		NS		NS		NA	
	BM Lower Elk Pond	MSP012-Avg	NS		NS		0.22	J	0.17		NS		NS		NS		NS		NS		NS		NS		NS		0.12	
		MSP012	NS		NS		0.22	J	NA		NS		NS		NS		NS		NS		NS		NS		NS		0.12	
		MSP012-D	NS		NS		0.21	J	NA		NS		NS		NS		NS		NS		NS		NS		NS		NA	
	BM Northeast Pond	MSP013	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS	
	BM Pit #4 Stock Pond	MSP059	NS		NS		0.024	J	<0.015	U	NS		NS		NS		NS		NS		NS		NS		NS		0.029	
	BM Pit #6 Pond	MSP062	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		0.0020	

Table 6 continued
Ponds - Unfiltered Results - COPC (mg/L)†

Station			Cadmium		Nickel		Vanadium		Zinc	
			1998[a]		1998[a]		1998[a]		1998[a]	
	Name	ID	May	Flag	May	Flag	May	Flag	May	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	NS		NS		NS		NS	
		MSP017	NS		NS		NS		NS	
		MSP017-R1	NS		NS		NS		NS	
		MSP017-R2	NS		NS		NS		NS	
		MSP017-R3	NS		NS		NS		NS	
	EVM Keyhole Pond	MSP018	NS		NS		NS		NS	
	EVM Bat Cave Pond	MSP019	NS		NS		NS		NS	
	EVM West Pond	MSP020	NS		NS		NS		NS	
	EVM Stock Pond	MSP021-Avg	NS		NS		NS		NS	
		MSP021	NS		NS		NS		NS	
		MSP021-R1	NS		NS		NS		NS	
		MSP021-R2	NS		NS		NS		NS	
		MSP021-R2-D	NS		NS		NS		NS	
		MSP021-R3	NS		NS		NS		NS	
	EVM Tipple Pond	MSP022	NS		NS		NS		NS	
	EVM Haul Road Pond	MSP023	NS		NS		NS		NS	
	EVM Shop Pond	MSP031	NS		NS		NS		NS	
Henry Mine	HM Henry Pond	MSP014	NS		NS		NS		NS	
	HM Smith Pond	MSP015-Avg	NS		NS		NS		NS	
		MSP015	NS		NS		NS		NS	
		MSP015-R1	NS		NS		NS		NS	
		MSP015-R2	NS		NS		NS		NS	
		MSP015-R2-D	NS		NS		NS		NS	
		MSP015-R3	NS		NS		NS		NS	
	HM Center Henry Pond	MSP016-Avg	NS		NS		NS		NS	
		MSP016	NS		NS		NS		NS	
		MSP016-D	NS		NS		NS		NS	
		MSP016-R1	NS		NS		NS		NS	
		MSP016-R2	NS		NS		NS		NS	
		MSP016-R3	NS		NS		NS		NS	
	HM South Pit Pond	MSP055	NS		NS		NS		NS	
Ballard Mine	BM Dredge Pond	MSP010-Avg	NS		NS		NS		NS	
		MSP010	NS		NS		NS		NS	
		MSP010-R1	NS		NS		NS		NS	
		MSP010-R2	NS		NS		NS		NS	
		MSP010-R3	NS		NS		NS		NS	
	BM Upper Elk Pond	MSP011-Avg	0.0037		0.019		0.047		0.0061	
		MSP011	0.0037		0.019		0.047		0.0061	
		MSP011-R1	NA		NA		NA		NA	
		MSP011-R2	NA		NA		NA		NA	
		MSP011-R3	NA		NA		NA		NA	
	BM Lower Elk Pond	MSP012-Avg	NS		NS		NS		NS	
		MSP012	NS		NS		NS		NS	
		MSP012-D	NS		NS		NS		NS	
	BM Northeast Pond	MSP013	NS		NS		NS		NS	
	BM Pit #4 Stock Pond	MSP059	NS		NS		NS		NS	
	BM Pit #6 Pond	MSP062	NS		NS		NS		NS	

Notes:

† All data has been censored at the reporting limit.

[a] Data from 1997 and 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1997 and 1998.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

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(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and ma

COPC - Constituent of Potential Concern

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 7

Ponds - Unfiltered Results - Screening Analytes (mg/L)[†]

Station			Calcium		Chloride		Iron		Magnesium		Manganese		Potassium		Sodium		Sulfate		Total Alkalinity									
			1998[a]		1998[a]		1998[a]		1998[a]		1998[a]		1998[a]		1998[a]		1998[a]		1998[a]		2001		2002				2004	
Mine	Name	ID	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	NS		NS		NS		NS		NS		NS		NS		NS		NS		110		90		49		110	
		MSP017	NS		NS		NS		NS		NS		NS		NS		NS		NS		110		90		49		NA	
		MSP017-R1	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		NA		110	
		MSP017-R2	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		NA		110	
		MSP017-R3	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		NA		100	
	EVM Keyhole Pond	MSP018	NS		NS		NS		NS		NS		NS		NS		NS		NS		130		110		130		130	
	EVM Bat Cave Pond	MSP019	NS		NS		NS		NS		NS		NS		NS		NS		NS		99		100		61		80	
	EVM West Pond	MSP020	NS		NS		NS		NS		NS		NS		NS		NS		NS		43		54		150		59	
	EVM Stock Pond	MSP021-Avg	NS		NS		NS		NS		NS		NS		NS		NS		NS		120		100		160		150	
		MSP021	NS		NS		NS		NS		NS		NS		NS		NS		NS		120		NA		160		150	
		MSP021-R1	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		100		NA		NA	
		MSP021-R2	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		100		NA		NA	
		MSP021-R3	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		100		NA		NA	
	EVM Tipple Pond	MSP022	NS		NS		NS		NS		NS		NS		NS		NS		NS		73		79		110		51	
	EVM Haul Road Pond	MSP023	NS		NS		NS		NS		NS		NS		NS		NS		NS		56		46		46		70	
	EVM Shop Pond	MSP031-Avg	NS		NS		NS		NS		NS		NS		NS		NS		NS		91		66		110		90	
Henry Mine	HM Henry Pond	MSP014	NS		NS		NS		NS		NS		NS		NS		NS		NS		110		56		120		92	
	HM Smith Pond	MSP015	NS		NS		NS		NS		NS		NS		NS		NS		NS		250		180		98		240	
	HM Center Henry Pond	MSP016-Avg	NS		NS		NS		NS		NS		NS		NS		NS		NS		150		150		140		180	
		MSP016	NS		NS		NS		NS		NS		NS		NS		NS		NS		150		150		NA		180	
		MSP016-D	NS		NS		NS		NS		NS		NS		NS		NS		NS		150		NA		NA		NA	
		MSP016-R1	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		140		180	
		MSP016-R2	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		140		180	
		MSP016-R3	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		140		180	
	HM South Pit Pond	MSP055	NS		NS		NS		NS		NA		NS		NS		NS		NS		140		58		NS		85	
Ballard Mine	BM Dredge Pond	MSP010-Avg	NS		NS		NS		NS		NS		NS		NS		NS		NS		230		210		110		240	
		MSP010	NS		NS		NS		NS		NS		NS		NS		NS		NS		230		NA		110		240	
		MSP010-R1	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		210		NA		NA	
		MSP010-R2	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		210		NA		NA	
		MSP010-R3	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		220		NA		NA	
	BM Upper Elk Pond	MSP011-Avg	30		0.55		0.0082		5.8		0.0053		1.6		1.1		17		82		86		69		NS		96	
		MSP011	30		0.55		0.0082		5.8		0.0053		1.6		1.1		17		82		86		69		NS		NA	
		MSP011-R1	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NS		95	
		MSP011-R2	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NS		96	
		MSP011-R3	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NS		97	
	BM Lower Elk Pond	MSP012	NS		NS		NS		NS		NS		NS		NS		NS		NS		80		70		NS		89	
	BM Northeast Pond	MSP013	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS	
	BM Pit #4 Stock Pond	MSP059	NS		NS		NS		NS		NS		NS		NS		NS		NS		60		56		NS		73	
	BM Pit #6 Pond	MSP062	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		170	

Notes:

[†] All data has been censored at the reporting limit.

[a] Data from 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1998.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004). Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

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RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Appendix C
Filtered Results[†]

[†] All data has been censored at the reporting limit.

Appendix C: Filtered Results[†]

Table 1: Domestic and Agricultural Wells – Filtered Results – COPC

Table 2: Domestic and Agricultural Wells – Filtered Results – Screening Analytes

Table 3: Monitoring and Production Wells – Filtered Results – COPC

Table 4: Monitoring and Production Wells – Filtered Results – Screening Analytes

Table 5: Seeps, Springs, and Headwater Streams – Filtered Results – COPC

Table 6: Seeps, Springs, and Headwater Streams – Filtered Results – Screening Analytes

Table 7: Ponds – Filtered Results – COPC

Table 8: Ponds – Filtered Results – Screening Analytes

[†] All data has been censored at the reporting limit.

Table 1
Domestic and Agricultural Wells - Filtered Results - COPC (mg/L)†

Station		Selenium				Cadmium				Chromium			
		2004				2004				2004			
Well Name	Well ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
School Bus Well	MAW001-Avg	<0.0010	U	NS		<0.00020	U	NS		0.000067<x<0.00020	U	NS	
	MAW001	NA		NS		NA		NS		NA		NS	
	MAW001-R1	<0.0010	U	NS		<0.00020	U	NS		<0.00020	U	NS	
	MAW001-R2	<0.0010	U	NS		<0.00020	U	NS		0.00020		NS	
	MAW001-R3	<0.0010	U	NS		<0.00020	U	NS		<0.00020	U	NS	
(b) (6) Field Well	MAW002	<0.0010	U	NS		<0.00020	U	NS		<0.00020	U	NS	
(b) (6) Field Well	MAW003	<0.0010	U	NS		<0.00020	U	NS		0.0013		NS	
(b) (6) Field Well	MAW004	<0.0010	U	NS		<0.00020	U	NS		<0.00020	U	NS	
(b) (6) Windmill Field Well	MAW005	<0.0010	U	NS		0.00060		NS		<0.00020	U	NS	
(b) (6) Field Well West	MAW006	NS		<0.0010	U	NS		<0.00010	U	NS		<0.0015	U
(b) (6) Field Well North	MAW007	NS		<0.0010	U	NS		<0.0025	U	NS		<0.075	U
(b) (6) House Well	MDW001	<0.0010	U	NS		<0.00020	U	NS		<0.00020	U	NS	
(b) (6) House Well	MDW002	<0.0010	U	NS		<0.00020	U	NS		0.00060		NS	
(b) (6) House Well	MDW003	0.0010		NS		<0.00020	U	NS		0.00040		NS	
(b) (6) House Well	MDW004	<0.0010	U	NS		<0.00020	U	NS		0.0011		NS	
Cedar Bay RV Park Well	MDW005	<0.0010	U	NS		<0.00020	U	NS		0.00040		NS	
(b) (6) House Well	MDW006	<0.0010	U	NS		<0.00020	U	NS		0.00070		NS	

Station		Nickel				Vanadium				Zinc			
		2004				2004				2004			
Well Name	Well ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
School Bus Well	MAW001-Avg	0.00057<x<0.00070	U	NS		0.00020		NS		0.017		NS	
	MAW001	NA		NS		NA		NS		NA		NS	
	MAW001-R1	<0.00040	U	NS		0.00020		NS		0.021		NS	
	MAW001-R2	0.0010		NS		0.00020		NS		0.015		NS	
	MAW001-R3	0.00070		NS		0.00020		NS		0.015		NS	
(b) (6) Field Well	MAW002	0.0012		NS		<0.0010	U	NS		0.026		NS	
(b) (6) Field Well	MAW003	<0.00040	U	NS		0.0017		NS		0.18		NS	
(b) (6) Field Well	MAW004	0.0028		NS		0.00070		NS		0.0080		NS	
(b) (6) Windmill Field Well	MAW005	0.0019		NS		0.00020		NS		2.9		NS	
(b) (6) Field Well West	MAW006	NS		0.0023		NS		0.0081		NS		0.022	
(b) (6) Field Well North	MAW007	NS		<0.065	U	NS		<0.000050	U	NS		<5.4	U
(b) (6) House Well	MDW001	0.0011		NS		0.00020		NS		0.020		NS	
(b) (6) House Well	MDW002	0.0016		NS		0.0039		NS		0.060		NS	
(b) (6) House Well	MDW003	0.0012		NS		0.00020		NS		<0.0040	U	NS	
(b) (6) House Well	MDW004	0.00040		NS		0.0018		NS		0.085		NS	
Cedar Bay RV Park Well	MDW005	0.0016		NS		0.00050		NS		0.056		NS	
(b) (6) House Well	MDW006	0.00060		NS		0.0026		NS		0.033		NS	

Notes:

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(J) - The result is an estimated quantity.

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COPC - Constituent of Potential Concern

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 2
Domestic and Agricultural Wells - Filtered Results - Screening Analytes (mg/L)†

Station		Calcium				Chloride				Magnesium			
		2004				2004				2004			
Well Name	Well ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
School Bus Well	MAW001-Avg	66		NS		11		NS		12		NS	
	MAW001	NA		NS		NA		NS		NA		NS	
	MAW001-R1	62		NS		12		NS		11		NS	
	MAW001-R2	68		NS		8.0		NS		13		NS	
	MAW001-R3	69		NS		12		NS		13		NS	
(b) (6) Field Well	MAW002	62		NS		3.2		NS		22		NS	
(b) (6) Field Well	MAW003	34		NS		4.8		NS		8.6		NS	
(b) (6) Field Well	MAW004	180		NS		7.5		NS		61		NS	
(b) (6) Windmill Field Well	MAW005	110		NS		140		NS		38		NS	
(b) (6) Field Well West	MAW006	NS		38		NS		9.2		NS		10	
(b) (6) Field Well North	MAW007	NS		58		NS		12		NS		20	
(b) (6) House Well	MDW001	67		NS		13		NS		13		NS	
(b) (6) House Well	MDW002	54		NS		32		NS		19		NS	
(b) (6) House Well	MDW003	74		NS		7.8		NS		6.5		NS	
(b) (6) House Well	MDW004	73		NS		7.8		NS		20		NS	
Cedar Bay RV Park Well	MDW005	150		NS		17		NS		38		NS	
(b) (6) House Well	MDW006	66		NS		58		NS		27		NS	

Station		Potassium				Sodium				Sulfate			
		2004				2004				2004			
Well Name	Well ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
School Bus Well	MAW001-Avg	0.57		NS		5.9		NS		11		NS	
	MAW001	NA		NS		NA		NS		NA		NS	
	MAW001-R1	0.60		NS		5.7		NS		11		NS	
	MAW001-R2	0.50		NS		6.0		NS		12		NS	
	MAW001-R3	0.60		NS		6.0		NS		11		NS	
(b) (6) Field Well	MAW002	2.0		NS		22		NS		<0.50	U	NS	
(b) (6) Field Well	MAW003	0.40		NS		9.0		NS		6.4		NS	
(b) (6) Field Well	MAW004	4.8		NS		10		NS		7.7		NS	
(b) (6) Windmill Field Well	MAW005	5.7		NS		100		NS		270		NS	
(b) (6) Field Well West	MAW006	NS		1.6		NS		8.7		NS		10	
(b) (6) Field Well North	MAW007	NS		<3.0	U	NS		<320	U	NS		24	
(b) (6) House Well	MDW001	0.50		NS		5.9		NS		11		NS	
(b) (6) House Well	MDW002	2.4		NS		21		NS		44		NS	
(b) (6) House Well	MDW003	0.50		NS		6.0		NS		6.4		NS	
(b) (6) House Well	MDW004	2.2		NS		15		NS		15		NS	
Cedar Bay RV Park Well	MDW005	2.4		NS		16		NS		44		NS	
(b) (6) House Well	MDW006	2.8		NS		45		NS		100		NS	

Notes:

† All data has been censored at the reporting limit.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

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RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 3
Monitoring and Production Wells - Filtered Results - COPC (mg/L)†

Station			Selenium								Cadmium								Chromium							
			2004				2005				2004				2005				2004				2005			
Mine	Name	ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	<0.0010	U	<0.0010	U	NS		NS		<0.00020	U	0.00010		NS		NS		<0.00020	U	<0.00010	U	NS		NS	
	EVM Shop Well	MPW019	<0.0010	U	<0.0010	U	0.0010		NS		<0.00020	U	<0.00075	U	<0.00010	U	NS		<0.00020	U	<0.015	U	<0.017	U	NS	
	Degerstrom Well at EVM	MPW020	NS		<0.0010	U	NS		NS		NS		<0.0025	U	NS		NS		NS		<0.075	U	NS		NS	
Henry Mine	Henry North Pit Well S	MMW003	0.0050		0.058		0.033		NS		<0.00020	U	0.00020		<0.00010	U	NS		<0.00020	U	<0.00010	U	<0.017	U	NS	
	Henry North Pit Well N	MMW004-Avg	<0.0010	U	<0.0010	U	0.0013		0.0013		<0.00020	U	<0.0025	U	<0.00010	U	<0.00010	U	<0.00020	U	<0.075	U	<0.017	U	<0.0011	U
		MMW004	NA		<0.0010	U	0.0013		NA		NA		<0.0025	U	<0.00010	U	NA		NA		<0.075	U	<0.017	U	NA	
		MMW004-R1	<0.0010	U	NA		NA		0.0020		<0.00020	U	NA		NA		<0.00010	U	<0.00020	U	NA		NA		<0.0011	U
		MMW004-R2	<0.0010	U	NA		NA		0.0010		<0.00020	U	NA		NA		<0.00010	U	<0.00020	U	NA		NA		<0.0011	U
		MMW004-R3	<0.0010	U	NA		NA		0.0010		<0.00020	U	NA		NA		<0.00010	U	<0.00020	U	NA		NA		<0.0011	U
	Henry South Pit Well	MPW022	0.0030		<0.0010	U	<0.0010	U	<0.0010	U	<0.00020	U	<0.0025	U	<0.00010	U	<0.00010	U	<0.00020	U	<0.075	U	<0.017	U	<0.0011	U
	Henry Center Pit Well	MPW023	NS		<0.0010	U	<0.0010	U	NS		NS		<0.0025	U	<0.00010	U	NS		NS		<0.075	U	<0.017	U	NS	
Ballard Mine	Ballard Pit East Well	MMW001-Avg	0.046		0.017		0.067		0.072		0.0033		0.0059		0.0061		0.0029		<0.00020	U	<0.075	U	<0.017	U	<0.0011	U
		MMW001	0.046		NA		0.067		0.072		0.0033		NA		0.0061		0.0029		<0.00020	U	NA		<0.017	U	<0.0011	U
		MMW001-R1	NA		0.017		NA		NA		NA		0.0060		NA		NA		NA		<0.075	U	NA		NA	
		MMW001-R2	NA		0.017		NA		NA		NA		0.0058		NA		NA		NA		<0.075	U	NA		NA	
		MMW001-R3	NA		0.017		NA		NA		NA		0.0060		NA		NA		NA		<0.075	U	NA		NA	
	Ballard Pit West Well	MMW002-Avg	<0.0010	U	0.024		0.031		0.022		<0.00020	U	<0.0025	U	<0.00010	U	<0.00010	U	<0.00020	U	<0.075	U	<0.017	U	<0.0011	U
		MMW002	<0.0010		NA		0.031		0.022		<0.00020	U	NA		<0.00010	U	<0.00010	U	<0.00020	U	NA		<0.017	U	<0.0011	U
		MMW002-R1	NA		0.024		NA		NA		NA		<0.0025	U	NA		NA		NA		<0.075	U	NA		NA	
		MMW002-R2	NA		0.023		NA		NA		NA		<0.0025	U	NA		NA		NA		<0.075	U	NA		NA	
		MMW002-R3	NA		0.024		NA		NA		NA		<0.0025	U	NA		NA		NA		<0.075	U	NA		NA	

Table 3 continued

Monitoring and Production Wells - Filtered Results - COPC (mg/L)†

Station			Nickel								Vanadium								Zinc							
			2004				2005				2004				2005				2004				2005			
Mine	Name	ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	0.0032		0.0072		NS		NS		0.0045		0.0022		NS		NS		0.051		<0.015	U	NS		NS	
	EVM Shop Well	MPW019	<0.00040	U	0.0045		<0.00060	U	NS		0.00020		<0.00079	U	<0.00020	U	NS		0.036		<0.015	U	<0.95	U	NS	
	Degerstrom Well at EVM	MPW020	NS		<0.065	U	NS		NS		NS		<0.0058	U	NS		NS		NS		<5.4	U	NS		NS	
Henry Mine	Henry North Pit Well S	MMW003	0.0045		0.010		<0.0085	U	NS		<0.0010	U	<0.00079	U	<0.00020	U	NS		<0.0040	U	<0.015	U	<0.95	U	NS	
	Henry North Pit Well N	MMW004-Avg	0.00043<x<0.00057	U	<0.065	U	<0.00060	U	<0.00060	U	0.0013		<0.0058	U	0.0019		<0.0019	U	<0.0040	U	<5.4	U	<0.95	U	0.039	
		MMW004	NA		<0.065	U	<0.00060	U	NA		NA		<0.0058	U	0.0019		NA		NA		<5.4	U	<0.95	U	NA	
		MMW004-R1	<0.00040	U	NA		NA		<0.00060	U	0.0013		NA		NA		<0.0019		<0.0040		NA		NA		0.040	
		MMW004-R2	0.00080		NA		NA		<0.00060	U	0.0014		NA		NA		<0.0019		<0.0040		NA		NA		0.038	
		MMW004-R3	0.00050		NA		NA		<0.00060	U	0.0013		NA		NA		<0.0019		<0.0040		NA		NA		0.040	
	Henry South Pit Well	MPW022	0.00070		<0.065	U	<0.0085	U	<0.00060	U	0.00030		<0.0058	U	<0.00020	U	<0.00020	U	<0.0040	U	<5.4	U	<0.95	U	0.13	
	Henry Center Pit Well	MPW023	NS		<0.065	U	0.015		NS		NS		<0.0058	U	<0.00020	U	NS		NS		<5.4	U	<0.95	U	NS	
Ballard Mine	Ballard Pit East Well	MMW001-Avg	0.052		<0.065	U	0.058		0.045		0.0055		0.011		0.0091		0.0053		0.28		<5.4	U	<0.95	U	0.25	
		MMW001	0.052		NA		0.058		0.045		0.0055		NA		0.0091		0.0053		0.28		NA		<0.95	U	0.25	
		MMW001-R1	NA		<0.065	U	NA		NA		NA		0.011		NA		NA		NA		<5.4	U	NA		NA	
		MMW001-R2	NA		<0.065	U	NA		NA		NA		0.011		NA		NA		NA		<5.4	U	NA		NA	
		MMW001-R3	NA		<0.065	U	NA		NA		NA		0.011		NA		NA		NA		<5.4	U	NA		NA	
	Ballard Pit West Well	MMW002-Avg	0.0017		<0.065	U	<0.0085	U	0.0041		<0.0010	U	<0.0058	U	<0.00020	U	<0.00020	U	<0.0040	U	<5.4	U	<0.95	U	0.16	
		MMW002	0.0017		NA		<0.0085	U	0.0041		<0.0010	U	NA		<0.00020	U	<0.00020	U	<0.0040	U	NA		<0.95	U	0.16	
		MMW002-R1	NA		<0.065	U	NA		NA		NA		<0.0058	U	NA		NA		NA		<5.4	U	NA		NA	
		MMW002-R2	NA		<0.065	U	NA		NA		NA		<0.0058	U	NA		NA		NA		<5.4	U	NA		NA	
		MMW002-R3	NA		<0.065	U	NA		NA		NA		<0.0058	U	NA		NA		NA		<5.4	U	NA		NA	

Notes:

† All data has been censored at the reporting limit.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

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COPC - Constituent of Potential Concern

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

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NA - Not Analyzed

Table 4
Monitoring and Production Wells - Filtered Results - Screening Analytes (mg/L)†

Station			Aluminum				Calcium								Chloride											
			2005				2004				2005				1998[a]				2004				2005			
Mine	Name	ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	NS		NS		72		71		NS		NS		4.8		5.0		3.9		4.0		NS		NS	
	EVM Shop Well	MPW019	<0.030	U	NS		72		69		71		NS		5.7		5.0		6.1		6.7		8.0		NS	
	Degerstrom Well at EVM	MPW020	NS		NS		NS		51		NS		NS		5.5		5.0		NS		6.2		NS		NS	
Henry Mine	Henry North Pit Well S	MMW003	<0.030	U	NS		54		66		62		NS		NS		NS		34		55		41		NS	
	Henry North Pit Well N	MMW004-Avg	<0.030	U	0.013<x<0.033	U	76		70		71		77		NS		NS		67		64		57		57	J
		MMW004	<0.030	U	NA		NA		70		71		NA		NS		NS		NA		64		57		NA	
		MMW004-R1	NA		<0.030	U	76		NA		NA		77		NS		NS		66		NA		NA		56	
		MMW004-R2	NA		0.040		76		NA		NA		77		NS		NS		67		NA		NA		55	J
		MMW004-R3	NA		<0.030	U	76		NA		NA		75		NS		NS		67		NA		NA		61	J
	Henry South Pit Well	MPW022	<0.030	U	<0.030	U	NS		52		57		50		NS		NS		NS		5.8		<5.5	U	5.0	
	Henry Center Pit Well	MPW023	<0.030	U	NS		NS		63		61		NS		NS		NS		NS		6.6		6.8		NS	
Ballard Mine	Ballard Pit East Well	MMW001-Avg	<0.030	U	<0.030	U	120		110		110		110		NS		NS		5.8		6.6		6.6		6.0	
		MMW001	<0.030	U	<0.030	U	120		NA		110		110		NS		NS		5.8		NA		6.6		6.0	
		MMW001-R1	NA		NA		NA		110		NA		NA		NS		NS		NA		6.6		NA		NA	
		MMW001-R2	NA		NA		NA		110		NA		NA		NS		NS		NA		6.6		NA		NA	
		MMW001-R3	NA		NA		NA		100		NA		NA		NS		NS		NA		6.7		NA		NA	
	Ballard Pit West Well	MMW002-Avg	<0.030	U	<0.030	U	78		69		74		73		NS		NS		12		12		15		14	
		MMW002	<0.030	U	<0.030	U	78		NA		74		73		NS		NS		12		NA		15		14	
		MMW002-R1	NA		NA		NA		69		NA		NA		NS		NS		NA		12		NA		NA	
		MMW002-R2	NA		NA		NA		69		NA		NA		NS		NS		NA		12		NA		NA	
		MMW002-R3	NA		NA		NA		69		NA		NA		NS		NS		NA		12		NA		NA	

Station			Iron				Manganese				Magnesium								Potassium							
			2005				2005				2004				2005				2004				2005			
Mine	Name	ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	NS		NS		NS		NS		28		30		NS		NS		1.3		1.1		NS		NS	
	EVM Shop Well	MPW019	<1.6	U	NS		0.047		NS		9.9		9.5		10		NS		0.80		0.60		0.60		NS	
	Degerstrom Well at EVM	MPW020	NS		NS		NS		NS		NS		17		NS		NS		NS		<3.0	U	NS		NS	
Henry Mine	Henry North Pit Well S	MMW003	<0.010	U	NS		<0.023	U	NS		21		28		25		NS		2.2		2.7		2.6		NS	
	Henry North Pit Well N	MMW004-Avg	<1.6	U	<0.020	U	<0.023	U	0.0028		26		37		26		27		3.6		<3.0	U	3.4		3.6	
		MMW004	<1.6	U	NA		<0.023	U	NA		NA		37		26		NA		NA		<3.0	U	3.4		NA	
		MMW004-R1	NA		<0.020	U	NA		0.0030		27		NA		NA		28		3.6		NA		NA		3.6	
		MMW004-R2	NA		<0.020	U	NA		0.0028		26		NA		NA		28		3.6		NA		NA		3.6	
		MMW004-R3	NA		<0.020	U	NA		0.0026		26		NA		NA		27		3.6		NA		NA		3.5	
	Henry South Pit Well	MPW022	<1.6	U	4.3		<0.023	U	0.23		NS		12		13		13		NS		<3.0	U	1.2		1.3	
	Henry Center Pit Well	MPW023	<1.6	U	NS		0.19		NS		NS		24		23		NS		NS		<3.0	U	0.80		NS	
Ballard Mine	Ballard Pit East Well	MMW001-Avg	<0.010	U	<0.020	U	0.031		0.059		22		21		23		22		0.90		<3.0	U	0.90		0.90	
		MMW001	<0.010	U	<0.020	U	0.031		0.059		22		NA		23		22		0.90		NA		0.90		0.90	
		MMW001-R1	NA		NA		NA		NA		NA		22		NA		NA		NA		<3.0	U	NA		NA	
		MMW001-R2	NA		NA		NA		NA		NA		21		NA		NA		NA		<3.0	U	NA		NA	
		MMW001-R3	NA		NA		NA		NA		NA		21		NA		NA		NA		<3.0	U	NA		NA	
	Ballard Pit West Well	MMW002-Avg	<0.010	U	<0.020	U	<0.023	U	0.0074		45		36		40		40		1.9		<3.0	U	1.7		1.6	
		MMW002	<0.010	U	<0.020	U	<0.023	U	0.0074		45		NA		40		40		1.9		NA		1.7		1.6	
		MMW002-R1	NA		NA		NA		NA		NA		36		NA		NA		NA		<3.0	U	NA		NA	
		MMW002-R2	NA		NA		NA		NA		NA		36		NA		NA		NA		<3.0	U	NA		NA	
		MMW002-R3	NA		NA		NA		NA		NA		36		NA		NA		NA		<3.0	U	NA		NA	

Table 4 continued
Monitoring and Production Wells - Filtered Results - Screening Analytes (mg/L)†

Station			Sodium								Sulfate											
			2004				2005				1998[a]				2004				2005			
Mine	Name	ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	18		17		NS		NS		20		20		120		170		NS		NS	
	EVM Shop Well	MPW019	6.9		6.8		7.3		NS		8.9		8.0		8.3		9.8		8.3		NS	
	Degerstrom Well at EVM	MPW020	NS		<320	U	NS		NS		43		36		NS		98		NS		NS	
Henry Mine	Henry North Pit Well S	MMW003	21		35		36		NS		NS		NS		81		120		99		NS	
	Henry North Pit Well N	MMW004-Avg	46		<320	U	45		45		NS		NS		130		140		120		130	
		MMW004	NA		<320	U	45		NA		NS		NS		NA		140		120		130	
		MMW004-R1	46		NA		NA		45		NS		NS		130		NA		NA		NA	
		MMW004-R2	46		NA		NA		46		NS		NS		140		NA		NA		NA	
		MMW004-R3	46		NA		NA		44		NS		NS		120		NA		NA		NA	
	Henry South Pit Well	MPW022	NS		<320	U	7.4		7.0		NS		NS		NS		<8.0	U	<7.5	U	<0.50	U
	Henry Center Pit Well	MPW023	NS		<320	U	9.5		NS		NS		NS		NS		70		63		NS	
Ballard Mine	Ballard Pit East Well	MMW001-Avg	10		<320	U	10		11		NS		NS		100		99		120	J	98	
		MMW001	10		NA		10		11		NS		NS		100		NA		120	J	98	
		MMW001-R1	NA		<320	U	NA		NA		NS		NS		NA		100		NA		NA	
		MMW001-R2	NA		<320	U	NA		NA		NS		NS		NA		100		NA		NA	
		MMW001-R3	NA		<320	U	NA		NA		NS		NS		NA		98		NA		NA	
	Ballard Pit West Well	MMW002-Avg	9.7		<320	U	13		17		NS		NS		54		49	J	50		59	
		MMW002	9.7		NA		13		17		NS		NS		54		NA		50		59	
		MMW002-R1	NA		<320	U	NA		NA		NS		NS		NA		49	J	NA		NA	
		MMW002-R2	NA		<320	U	NA		NA		NS		NS		NA		49	J	NA		NA	
		MMW002-R3	NA		<320	U	NA		NA		NS		NS		NA		49	J	NA		NA	

Notes:
† All data has been censored at the reporting limit.
[a] Data from 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1998.
Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).
Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.
Data qualifier definitions are:
(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.
(J) - The result is an estimated quantity.
(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 5
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Selenium				Cadmium															
			2004				1998[a]				2000		2001		2002							
Mine	Station Name	Station ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	0.013		Dry		NS		NS		NS		0.00080		0.0014		NS		Dry		NS	
	EVM S Dump Seep	MDS026	0.32		0.0060		NS		NS		NS		0.0048		0.00050		NS		<0.0011	U	NS	
	Hedin Spring	MSG001-Avg	<0.0010	U	0.00067<x<0.0013	U	NS		NS		NS		NS		<0.00010	U	NS		<0.00010	U	NS	
		MSG001	<0.0010	U	NA		NS		NS		NS		NS		<0.00010	U	NS		<0.00010	U	NS	
		MSG001-R1	NA		0.0020		NS		NS		NS		NS		NA		NS		NA		NS	
		MSG001-R2	NA		<0.0010	U	NS		NS		NS		NS		NA		NS		NA		NS	
		MSG001-R3	NA		<0.0010	U	NS		NS		NS		NS		NA		NS		NA		NS	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	Dry		Dry		NS		NS		NS		NS		Dry		NS		Dry		NS	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	Dry		Dry		NS		NS		NS		NS		Dry		NS		Dry		NS	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	Dry		Dry		NS		NS		NS		NS		Dry		NS		Dry		NS	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	0.016		Dry		NS		NS		NS		NS		0.00030		Dry		Dry		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	0.18		Dry		NS		NS		NS		NS		Dry		NS		Dry		NS	
	E Fork Rasmussen Creek Headwaters	MST269	Dry		Dry		NS		NS		NS		NS		Dry		NS		NA		NS	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	0.0030		<0.0010	U	NS		NS		NS		NS		<0.00010	U	NA		<0.00010	U	NS	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	<0.0010	U	<0.0010	U	NS		NS		NS		NS		Dry		NS		<0.0010	U	NS	
Henry Mine	S Pit Overburden Dump Seep	MDS016	<0.0010	U	Dry		NS		NS		NS		NS		Dry		NS		Dry		NS	
	S Pit Overburden Limestone Drain	MDS022-Avg	NA		<0.0010	U	0.0027		<0.0020	U	NS		0.00017		<0.00010	U	NS		<0.00010	U	NS	
		MDS022	NA		<0.0010	U	0.0027		<0.0020	U	NS		0.00017		NA		NS		<0.00010	U	NS	
		MDS022-R1	NA		NA		NA		NA		NS		NA		<0.00010	U	NS		NA		NS	
		MDS022-R2	NA		NA		NA		NA		NS		NA		<0.00010	U	NS		NA		NS	
		MDS022-R3	NA		NA		NA		NA		NS		NA		<0.00010	U	NS		NA		NS	
	Taylor Spring	MSG002	Dry		Dry		NS		NS		NS		NS		Dry		NS		Dry		NS	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	<0.0010	U	<0.0010	U	NS		NS		NS		NS		NS		NS		<0.0011	U	NS	
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	0.0030		0.0013		NS		NS		NS		NS		<0.00010	U	<0.00020	U	<0.00010	U	<0.00010	U
		MST064	0.0030		NA		NS		NS		NS		NS		<0.00010	U	<0.00020	U	<0.00010	U	<0.00010	
		MST064-R1	NA		0.0010		NS		NS		NS		NS		NA		NA		NA		NA	
		MST064-R2	NA		0.0020		NS		NS		NS		NS		NA		NA		NA		NA	
		MST064-R3	NA		0.0010		NS		NS		NS		NS		NA		NA		NA		NA	
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	Dry		Dry		NS		NS		<0.00025	U	NS		<0.00010	U	NS		Dry		Dry	
	Tributary Above W Fork Lone Pine Creek	MST276	0.0030		0.0020		NS		NS		NS		NS		<0.00010	U	NA		<0.00010	U	<0.00010	U
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	<0.0010	U	Dry		NS		NS		NS		NS		NS		NS		NS		NS	
		MST277	NA		Dry		NS		NS		NS		NS		NS		NS		NS		NS	
		MST277-R1	<0.0010	U	Dry		NS		NS		NS		NS		NS		NS		NS		NS	
		MST277-R2	<0.0010	U	Dry		NS		NS		NS		NS		NS		NS		NS		NS	
		MST277-R3	<0.0010	U	Dry		NS		NS		NS		NS		NS		NS		NS		NS	

Table 5 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Selenium				Cadmium															
			2004				1998[a]				2000		2001		2002							
Mine	Station Name	Station ID	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	0.42		0.59		NS		NS		NS		NS		NS		NS		NS		NS	
	Pit #2 Lower Dump Seep S	MDS031	0.45		0.43		NS		NS		NS		NS		NS		NS		NS		NS	
	Pit #2 Lower Dump Seep N	MDS032	0.45		0.29		NS		NS		NS		NS		NS		NS		NS		NS	
	Goat Seep	MDS033	1.4		Dry		NS		NS		NS		NS		NS		NS		NS		NS	
	Garden Hose Spring	MSG003	0.39		0.46		NS		NS		NS		<0.00013	U	<0.00010	U	NS		<0.00010	U	NS	
	Holmgren Spring	MSG004	0.0090		0.018		NS		NS		NS		NS		NS		NS		<0.00010	U	NS	
	Cattle Spring	MSG005-Avg	0.0070		0.0040		NS		NS		NS		NS		NS		NS		<0.00010	U	NS	
		MSG005	0.0070		NA		NS		NS		NS		NS		NS		NS		<0.00010	U	NS	
		MSG005-R1	NA		0.0040		NS		NS		NS		NS		NS		NS		NA		NS	
		MSG005-R2	NA		0.0040		NS		NS		NS		NS		NS		NS		NA		NS	
		MSG005-R3	NA		0.0040		NS		NS		NS		NS		NS		NS		NA		NS	
	SE Spring	MSG006	0.21		0.26		NS		NS		NS		NS		NS		NS		NS		NS	
	Ballard Creek, Headwaters	MST067	0.010		Dry		NS		NS		NS		NS		0.0022		Dry		Dry		Dry	
	W Fork Ballard Creek, Headwaters	MST068	Dry		Dry		NS		NS		NS		NS		Dry		NS		Dry		NS	
	Short Creek, Below BM	MST069-Avg	0.64		0.49		NS		NS		NS		NS		0.000067<x<0.00013	U	<0.00020	U	<0.00010	U	<0.00010	U
		MST069	0.64		0.49		NS		NS		NS		NS		NA		<0.00020	U	<0.00010	U	<0.00010	U
		MST069-R1	NA		NA		NS		NS		NS		NS		<0.00020	U	NA		NA		NA	
		MST069-R2	NA		NA		NS		NS		NS		NS		0.00010		NA		NA		NA	
		MST069-R3	NA		NA		NS		NS		NS		NS		0.00010		NA		NA		NA	
	N Fork Wooley Valley Creek, Above BM	MST093	0.0010		Dry		NS		NS		NS		NS		<0.00010	U	NS		Dry		NS	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	0.021		Dry		NS		NS		Dry		NS		<0.00010	U	Dry		Dry		Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NA		Dry		NS		NS		<0.00025	U	NS		0.00020		Dry		Dry		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	0.016		0.027		NS		NS		<0.00025	U	NS		<0.00010	U	Dry		Dry		Dry	

Table 5 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Cadmium															
			2003												2004			
Mine	Station Name	Station ID	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS		NS		NS		NS		NS		NS		0.00050		Dry	
	EVM S Dump Seep	MDS026	NS		NS		NS		NS		NS		NS		0.0017		0.00010	
	Hedin Spring	MSG001-Avg	NS		NS		NS		NS		NS		NS		<0.00010	U	<0.00075	U
		MSG001	NS		NS		NS		NS		NS		NS		<0.00010	U	NA	
		MSG001-R1	NS		NS		NS		NS		NS		NS		NA		<0.00075	U
		MSG001-R2	NS		NS		NS		NS		NS		NS		NA		<0.00075	U
		MSG001-R3	NS		NS		NS		NS		NS		NS		NA		<0.00075	U
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	Dry		Dry		0.00020		0.00020		NS		NS		0.00010		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NS		NS		NS		NS		NS		NS		0.00010		Dry	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		NS		NS		NS		NS		<0.00010	U	<0.00075	U
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		NS		NS		NS		NS		<0.00020	U	<0.00075	U
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		NS		NS		NS		<0.00020	U	Dry	
	S Pit Overburden Limestone Drain	MDS022	NS		NS		NS		NS		NS		NS		<0.00010	U	<0.00075	U
	Taylor Spring	MSG002	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		<0.00010	U	NS		NS		<0.00010	U	<0.00075	U
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	<0.00010	U	NA		<0.00010	U	<0.00010	U	<0.00010	U	<0.00010	U	<0.00010	U	<0.00075	U
		MST064	<0.00010	U	NA		<0.00010	U	<0.00010	U	<0.00010	U	<0.00010	U	<0.00010	U	NA	
		MST064-R1	NA		NA		NA		NA		NA		NA		NA		<0.00075	U
		MST064-R2	NA		NA		NA		NA		NA		NA		NA		<0.00075	U
		MST064-R3	NA		NA		NA		NA		NA		NA		NA		<0.00075	U
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Tributary Above W Fork Lone Pine Creek	MST276	<0.00010	U	<0.00010	U	0.00016		<0.00010	U	<0.00010	U	<0.00010	U	<0.00010	U	<0.00075	U
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		NS		NS		<0.00050	U	Dry	
		MST277	NS		NS		NS		NS		NS		NS		NA		Dry	
		MST277-R1	NS		NS		NS		NS		NS		NS		<0.00050	U	Dry	
		MST277-R2	NS		NS		NS		NS		NS		NS		<0.00050	U	Dry	
		MST277-R3	NS		NS		NS		NS		NS		NS		<0.00050	U	Dry	

Table 5 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Cadmium															
			2003												2004			
Mine	Station Name	Station ID	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		<0.00010	U	<0.00075	U
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		<0.00010	U	<0.00075	U
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		<0.00010	U	<0.00075	U
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		0.00020		Dry	
	Garden Hose Spring	MSG003	NS		NS		NS		NS		NS		NS		<0.00010	U	<0.00075	U
	Holmgren Spring	MSG004	NS		NS		NS		NS		NS		NS		<0.00010	U	<0.00075	U
	Cattle Spring	MSG005-Avg	NS		NS		NS		NS		NS		NS		<0.00010	U	<0.00075	U
		MSG005	NS		NS		NS		NS		NS		NS		<0.00010	U	NA	
		MSG005-R1	NS		NS		NS		NS		NS		NS		NA		<0.00075	U
		MSG005-R2	NS		NS		NS		NS		NS		NS		NA		<0.00075	U
		MSG005-R3	NS		NS		NS		NS		NS		NS		NA		<0.00075	U
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		<0.00010	U	<0.00075	U
	Ballard Creek, Headwaters	MST067	Dry		Dry		0.0017		0.0019		Dry		Dry		0.0013		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Short Creek, Below BM	MST069	Dry		Dry		<0.00010	U	<0.00010	U	<0.00010	U	<0.00010	U	0.00010		<0.00075	U
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		NS		NS		NS		NS		<0.00020	U	Dry	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry		Dry		<0.00010	U	Dry		Dry		Dry		<0.00020	U	Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	Dry		Dry		0.00030		0.00030		Dry		Dry		0.00020		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	Dry		Dry		Dry		Dry		Dry		Dry		<0.00010	U	<0.00075	U

Table 5 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Chromium											Nickel					
			2001			2002				2004				1998[a]				2001	
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	0.019			<0.010	U	Dry		0.00020		Dry		NS		NS		0.17	
	EVM S Dump Seep	MDS026	0.0085			<0.010	U	NA		0.00040		<0.0015	U	NS		NS		0.021	
	Hedin Spring	MSG001-Avg	NS			<0.010	U	NA		0.00020		<0.0015	U	NS		NS		NS	
		MSG001	NS			<0.010	U	NA		0.00020		NA		NS		NS		NS	
		MSG001-R1	NS			NA		NA		NA		<0.0015	U	NS		NS		NS	
		MSG001-R2	NS			NA		NA		NA		<0.0015	U	NS		NS		NS	
		MSG001-R3	NS			NA		NA		NA		<0.0015	U	NS		NS		NS	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			Dry		Dry		Dry		Dry		NS		NS		NS	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			Dry		Dry		Dry		Dry		NS		NS		NS	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			Dry		Dry		Dry		Dry		NS		NS		NS	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS			<0.010	U	Dry		0.00010		Dry		NS		NS		NS	
	W Pond Creek Headwaters, below W Pond	MST144	NS			Dry		Dry		0.00020		Dry		NS		NS		NS	
	E Fork Rasmussen Creek Headwaters	MST269	NS			Dry		NA		Dry		Dry		NS		NS		NS	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			<0.010	U	NA		0.00020		<0.0015	U	NS		NS		NS	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			Dry		NA		0.00050		<0.0015	U	NS		NS		NS	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			Dry		Dry		<0.00020	U	Dry		NS		NS		NS	
	S Pit Overburden Limestone Drain	MDS022-Avg	0.0024			<0.010	U	NA		NA		<0.0015	U	0.034		0.018		0.0032	
		MDS022	0.0024			NA		NA		NA		<0.0015	U	0.034		0.018		0.0032	
		MDS022-R1	NA			<0.010	U	NA		NA		NA		NA		NA		NA	
		MDS022-R2	NA			<0.010	U	NA		NA		NA		NA		NA		NA	
		MDS022-R3	NA			<0.010	U	NA		NA		NA		NA		NA		NA	
	Taylor Spring	MSG002	NS			Dry		Dry		Dry		Dry		NS		NS		NS	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS		NS		<0.00010	U	<0.0015	U	NS		NS		NS	
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS			<0.010	U	NA		<0.00010	U	<0.0015	U	NS		NS		NS	
		MST064	NS			<0.010	U	NA		<0.00010	U	NA		NS		NS		NS	
		MST064-R1	NS			NA		NA		NA		<0.0015	U	NS		NS		NS	
		MST064-R2	NS			NA		NA		NA		<0.0015	U	NS		NS		NS	
		MST064-R3	NS			NA		NA		NA		<0.0015	U	NS		NS		NS	
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			<0.010	U	Dry		Dry		Dry		NS		NS		NS	
	Tributary Above W Fork Lone Pine Creek	MST276	NS			<0.010	U	NA		0.00020		<0.0015	U	NS		NS		NS	
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS		NS		<0.00050	U	Dry		NS		NS		NS	
		MST277	NS			NS		NS		NA		Dry		NS		NS		NS	
		MST277-R1	NS			NS		NS		<0.00050	U	Dry		NS		NS		NS	
		MST277-R2	NS			NS		NS		<0.00050	U	Dry		NS		NS		NS	
		MST277-R3	NS			NS		NS		<0.00050	U	Dry		NS		NS		NS	

Table 5 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Chromium											Nickel					
			2001			2002				2004				1998[a]				2001	
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS		NS		0.0015		<0.0015	U	NS		NS		NS	
	Pit #2 Lower Dump Seep S	MDS031	NS			NS		NS		0.0011		<0.0015	U	NS		NS		NS	
	Pit #2 Lower Dump Seep N	MDS032	NS			NS		NS		0.00050		<0.0015	U	NS		NS		NS	
	Goat Seep	MDS033	NS			NS		NS		0.00070		Dry		NS		NS		NS	
	Garden Hose Spring	MSG003	0.023			<0.010	U	NA		0.00090		<0.0015	U	NS		NS		0.0011	
	Holmgren Spring	MSG004	NS			NS		NS		0.00060		<0.0015	U	NS		NS		NS	
	Cattle Spring	MSG005-Avg	NS			NS		NS		0.00050		<0.0015	U	NS		NS		NS	
		MSG005	NS			NS		NS		0.00050		NA		NS		NS		NS	
		MSG005-R1	NS			NS		NS		NA		<0.0015	U	NS		NS		NS	
		MSG005-R2	NS			NS		NS		NA		<0.0015	U	NS		NS		NS	
		MSG005-R3	NS			NS		NS		NA		<0.0015	U	NS		NS		NS	
	SE Spring	MSG006	NS			NS		NS		0.00080		<0.0015	U	NS		NS		NS	
	Ballard Creek, Headwaters	MST067	NS			<0.010	U	Dry		0.00060		Dry		NS		NS		NS	
	W Fork Ballard Creek, Headwaters	MST068	NS			Dry		Dry		Dry		Dry		NS		NS		NS	
	Short Creek, Below BM	MST069-Avg	NS			<0.010	U	NA		0.00070		<0.0015	U	NS		NS		NS	
		MST069	NS			NA		NA		0.00070		<0.0015	U	NS		NS		NS	
		MST069-R1	NS			<0.010	U	NA		NA		NA		NS		NS		NS	
		MST069-R2	NS			<0.010	U	NA		NA		NA		NS		NS		NS	
		MST069-R3	NS			<0.010	U	NA		NA		NA		NS		NS		NS	
	N Fork Wooley Valley Creek, Above BM	MST093	NS			<0.010	U	Dry		<0.00010	U	Dry		NS		NS		NS	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS			<0.010	U	Dry		NA		Dry		NS		NS		NS	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS			<0.010	U	Dry		NA		Dry		NS		NS		NS	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS			<0.010	U	Dry		0.00020		<0.0015	U	NS		NS		NS	

Table 5 continued

Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Nickel																							
			2002								2003												2004			
Mine	Station Name	Station ID	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	0.17		NS		Dry		NS		NS		NS		NS		NS		NS		NS		0.19		Dry	
	EVM S Dump Seep	MDS026	0.0093	J	NS		<0.028	U	NS		NS		NS		NS		NS		NS		NS		0.014		0.0087	
	Hedin Spring	MSG001-Avg	<0.0035	UJ	NS		<0.028	U	NS		NS		NS		NS		NS		NS		NS		<0.0050	U	0.0020	
		MSG001	<0.0035	UJ	NS		<0.028	U	NS		NS		NS		NS		NS		NS		NS		<0.0050	U	NA	
		MSG001-R1	NA		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		0.0021	
		MSG001-R2	NA		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		0.0019	
		MSG001-R3	NA		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		0.0020	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	<0.0035	UJ	Dry		Dry		Dry		Dry		Dry		0.0032		0.0026		Dry		Dry		<0.0050	U	Dry	
	W Pond Creek Headwaters, below W Pond	MST144	Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		<0.0050	U	Dry	
	E Fork Rasmussen Creek Headwaters	MST269	Dry		NS		NA		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	<0.0035	UJ	NA		<0.028	U	NS		NS		NS		NS		NS		NS		NS		<0.0050	U	0.0019	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	Dry		Dry		<0.028	U	NS		NS		NS		NS		NS		NS		NS		0.0053		0.020	
Henry Mine	S Pit Overburden Dump Seep	MDS016	Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		0.013		Dry	
	S Pit Overburden Limestone Drain	MDS022-Avg	0.0056<x<0.0067	J	NS		<0.028	U	NS		NS		NS		NS		NS		NS		NS		0.0057		0.0085	
		MDS022	NA		NS		<0.028	U	NS		NS		NS		NS		NS		NS		NS		0.0057		0.0085	
		MDS022-R1	<0.0035	UJ	NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		NA	
		MDS022-R2	0.0086	J	NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		NA	
		MDS022-R3	0.0081	J	NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		NA	
	Taylor Spring	MSG002	Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		<0.028	U	NS		NS		NS		NS		<0.0015	U	NS		NS		<0.0050	U	0.0032	
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	<0.0035	UJ	<0.0045	U	<0.028	U	0.045		0.0028		NA		<0.0020	U	<0.0015	U	<0.013	U	<0.0030	U	<0.0050	U	0.0016	
		MST064	<0.0035	UJ	<0.0045	U	<0.028	U	0.045		0.0028		NA		<0.0020	U	<0.0015	U	<0.013	U	<0.0030	U	<0.0050	U	NA	
		MST064-R1	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		0.0021	
		MST064-R2	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		0.0019	
		MST064-R3	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		0.0020	
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	<0.0035	UJ	NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	Tributary Above W Fork Lone Pine Creek	MST276	<0.0035	UJ	NA		<0.028	U	0.037		0.0029		0.0019		0.0026		0.0022		0.0020		0.019		<0.0050	U	0.0020	
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		<0.0050	U	Dry	
		MST277	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		Dry	
		MST277-R1	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		<0.0050	U	Dry	
		MST277-R2	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		<0.0050	U	Dry	
		MST277-R3	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		<0.0050	U	Dry	

Table 5 continued

Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Nickel																							
			2002								2003												2004			
Mine	Station Name	Station ID	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		<0.0050	U	0.0050	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		<0.0050	U	0.0057	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		0.0067		0.011	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		0.011		Dry	
	Garden Hose Spring	MSG003	<0.0035	UJ	NS		<0.028	U	NS		NS		NS		NS		NS		NS		NS		<0.0050	U	0.0066	
	Holmgren Spring	MSG004	NS		NS		<0.028	U	NS		NS		NS		NS		NS		NS		NS		<0.0050	U	0.0089	
	Cattle Spring	MSG005-Avg	NS		NS		<0.028	U	NS		NS		NS		NS		NS		NS		NS		<0.00020	U	0.0039	
		MSG005	NS		NS		<0.028	U	NS		NS		NS		NS		NS		NS		NS		<0.00020	U	NA	
		MSG005-R1	NS		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		0.0039	
		MSG005-R2	NS		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		0.0040	
		MSG005-R3	NS		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		0.0039	
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		<0.00020	U	0.0072	
	Ballard Creek, Headwaters	MST067	0.014	J	Dry		Dry		Dry		Dry		Dry		0.010		0.010		Dry		Dry		0.013		Dry	
	W Fork Ballard Creek, Headwaters	MST068	Dry		NS		Dry		NS		NS		NS		NS		NS		NS		<0.0030	U	Dry		Dry	
	Short Creek, Below BM	MST069-Avg	0.027	J	0.018		0.033		0.0066		Dry		Dry		0.019		0.020		0.019		NA		0.025		0.037	
		MST069	NA		0.018		0.033		0.0066		Dry		Dry		0.019		0.020		0.019		NA		0.025		0.037	
		MST069-R1	0.026	J	NA		NA		NA		Dry		Dry		NA		NA		NA		NA		NA		NA	
		MST069-R2	0.027	J	NA		NA		NA		Dry		Dry		NA		NA		NA		NA		NA		NA	
		MST069-R3	0.027	J	NA		NA		NA		Dry		Dry		NA		NA		NA		NA		NA		NA	
	N Fork Wooley Valley Creek, Above BM	MST093	<0.0035	UJ	NS		Dry		NS		NS		NS		NS		NS		NS		NS		<0.0050	U	Dry	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	<0.0035	UJ	Dry		Dry		Dry		Dry		Dry		<0.0020	U	Dry		Dry		Dry		<0.0050	U	Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	0.0074	J	Dry		Dry		Dry		Dry		Dry		0.0093		0.0071		Dry		Dry		0.0068		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	<0.0035	UJ	Dry		Dry		Dry		Dry		Dry		Dry		Dry		Dry		Dry		<0.0050	U	0.0036	

Table 5 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Vanadium													
			1998[a]				2001		2002							
Mine	Station Name	Station ID	Spring	Flag	Fall	Flag	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS		NS		0.0028	J	<0.0050	U	NS		Dry		NS	
	EVM S Dump Seep	MDS026	NS		NS		0.0018	J	<0.0050	U	NS		<0.0050	U	NS	
	Hedin Spring	MSG001	NS		NS		NS		<0.0050	U	NS		<0.0050	U	NS	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		Dry		NS		Dry		NS	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		Dry		NS		Dry		NS	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		Dry		NS		Dry		NS	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS		NS		NS		<0.0050	U	Dry		Dry		NS	
	W Pond Creek Headwaters, below W Pond	MST144	NS		NS		NS		Dry		NS		Dry		NS	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		Dry		NS		NA		NS	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		NS		<0.0050	U	NA		<0.0050	U	NS	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		NS		Dry		NS		0.0088		NS	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		Dry		NS		Dry		NS	
	S Pit Overburden Limestone Drain	MDS022-Avg	0.023		<0.0043	U	0.024	J	<0.0050	U	NS		<0.0050	U	NS	
		MDS022	0.023		<0.0043	U	0.024	J	NA		NS		<0.0050	U	NS	
		MDS022-R1	NA		NA		NA		<0.0050	U	NS		NA		NS	
		MDS022-R2	NA		NA		NA		<0.0050	U	NS		NA		NS	
		MDS022-R3	NA		NA		NA		<0.0050	U	NS		NA		NS	
	Taylor Spring	MSG002	NS		NS		NS		Dry		NS		Dry		NS	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		NS		NS		<0.0050	U	NS	
	W Fork Lone Pine Creek Above Tributary	MST064	NS		NS		NS		<0.0050	U	0.00070		<0.0050	U	0.00074	
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS		NS		NS		<0.0050	U	NS		Dry		NS	
	Tributary Above W Fork Lone Pine Creek	MST276	NS		NS		NS		<0.0050	U	NA		<0.0050	U	0.0010	
	Lone Pine Creek, Spring Fed Tributary	MST277	NS		NS		NS		NS		NS		NS		NS	
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		NS	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		NS	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		NS	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		NS	
	Garden Hose Spring	MSG003	NS		NS		0.0028	J	<0.0050	U	NS		<0.0050	U	NS	
	Holmgren Spring	MSG004	NS		NS		NS		NS		NS		<0.0050	U	NS	
	Cattle Spring	MSG005	NS		NS		NS		NS		NS		<0.0050	U	NS	
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		NS	
	Ballard Creek, Headwaters	MST067	NS		NS		NS		0.019		Dry		Dry		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		Dry		NS		Dry		NS	
	Short Creek, Below BM	MST069-Avg	NS		NS		NS		<0.0050	U	0.0016		<0.0050	U	0.0019	
		MST069	NS		NS		NS		NA		0.0016		<0.0050	U	0.0019	
		MST069-R1	NS		NS		NS		<0.0050	U	NA		NA		NA	
		MST069-R2	NS		NS		NS		<0.0050	U	NA		NA		NA	
		MST069-R3	NS		NS		NS		<0.0050	U	NA		NA		NA	
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		NS		0.011		NS		Dry		Dry	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS		NS		NS		<0.0050	U	Dry		Dry		Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS		NS		NS		<0.0050	U	Dry		Dry		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS		NS		NS		<0.0050	U	Dry		Dry		Dry	

Table 5 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Vanadium															
			2003												2004			
Mine	Station Name	Station ID	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS		NS		NS		NS		NS		NS		0.0011		Dry	
	EVM S Dump Seep	MDS026	NS		NS		NS		NS		NS		NS		0.0034		0.00089	
	Hedin Spring	MSG001-Avg	NS		NS		NS		NS		NS		NS		<0.00048	U	<0.00079	U
		MSG001	NS		NS		NS		NS		NS		NS		<0.00048	U	NA	
		MSG001-R1	NS		NS		NS		NS		NS		NS		NA		<0.00079	U
		MSG001-R2	NS		NS		NS		NS		NS		NS		NA		<0.00079	U
		MSG001-R3	NS		NS		NS		NS		NS		NS		NA		<0.00079	U
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	Dry		Dry		0.0016		0.0013		Dry		Dry		0.0022		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NS		NS		NS		NS		NS		NS		0.00058		Dry	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		NS		NS		NS		NS		0.00056		<0.00079	U
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		NS		NS		NS		NS		0.011		0.0034	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		NS		NS		NS		<0.00048	U	Dry	
	S Pit Overburden Limestone Drain	MDS022	NS		NS		NS		NS		NS		NS		<0.00048	U	<0.00079	U
	Taylor Spring	MSG002	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		0.00060		NS		NS		0.00072		0.0013	
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	0.0055		NS		0.00069		0.00064		0.00065		0.00093		0.00065		<0.00079	U
		MST064	0.0055		NS		0.00069		0.00064		0.00065		0.00093		0.00065		NA	
		MST064-R1	NA		NS		NA		NA		NA		NA		NA		<0.00079	U
		MST064-R2	NA		NS		NA		NA		NA		NA		NA		<0.00079	U
		MST064-R3	NA		NS		NA		NA		NA		NA		NA		<0.00079	U
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Tributary Above W Fork Lone Pine Creek	MST276	0.00085		0.00092		0.0014		0.0011		0.0010		0.0014		0.0011		0.00086	
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		NS		NS		<0.00042	U	Dry	
		MST277	NS		NS		NS		NS		NS		NS		NA		Dry	
		MST277-R1	NS		NS		NS		NS		NS		NS		<0.00048		Dry	
		MST277-R2	NS		NS		NS		NS		NS		NS		<0.00048		Dry	
		MST277-R3	NS		NS		NS		NS		NS		NS		<0.00030		Dry	

Table 5 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Vanadium															
			2003												2004			
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		0.00090		<0.00079	U
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		0.00099		<0.00079	U
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		0.0011		0.00081	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		0.0016		Dry	
	Garden Hose Spring	MSG003	NS		NS		NS		NS		NS		NS		0.0011		0.00087	
	Holmgren Spring	MSG004	NS		NS		NS		NS		NS		NS		0.0016		0.0052	
	Cattle Spring	MSG005-Avg	NS		NS		NS		NS		NS		NS		<0.00048	U	<0.00079	U
		MSG005	NS		NS		NS		NS		NS		NS		<0.00048	U	NA	
		MSG005-R1	NS		NS		NS		NS		NS		NS		NA		<0.00079	U
		MSG005-R2	NS		NS		NS		NS		NS		NS		NA		<0.00079	U
		MSG005-R3	NS		NS		NS		NS		NS		NS		NA		<0.00079	U
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		0.00073		0.0011	
	Ballard Creek, Headwaters	MST067	Dry		Dry		0.018		0.013		Dry		Dry		0.0084		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Short Creek, Below BM	MST069	NA		Dry		0.0015		0.0020		0.0015		0.0019		0.0011		0.0011	
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		NS		NS		NS		NA		0.0062		Dry	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry		Dry		0.00080		Dry		Dry		Dry		0.0017		Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	Dry		Dry		0.0038		0.0057		Dry		Dry		0.0023		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	Dry		Dry		Dry		Dry		Dry		Dry		0.00072		<0.00079	U

Table 5 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Zinc													
			1998[a]				2001		2002							
Mine	Station Name	Station ID	Spring	Flag	Fall	Flag	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS		NS		0.14	J	0.12		NS		Dry		NS	
	EVM S Dump Seep	MDS026	NS		NS		0.047	J	<0.015	U	NS		<0.075	U	NS	
	Hedin Spring	MSG001	NS		NS		NS		<0.0020	U	NS		<0.075	U	NS	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		Dry		NS		Dry		NS	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		Dry		NS		Dry		NS	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		Dry		NS		Dry		NS	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS		NS		NS		<0.0020	U	Dry		Dry		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NS		NS		NS		Dry		NS		Dry		NS	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		Dry		NS		NA		NS	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		NS		<0.0020	U	NA		<0.075	U	NS	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		NS		Dry		NS		<0.075	U	NS	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		Dry		NS		Dry		NS	
	S Pit Overburden Limestone Drain	MDS022-Avg	0.0060		<0.0011	U	0.10		<0.0063	U	NS		<0.075	U	NS	
		MDS022	0.0060		<0.0011	U	0.10		NA		NS		<0.075	U	NS	
		MDS022-R1	NA		NA		NA		<0.015	U	NS		NA		NS	
		MDS022-R2	NA		NA		NA		<0.0020	U	NS		NA		NS	
		MDS022-R3	NA		NA		NA		<0.0020	U	NS		NA		NS	
	Taylor Spring	MSG002	NS		NS		NS		Dry		NS		Dry		NS	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		NS		NS		<0.075	U	NS	
	W Fork Lone Pine Creek Above Tributary	MST064	NS		NS		NS		<0.0020	U	<0.070	U	<0.075	U	<0.045	UJ
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS		NS		NS		<0.015	U	NS		Dry		NS	
	Tributary Above W Fork Lone Pine Creek	MST276	NS		NS		NS		<0.0020	U	NA		<0.075	U	<0.045	UJ
	Lone Pine Creek, Spring Fed Tributary	MST277	NS		NS		NS		NS		NS		NS		NS	
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		NS	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		NS	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		NS	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		NS	
	Garden Hose Spring	MSG003	NS		NS		0.016	J	<0.0020	U	NS		<0.075	U	NS	
	Holmgren Spring	MSG004	NS		NS		NS		NS		NS		<0.075	U	NS	
	Cattle Spring	MSG005	NS		NS		NS		NS		NS		<0.075	U	NS	
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		NS	
	Ballard Creek, Headwaters	MST067	NS		NS		NS		0.033		Dry		Dry		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		Dry		NS		NS		NS	
	Short Creek, Below BM	MST069-Avg	NS		NS		NS		<0.015	U	<0.070	U	<0.075	U	<0.045	UJ
		MST069	NS		NS		NS		NA		<0.070	U	<0.075	U	<0.045	UJ
		MST069-R1	NS		NS		NS		<0.015	U	NA		NA		NA	
		MST069-R2	NS		NS		NS		<0.015	U	NA		NA		NA	
		MST069-R3	NS		NS		NS		<0.015	U	NA		NA		NA	
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		NS		<0.0020	U	NS		Dry		NS	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS		NS		NS		<0.015	U	Dry		Dry		Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS		NS		NS		0.016		Dry		Dry		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS		NS		NS		<0.015	U	Dry		Dry		Dry	

Table 5 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Zinc															
			2003												2004			
Mine	Station Name	Station ID	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS		NS		NS		NS		NS		NS		<0.00040	U	NS	
	EVM S Dump Seep	MDS026	NS		NS		NS		NS		NS		NS		<0.00040	U	<0.015	U
	Hedin Spring	MSG001-Avg	NS		NS		NS		NS		NS		NS		<0.00040	U	<0.015	U
		MSG001	NS		NS		NS		NS		NS		NS		<0.00040	U	NA	
		MSG001-R1	NS		NS		NS		NS		NS		NS		NA		<0.015	U
		MSG001-R2	NS		NS		NS		NS		NS		NS		NA		<0.015	U
		MSG001-R3	NS		NS		NS		NS		NS		NS		NA		<0.015	U
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	Dry		Dry		<0.045	U	<0.070	U	Dry		Dry		<0.0020	U	Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NS		NS		NS		NS		NS		NS		<0.00040	U	Dry	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		NS		NS		NS		NS		<0.0020	U	<0.015	U
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		NS		NS		NS		NS		<0.00040	U	<0.015	U
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		NS		NS		NS		<0.00040	U	Dry	
	S Pit Overburden Limestone Drain	MDS022	NS		NS		NS		NS		NS		NS		<0.0020	U	<0.015	U
	Taylor Spring	MSG002	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		<0.070	U	NS		NS		<0.00040	U	<0.015	U
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	<0.065	U	NA		<0.045	U	<0.070	U	<0.080	U	<0.075	U	<0.0020	U	<0.015	U
		MST064	<0.065	U	NA		<0.045	U	<0.070	U	<0.080	U	<0.075	U	<0.0020	U	NA	
		MST064-R1	NA		NA		NA		NA		NA		NA		NA		<0.015	U
		MST064-R2	NA		NA		NA		NA		NA		NA		NA		<0.015	U
		MST064-R3	NA		NA		NA		NA		NA		NA		NA		<0.015	U
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Tributary Above W Fork Lone Pine Creek	MST276	<0.065	U	<0.050	U	<0.045	U	<0.070	U	<0.080	U	<0.075	U	<0.0020	U	<0.015	U
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		NS		NS		<0.010	U	Dry	
		MST277	NS		NS		NS		NS		NS		NS		NA	U	Dry	
		MST277-R1	NS		NS		NS		NS		NS		NS		<0.010	U	Dry	
		MST277-R2	NS		NS		NS		NS		NS		NS		<0.010	U	Dry	
		MST277-R3	NS		NS		NS		NS		NS		NS		<0.010	U	Dry	

Table 5 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)†

Station			Zinc															
			2003												2004			
Mine	Station Name	Station ID	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		<0.0020	U	<0.015	U
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		<0.0020	U	<0.015	U
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		<0.0020	U	<0.015	U
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		<0.0020	U	Dry	
	Garden Hose Spring	MSG003	NS		NS		NS		NS		NS		NS		<0.0020	U	<0.015	U
	Holmgren Spring	MSG004	NS		NS		NS		NS		NS		NS		<0.00040	U	<0.015	U
	Cattle Spring	MSG005-Avg	NS		NS		NS		NS		NS		NS		<0.00040	U	<0.015	U
		MSG005	NS		NS		NS		NS		NS		NS		<0.00040	U	NA	
		MSG005-R1	NS		NS		NS		NS		NS		NS		NA		<0.015	U
		MSG005-R2	NS		NS		NS		NS		NS		NS		NA		<0.015	U
		MSG005-R3	NS		NS		NS		NS		NS		NS		NA		<0.015	U
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		<0.0020	U	<0.015	U
	Ballard Creek, Headwaters	MST067	Dry		Dry		<0.045	U	<0.070	U	Dry		Dry		0.027		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		NS		NS		NS		Dry		Dry	
	Short Creek, Below BM	MST069	Dry		Dry		<0.045	U	<0.070	U	<0.080	U	<0.075	U	<0.015	U	<0.015	U
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		NS		NS		NS		NS		<0.00040	U	Dry	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry		Dry		<0.045	U	Dry		Dry		Dry		<0.00040	U	Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	Dry		Dry		<0.045	U	<0.070	U	Dry		Dry		0.013		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	Dry		Dry		Dry		Dry		Dry		Dry		<0.00040	U	<0.015	U

Notes:
† All data has been censored at the reporting limit.
[a] Data from 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1998.
Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).
Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.
Data qualifier definitions are:
(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.
(J) - The result is an estimated quantity.
(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
COPC - Constituent of Potential Concern
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 6
Seeps, Springs, and Headwater Streams - Filtered Censored Results - Screening Analytes (mg/L)

Station			Aluminum		Antimony		Arsenic		Barium		Beryllium		Boron		Chloride											
			2001		2001		2001		2001		2001		2001		2000		2001		2002				2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	<0.0010	U	<0.0025	U	0.0081		0.031	J	<0.0050	U	0.026		NS		5.0		4.6	J	Dry		5.0		Dry	
	EVM S Dump Seep	MDS026	<0.0010	U	<0.0025	U	<0.00050	U	0.023	J	<0.0050	U	<0.025	U	NS		7.4		NA		21	J	0.80		6.8	
	Hedin Spring	MSG001-Avg	NS		NS		NS		NS		NS		NS		NS		NS		11	J	11	J	11		11	
		MSG001	NS		NS		NS		NS		NS		NS		NS		NS		11	J	11	J	11		NA	
		MSG001-R1	NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		NA		11	
		MSG001-R2	NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		NA		11	
		MSG001-R3	NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		NA		11	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		NS		NS		NS		NS		NS		Dry		Dry		Dry		Dry	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		NS		NS		NS		NS		NS		Dry		Dry		Dry		Dry	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		NS		NS		NS		NS		NS		Dry		Dry		Dry		Dry	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS		NS		NS		NS		NS		NS		NA		NS		180	J	Dry		160		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NS		NS		NS		NS		NS		NS		NA		NS		Dry		Dry		5.5		Dry	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		NS		NS		NS		NS		NS		Dry		280	J	Dry		Dry	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		NS		NS		NS		NS		NS		NS		18	J	13	J	23		23	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		NS		NS		NS		NS		NS		NS		Dry		NA		5.6		37	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		NS		NS		NS		NS		NS		Dry		Dry		1.3		Dry	
	S Pit Overburden Limestone Drain	MDS022-Avg	0.0041	J	<0.0025	U	0.0018		0.015	J	<0.0050	U	<0.025	U	NS		3.3		12	J	7.0	J	3.6		5.5	
		MDS022	0.0041	J	<0.0025	U	0.0018		0.015	J	<0.0050	U	<0.025	U	NS		3.3		NA		7.0	J	3.6		5.5	
		MDS022-R1	NS		NS		NS		NS		NS		NA		NS		NA		29	J	NA		NA		NA	
		MDS022-R2	NS		NS		NS		NS		NS		NA		NS		NA		4.7	J	NA		NA		NA	
		MDS022-R3	NS		NS		NS		NS		NS		NA		NS		NA		4.5	J	NA		NA		NA	
	Taylor Spring	MSG002	NS		NS		NS		NS		NS		NS		NS		NS		Dry		Dry		Dry		Dry	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		NS		NS		NS		NS		NS		NS		7.0	J	3.3		5.2	
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS		NS		NS		NS		NS		NS		NS		NS		4.0	J	4.4	J	4.1		4.1	
		MST064	NS		NS		NS		NS		NS		NS		NS		NS		4.0	J	4.4	J	4.1		NA	
		MST064-R1	NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		NA		4.4	
		MST064-R2	NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		NA		4.4	
		MST064-R3	NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		NA		3.5	
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS		NS		NS		NS		NS		NS		NS		NS		2.6	J	Dry		Dry		Dry	
	Tributary Above W Fork Lone Pine Creek	MST276	NS		NS		NS		NS		NS		NS		NS		NS		3.3	J	5.3	J	2.4		4.5	
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		4.5		Dry	
		MST277	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		Dry	
		MST277-R1	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		4.5		Dry	
		MST277-R2	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		4.4		Dry	
		MST277-R3	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		4.5		Dry	

Table 6 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Aluminum		Antimony		Arsenic		Barium		Beryllium		Boron		Chloride											
			2001		2001		2001		2001		2001		2001		2000		2001		2002				2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		3.9		4.9	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		2.9		3.2	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		6.6		7.4	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		4.1		Dry	
	Garden Hose Spring	MSG003	<0.0010	U	<0.0025	U	<0.00050	U	0.039		<0.0050	U	<0.025	U	NS		5.7		4.2	J	<10	UJ	4.5		10	
	Holmgren Spring	MSG004	NS		NS		NS		NS		NS		NS		NS		NS		NS		3.2	J	2.9		3.5	
	Cattle Spring	MSG005-Avg	NS		NS		NS		NS		NS		NS		NS		NS		NS		3.1	J	3.3		2.8	
		MSG005	NS		NS		NS		NS		NS		NS		NS		NS		NS		3.1	J	3.3		NA	
		MSG005-R1	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		2.7	
		MSG005-R2	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		2.8	
		MSG005-R3	NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		2.9	
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		4.8		4.8	
	Ballard Creek, Headwaters	MST067	NS		NS		NS		NS		NS		NS		NS		NS		6.2	J	Dry		8.3		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		NS		NS		NS		NS		NS		Dry		Dry		Dry		Dry	
	Short Creek, Below BM	MST069-Avg	NS		NS		NS		NS		NS		NS		NS		NS		12	J	20	J	12		17	
		MST069	NS		NS		NS		NS		NS		NS		NS		NS		NA		20	J	12		17	
		MST069-R1	NS		NS		NS		NS		NS		NS		NS		NS		12	J	NA		NA		NA	
		MST069-R2	NS		NS		NS		NS		NS		NS		NS		NS		12	J	NA		NA		NA	
		MST069-R3	NS		NS		NS		NS		NS		NS		NS		NS		12	J	NA		NA		NA	
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		NS		NS		NS		NS		NS		NS		8.4	J	Dry		8.9		Dry	
	Spring Fed Tributary #1 above N Fork Wooley Valley Creek below BM	MST094	NS		NS		NS		NS		NS		NS		Dry		NS		1.8	J	Dry		2.2		Dry	
	Spring Fed Tributary #2 above N Fork Wooley Valley Creek below BM	MST095	NS		NS		NS		NS		NS		NS		3.0		NS		3.5	J	Dry		4.1		Dry	
	Spring Fed Tributary #3 above N Fork Wooley Valley Creek below BM	MST096	NS		NS		NS		NS		NS		NS		3.0		NS		3.9	J	Dry		3.4		4.0	

Table 6 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Calcium																											
			2000		2001		2002								2003												2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS		250		250	J	NS		Dry		NS		NS		NS		NS		NS		NS		NS		240		Dry	
	EVM S Dump Seep	MDS026	NS		280		160	J	NS		250		NS		NS		NS		NS		NS		NS		NS		360		280	
	Hedin Spring	MSG001-Avg	NS		NS		69	J	NS		63		NS		NS		NS		NS		NS		NS		NS		70		69	
		MSG001	NS		NS		69	J	NS		63		NS		NS		NS		NS		NS		NS		NS		70		NA	
		MSG001-R1	NS		NS		NA		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		69	
		MSG001-R2	NS		NS		NA		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		69	
		MSG001-R3	NS		NS		NA		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		69	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NA		NS		140	J	Dry		Dry		Dry		Dry		Dry		130		130		Dry		Dry		130		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NA		NS		NS		NS		Dry		NS		NS		NS		NS		NS		NS		NS		150		Dry	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		NS		48		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Fork Rasmussen Creek above Rasmussen Creek	MST274	NS		NS		63	J	NA		62		NS		NS		NS		NS		NS		NS		NS		67		70	
	N Fork Lone Pine Creek above E Fork Lone Pine Creek	MST275	NS		NS		NS		NS		NA		NS		NS		NS		NS		NS		NS		NS		16		75	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		NS		Dry		NS		NS		NS		NS		NS		NS		NS		280		Dry	
	S Pit Overburden Limestone Drain	MDS022-Avg	NS		100		130	J	NS		130		NS		NS		NS		NS		NS		NS		NS		120		140	
		MDS022	NS		100		NA		NS		130		NS		NS		NS		NS		NS		NS		NS		120		140	
		MDS022-R1	NS		NA		120	J	NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		NA	
		MDS022-R2	NS		NA		130	J	NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		NA	
		MDS022-R3	NS		NA		130	J	NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		NA	
	Taylor Spring	MSG002	NS		NS		NS		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	Lone Pine Creek above W Fork Lone Pine Creek	MST058	NS		NS		NS		NS		91		NS		NS		NS		NS		64		NS		NS		76		98	
	W Fork Lone Pine Creek above Tributary	MST064-Avg	NS		NS		58	J	81		67		79		74		NA		70		72		75		80		76		76	
		MST064	NS		NS		58	J	81		67		79		74		NA		70		72		75		80		76		NA	
		MST064-R1	NS		NS		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		76	
		MST064-R2	NS		NS		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		75	
		MST064-R3	NS		NS		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		76	
	E Fork Lone Pine Creek below Wooley Valley Mine	MST226	33		NS		21	J	NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	Tributary above W Fork Lone Pine Creek	MST276	NS		NS		69	J	NA		77		79		71		61		57		62		82		84		76		80	
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		93		Dry	
		MST277	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		Dry	
		MST277-R1	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		94		Dry	
		MST277-R2	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		93		Dry	
		MST277-R3	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		93		Dry	

Table 6 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Calcium																											
			2000		2001		2002								2003												2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		160		160	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		140		140	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		230		230	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		280		Dry	
	Garden Hose Spring	MSG003	NS		130		140	J	NS		140		NS		NS		NS		NS		NS		NS		NS		140		140	
	Holmgren Spring	MSG004	NS		NS		NS		NS		75		NS		NS		NS		NS		NS		NS		NS		66		78	
	Cattle Spring	MSG005-Avg	NS		NS		NS		NS		78		NS		NS		NS		NS		NS		NS		NS		85		84	
		MSG005	NS		NS		NS		NS		78		NS		NS		NS		NS		NS		NS		NS		85		84	
		MSG005-R1	NS		NS		NS		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		84	
		MSG005-R2	NS		NS		NS		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		84	
		MSG005-R3	NS		NS		NS		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		84	
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		220		210	
	Ballard Creek, Headwaters	MST067	NS		NS		300	J	Dry		Dry		Dry		Dry		Dry		260		250		Dry		Dry		270		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	Short Creek, below BM	MST069-Avg	NS		NS		400	J	480		420		430		Dry		Dry		340		380		430		470		240		430	
		MST069	NS		NS		NA		480		420		430		Dry		Dry		340		380		430		470		240		430	
		MST069-R1	NS		NS		410	J	NA		NA		NA		Dry		Dry		NA		NA		NA		NA		NA		NA	
		MST069-R2	NS		NS		400	J	NA		NA		NA		Dry		Dry		NA		NA		NA		NA		NA		NA	
		MST069-R3	NS		NS		390	J	NA		NA		NA		Dry		Dry		NA		NA		NA		NA		NA		NA	
	N Fork Wooley Valley Creek, above BM	MST093	NS		NS		38	J	NS		Dry		NS		NS		NS		NS		NS		NS		NS		24		NS	
	Spring Fed Tributary #1 above N Fork Wooley Valley Creek below BM	MST094	Dry		NS		33	J	Dry		Dry		Dry		Dry		Dry		41		Dry		Dry		Dry		66		NS	
	Spring Fed Tributary #2 above N Fork Wooley Valley Creek below BM	MST095	7.0		NS		110	J	Dry		Dry		Dry		Dry		Dry		150		120		Dry		Dry		140		Dry	
	Spring Fed Tributary #3 above N Fork Wooley Valley Creek below BM	MST096	87		NS		92	J	Dry		Dry		Dry		Dry		Dry		Dry		Dry		Dry		Dry		94		100	

Table 6 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Copper		Flouride		Iron				Lead		Manganese		Molybdenum	
			2001		2001		2000		2001		2001		2001		2001	
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	0.0015		0.51		NS		6.5		<0.00025	U	5.0		0.0033	
	EVM S Dump Seep	MDS026	0.0018		0.40		NS		<0.010	U	<0.00025	U	0.77		<0.00025	U
	Hedin Spring	MSG001	NS		NS		NS		NS		NS		NS		NS	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		NS		NS		NS		NS	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		NS		NS		NS		NS	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		NS		NS		NS		NS	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS		NS		NA		NS		NS		NS		NS	
	W Pond Creek Headwaters, below W Pond	MST144	NS		NS		NA		NS		NS		NS		NS	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		NS		NS		NS		NS	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		NS		NS		NS		NS		NS	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		NS		NS		NS		NS		NS	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		NS		NS		NS		NS	
	S Pit Overburden Limestone Drain	MDS022	0.0013		0.17		NS		<0.010	U	<0.00025	U	0.027		0.0086	
	Taylor Spring	MSG002	NS		NS		NS		NS		NS		NS		NS	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		NS		NS		NS		NS	
	W Fork Lone Pine Creek Above Tributary	MST064	NS		NS		NS		NS		NS		NS		NS	
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS		NS		<0.020	U	NS		NS		NS		NS	
	Tributary Above W Fork Lone Pine Creek	MST276	NS		NS		NS		NS		NS		NS		NS	
	Lone Pine Creek, Spring Fed Tributary	MST277	NS		NS						NS		NS		NS	
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		NS	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		NS	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		NS	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		NS	
	Garden Hose Spring	MSG003	0.00058		<0.10	U	NS		<0.010	U	<0.00025	U	<0.0020	U	<0.00025	U
	Holmgren Spring	MSG004	NS		NS		NS		NS		NS		NS		NS	
	Cattle Spring	MSG005	NS		NS		NS		NS		NS		NS		NS	
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		NS	
	Ballard Creek, Headwaters	MST067	NS		NS		NS		NS		NS		NS		NS	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		NS		NS		NS		NS	
	Short Creek, Below BM	MST069	NS		NS		NS		NS		NS		NS		NS	
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		NS		NS		NS		NS		NS	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS		NS		Dry		NS		NS		NS		NS	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS		NS		<0.020	U	NS		NS		NS		NS	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS		NS		<0.020	U	NS		NS		NS		NS	

Table 6 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Magnesium																											
			2000		2001		2002								2003												2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS		64		68		NS		Dry		NS		NS		NS		NS		NS		NS		NS		62		NS	
	EVM S Dump Seep	MDS026	NS		79		42		NS		73		NS		NS		NS		NS		NS		NS		NS		83		77	
	Hedin Spring	MSG001-Avg	NS		NS		11		NS		<61	U	NS		NS		NS		NS		NS		NS		NS		10		10	
		MSG001	NS		NS		11		NS		<61	U	NS		NS		NS		NS		NS		NS		NS		10		NA	
		MSG001-R1	NS		NS		NA		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		10	
		MSG001-R2	NS		NS		NA		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		10	
		MSG001-R3	NS		NS		NA		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		10	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NA		NS		24		Dry		Dry		Dry		Dry		Dry		25		23		Dry		Dry		23		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NA		NS		Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		36		Dry	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		Dry		NS		85		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	W Fork Rasmussen Creek above Rasmussen Creek	MST274	NS		NS		8.5		NA		<61	U	NS		NS		NS		NS		NS		NS		NS		9.3		9.9	
	N Fork Lone Pine Creek above E Fork Lone Pine Creek	MST275	NS		NS		Dry		NS		NA		NS		NS		NS		NS		NS		NS		NS		4.1		22	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		52		NS	
	S Pit Overburden Limestone Drain	MDS022-Avg	NS		44		43		NS		<61	U	NS		NS		NS		NS		NS		NS		NS		47		56	
		MDS022	NS		44		NA		NS		<61	U	NS		NS		NS		NS		NS		NS		NS		47		56	
		MDS022-R1	NS		NA		35		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		NA	
		MDS022-R2	NS		NA		48		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		NA	
		MDS022-R3	NS		NA		48		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		NA	
	Taylor Spring	MSG002	NS		NS		Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	Lone Pine Creek above W Fork Lone Pine Creek	MST058	NS		NS		NS		NS		<61	U	NS		NS		NS		NS		12		NS		NS		13		18	
	W Fork Lone Pine Creek above Tributary	MST064-Avg	NS		NS		12		19		<61	U	19		17		NA		16		16		17		80		17		17	
		MST064	NS		NS		12		19		<61	U	19		17		NA		16		16		17		80		17		NA	
		MST064-R1	NS		NS		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		17	
		MST064-R2	NS		NS		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		17	
		MST064-R3	NS		NS		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		17	
	E Fork Lone Pine Creek below Wooley Valley Mine	MST226	5.0		NS		3.7		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	Tributary above W Fork Lone Pine Creek	MST276	NS		NS		9.5		NA		<61	U	12		12		9.9		8.4		9.1		14		84		11		13	
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		8.8		Dry	
		MST277	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		8.8		Dry	
		MST277-R1	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		Dry	
		MST277-R2	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		Dry	
		MST277-R3	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NA		Dry	

Table 6 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Magnesium																											
			2000		2001		2002								2003												2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	Jan.	Flag	Mar.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Fall	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		17		17	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		18		20	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		69		75	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		64		Dry	
	Garden Hose Spring	MSG003	NS		16		16		NS		<61	U	NS		NS		NS		NS		NS		NS		NS		15		15	
	Holmgren Spring	MSG004	NS		NS		NS		NS		<61	U	NS		NS		NS		NS		NS		NS		NS		24		26	
	Cattle Spring	MSG005-Avg	NS		NS		NS		NS		<61	U	NS		NS		NS		NS		NS		NS		NS		22		22	
		MSG005	NS		NS		NS		NS		<61	U	NS		NS		NS		NS		NS		NS		NS		22		NA	
		MSG005-R1	NS		NS		NS		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		22	
		MSG005-R2	NS		NS		NS		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		22	
		MSG005-R3	NS		NS		NS		NS		NA		NS		NS		NS		NS		NS		NS		NS		NA		22	
	SE Spring	MSG006	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		41		42	
	Ballard Creek, Headwaters	MST067	NS		NS		73		Dry		Dry		Dry		Dry		Dry		68		66		83		470		75		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		Dry		NS		Dry		NS		NS		NS		NS		NS		NS		NS		Dry		Dry	
	Short Creek, below BM	MST069-Avg	NS		NS		85		100		85		90		Dry		Dry		76		83		NA		NA		87		86	
		MST069	NS		NS		NA		100		85		90		Dry		Dry		76		83		NA		NA		87		86	
		MST069-R1	NS		NS		88		NA		NA		NA		Dry		Dry		NA		NA		NA		NA		NA		NA	
		MST069-R2	NS		NS		85		NA		NA		NA		Dry		Dry		NA		NA		NA		NA		NA		NA	
		MST069-R3	NS		NS		83		NA		NA		NA		Dry		Dry		NA		NA		NA		NA		NA		NA	
	N Fork Wooley Valley Creek, above BM	MST093	NS		NS		6.2		NS		Dry		NS		NS		NS		NS		NS		NS		NS		4.0		Dry	
	Spring Fed Tributary #1 above N Fork Wooley Valley Creek below BM	MST094	Dry		NS		6.5		Dry		Dry		Dry		Dry		Dry		6.8		Dry		Dry		Dry		11		Dry	
	Spring Fed Tributary #2 above N Fork Wooley Valley Creek below BM	MST095	15		NS		32		Dry		Dry		Dry		Dry		Dry		42		31		Dry		Dry		39		Dry	
	Spring Fed Tributary #3 above N Fork Wooley Valley Creek below BM	MST096	22		NS		16		Dry		Dry		Dry		Dry		Dry		Dry		Dry		Dry		Dry		17		19	

Table 6 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Potassium												Sodium											
			2000		2001		2002				2004				2000		2001		2002				2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS		3.0		3.1		Dry		3.4		Dry		NS		12	J	13		Dry		12		Dry	
	EVM S Dump Seep	MDS026	NS		1.6		0.90		13		5.3		1.8		NS		16	J	8.7		<17	UJ	17		17	
	Hedin Spring	MSG001-Avg	NS		NS		0.60		<4.5	U	0.70		0.63		NS		NS		5.5		<17	UJ	5.6		5.7	
		MSG001	NS		NS		0.60		<4.5	U	0.70		NA		NS		NS		5.5		<17	UJ	5.6		NA	
		MSG001-R1	NS		NS		NA		NA		NA		0.70		NS		NS		NA		NA		NA		5.7	
		MSG001-R2	NS		NS		NA		NA		NA		0.50		NS		NS		NA		NA		NA		5.7	
		MSG001-R3	NS		NS		NA		NA		NA		0.70		NS		NS		NA		NA		NA		5.7	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		Dry		Dry		Dry		Dry		NS		NS		Dry		Dry		Dry		Dry	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		Dry		Dry		Dry		Dry		NS		NS		Dry		Dry		Dry		Dry	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		Dry		Dry		Dry		Dry		NS		NS		Dry		Dry		Dry		Dry	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NA		NS		2.0		Dry		2.5		Dry		NA		NS		8.0		Dry		8.6		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NA		NS		Dry		Dry		1.4		Dry		NA		NS		Dry		Dry		6.8		Dry	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		Dry		6.3		Dry		Dry		NS		NS		Dry		<17	UJ	Dry		Dry	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		0.50		<4.5	U	0.60		7.8		NS		NS		4.5		<17	UJ	4.9		4.7	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		Dry		NA		20		100		NS		NS		Dry		NA		4.6		17	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		Dry		Dry		1.1		Dry		NS		NS		Dry		Dry		9.3		Dry	
	S Pit Overburden Limestone Drain	MDS022-Avg	NS		0.88		2.7		<4.5	U	1.4		1.9		NS		15	J	18		<17	UJ	14		17	
		MDS022	NS		0.88		NA		<4.5	U	1.4		1.9		NS		15	J	NA		<17	UJ	14		17	
		MDS022-R1	NS		NA		2.5		NA		NA		NA		NS		NA		24		NA		NA		NA	
		MDS022-R2	NS		NA		2.9		NA		NA		NA		NS		NA		15		NA		NA		NA	
		MDS022-R3	NS		NA		2.7		NA		NA		NA		NS		NA		15		NA		NA		NA	
	Taylor Spring	MSG002	NS		NS		Dry		Dry		Dry		Dry		NS		NS		Dry		Dry		Dry		Dry	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		<4.5	U	12		3.4		NS		NS		NS		<17	UJ	6.8		9.2	
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS		NS		0.60		<4.5	U	0.60		0.73		NS		NS		7.1		<17	UJ	9.4		9.5	
		MST064	NS		NS		0.60		<4.5	U	0.60		NA		NS		NS		7.1		<17	UJ	9.4		NA	
		MST064-R1	NS		NS		NA		NA		NA		0.70		NS		NS		NA		NA		NA		9.5	
		MST064-R2	NS		NS		NA		NA		NA		0.80		NS		NS		NA		NA		NA		9.5	
		MST064-R3	NS		NS		NA		NA		NA		0.70		NS		NS		NA		NA		NA		9.6	
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	1.0		NS		0.70		Dry		Dry		Dry		3.0		NS		2.5		Dry		Dry		Dry	
	Tributary Above W Fork Lone Pine Creek	MST276	NS		NS		1.0		<4.5	U	0.50		0.70		NS		NS		6.1		<17	UJ	7.0		7.9	
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		9.1		Dry		NS		NS		NS		NS		7.0		Dry	
		MST277	NS		NS		NS		NS		NA		Dry		NS		NS		NS		NS		NA		Dry	
		MST277-R1	NS		NS		NS		NS		9.1		Dry		NS		NS		NS		NS		6.9		Dry	
		MST277-R2	NS		NS		NS		NS		9.0		Dry		NS		NS		NS		NS		6.9		Dry	
		MST277-R3	NS		NS		NS		NS		9.1		Dry		NS		NS		NS		NS		7.1		Dry	

Table 6 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Potassium												Sodium											
			2000		2001		2002				2004				2000		2001		2002				2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		1.0		0.80		NS		NS		NS		NS		11		10	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		1.5		1.7		NS		NS		NS		NS		11		12	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		2.6		9.0		NS		NS		NS		NS		37		38	
	Goat Seep	MDS033	NS		NS		NS		NS		3.0		Dry		NS		NS		NS		NS		28		Dry	
	Garden Hose Spring	MSG003	NS		2.3		0.80		<4.5	U	0.80		0.90		NS		NS		10		<17	UJ	9.5		9.2	
	Holmgren Spring	MSG004	NS		NS		NS		<4.5	U	1.5		1.9		NS		NS		NS		<17	UJ	4.7		4.8	
	Cattle Spring	MSG005-Avg	NS		NS		NS		<4.5	U	0.50		0.63		NS		NS		NS		<17	UJ	4.2		4.6	
		MSG005	NS		NS		NS		<4.5	U	0.50		NA		NS		NS		NS		<17	UJ	4.2		NA	
		MSG005-R1	NS		NS		NS		NA		NA		0.60		NS		NS		NS		NA		NA		4.6	
		MSG005-R2	NS		NS		NS		NA		NA		0.70		NS		NS		NS		NA		NA		4.6	
		MSG005-R3	NS		NS		NS		NA		NA		0.60		NS		NS		NS		NA		NA		4.5	
	SE Spring	MSG006	NS		NS		NS		Dry		0.70		1.4		NS		NS		NS		NS		9.0		9.9	
	Ballard Creek, Headwaters	MST067	NS		NS		2.2		Dry		1.7		Dry		NS		NS		25		Dry		30		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		Dry		Dry		Dry		Dry		NS		NS		Dry		Dry		Dry		Dry	
	Short Creek, Below BM	MST069-Avg	NS		NS		3.0		9.2		2.7		3.9		NS		NS		25		25		25		24	
		MST069	NS		NS		NA		9.2		2.7		3.9		NS		NS		NA		25		25		24	
		MST069-R1	NS		NS		3.0		NA		NA		NA		NS		NS		26		NA		NA		NA	
		MST069-R2	NS		NS		3.0		NA		NA		NA		NS		NS		25		NA		NA		NA	
		MST069-R3	NS		NS		2.9		NA		NA		NA		NS		NS		24		NA		NA		NA	
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		0.80		Dry		0.40		Dry		NS		NS		7.6		Dry		7.0		Dry	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry		NS		0.60		Dry		1.2		Dry		Dry		NS		2.3		Dry		5.0		Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	2.0		NS		0.50		Dry		<0.30	U	Dry		7.0		NS		7.4		Dry		7.7		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	0.37		NS		1.6		Dry		1.2		1.6		6.0		NS		5.6		Dry		5.4		5.7	

Table 6 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Potassium												Sodium											
			2000		2001		2002				2004				2000		2001		2002				2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS		3.0		3.1		Dry		3.4		Dry		NS		12	J	13		Dry		12		Dry	
	EVM S Dump Seep	MDS026	NS		1.6		0.90		13		5.3		1.8		NS		16	J	8.7		<17	UJ	17		17	
	Hedin Spring	MSG001-Avg	NS		NS		0.60		<4.5	U	0.70		0.63		NS		NS		5.5		<17	UJ	5.6		5.7	
		MSG001	NS		NS		0.60		<4.5	U	0.70		NA		NS		NS		5.5		<17	UJ	5.6		NA	
		MSG001-R1	NS		NS		NA		NA		NA		0.70		NS		NS		NA		NA		NA		5.7	
		MSG001-R2	NS		NS		NA		NA		NA		0.50		NS		NS		NA		NA		NA		5.7	
		MSG001-R3	NS		NS		NA		NA		NA		0.70		NS		NS		NA		NA		NA		5.7	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		Dry		Dry		Dry		Dry		NS		NS		Dry		Dry		Dry		Dry	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		Dry		Dry		Dry		Dry		NS		NS		Dry		Dry		Dry		Dry	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		Dry		Dry		Dry		Dry		NS		NS		Dry		Dry		Dry		Dry	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NA		NS		2.0		Dry		2.5		Dry		NA		NS		8.0		Dry		8.6		Dry	
	W Pond Creek Headwaters, below W Pond	MST144	NA		NS		Dry		Dry		1.4		Dry		NA		NS		Dry		Dry		6.8		Dry	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		Dry		6.3		Dry		Dry		NS		NS		Dry		<17	UJ	Dry		Dry	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		0.50		<4.5	U	0.60		7.8		NS		NS		4.5		<17	UJ	4.9		4.7	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		Dry		NA		20		100		NS		NS		Dry		NA		4.6		17	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		Dry		Dry		1.1		Dry		NS		NS		Dry		Dry		9.3		Dry	
	S Pit Overburden Limestone Drain	MDS022-Avg	NS		0.88		2.7		<4.5	U	1.4		1.9		NS		15	J	18		<17	UJ	14		17	
		MDS022	NS		0.88		NA		<4.5	U	1.4		1.9		NS		15	J	NA		<17	UJ	14		17	
		MDS022-R1	NS		NA		2.5		NA		NA		NA		NS		NA		24		NA		NA		NA	
		MDS022-R2	NS		NA		2.9		NA		NA		NA		NS		NA		15		NA		NA		NA	
		MDS022-R3	NS		NA		2.7		NA		NA		NA		NS		NA		15		NA		NA		NA	
	Taylor Spring	MSG002	NS		NS		Dry		Dry		Dry		Dry		NS		NS		Dry		Dry		Dry		Dry	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		<4.5	U	12		3.4		NS		NS		NS		<17	UJ	6.8		9.2	
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS		NS		0.60		<4.5	U	0.60		0.73		NS		NS		7.1		<17	UJ	9.4		9.5	
		MST064	NS		NS		0.60		<4.5	U	0.60		NA		NS		NS		7.1		<17	UJ	9.4		NA	
		MST064-R1	NS		NS		NA		NA		NA		0.70		NS		NS		NA		NA		NA		9.5	
		MST064-R2	NS		NS		NA		NA		NA		0.80		NS		NS		NA		NA		NA		9.5	
		MST064-R3	NS		NS		NA		NA		NA		0.70		NS		NS		NA		NA		NA		9.6	
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	1.0		NS		0.70		Dry		Dry		Dry		3.0		NS		2.5		Dry		Dry		Dry	
	Tributary Above W Fork Lone Pine Creek	MST276	NS		NS		1.0		<4.5	U	0.50		0.70		NS		NS		6.1		<17	UJ	7.0		7.9	
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		9.1		Dry		NS		NS		NS		NS		7.0		Dry	
		MST277	NS		NS		NS		NS		NA		Dry		NS		NS		NS		NS		NA		Dry	
		MST277-R1	NS		NS		NS		NS		9.1		Dry		NS		NS		NS		NS		6.9		Dry	
		MST277-R2	NS		NS		NS		NS		9.0		Dry		NS		NS		NS		NS		6.9		Dry	
		MST277-R3	NS		NS		NS		NS		9.1		Dry		NS		NS		NS		NS		7.1		Dry	

Table 6 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Potassium												Sodium											
			2000		2001		2002				2004				2000		2001		2002				2004			
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		1.0		0.80		NS		NS		NS		NS		11		10	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		1.5		1.7		NS		NS		NS		NS		11		12	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		2.6		9.0		NS		NS		NS		NS		37		38	
	Goat Seep	MDS033	NS		NS		NS		NS		3.0		Dry		NS		NS		NS		NS		28		Dry	
	Garden Hose Spring	MSG003	NS		2.3		0.80		<4.5	U	0.80		0.90		NS		NS		10		<17	UJ	9.5		9.2	
	Holmgren Spring	MSG004	NS		NS		NS		<4.5	U	1.5		1.9		NS		NS		NS		<17	UJ	4.7		4.8	
	Cattle Spring	MSG005-Avg	NS		NS		NS		<4.5	U	0.50		0.63		NS		NS		NS		<17	UJ	4.2		4.6	
		MSG005	NS		NS		NS		<4.5	U	0.50		NA		NS		NS		NS		<17	UJ	4.2		NA	
		MSG005-R1	NS		NS		NS		NA		NA		0.60		NS		NS		NS		NA		NA		4.6	
		MSG005-R2	NS		NS		NS		NA		NA		0.70		NS		NS		NS		NA		NA		4.6	
		MSG005-R3	NS		NS		NS		NA		NA		0.60		NS		NS		NS		NA		NA		4.5	
	SE Spring	MSG006	NS		NS		NS		Dry		0.70		1.4		NS		NS		NS		NS		9.0		9.9	
	Ballard Creek, Headwaters	MST067	NS		NS		2.2		Dry		1.7		Dry		NS		NS		25		Dry		30		Dry	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		Dry		Dry		Dry		Dry		NS		NS		Dry		Dry		Dry		Dry	
	Short Creek, Below BM	MST069-Avg	NS		NS		3.0		9.2		2.7		3.9		NS		NS		25		25		25		24	
		MST069	NS		NS		NA		9.2		2.7		3.9		NS		NS		NA		25		25		24	
		MST069-R1	NS		NS		3.0		NA		NA		NA		NS		NS		26		NA		NA		NA	
		MST069-R2	NS		NS		3.0		NA		NA		NA		NS		NS		25		NA		NA		NA	
		MST069-R3	NS		NS		2.9		NA		NA		NA		NS		NS		24		NA		NA		NA	
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		0.80		Dry		0.40		Dry		NS		NS		7.6		Dry		7.0		Dry	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry		NS		0.60		Dry		1.2		Dry		Dry		NS		2.3		Dry		5.0		Dry	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	2.0		NS		0.50		Dry		<0.30	U	Dry		7.0		NS		7.4		Dry		7.7		Dry	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	0.37		NS		1.6		Dry		1.2		1.6		6.0		NS		5.6		Dry		5.4		5.7	

Table 6 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Silver		Sulfate												Thallium		Uranium	
			2001		2000		2001		2002				2004				2001		2001	
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Spring	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	<0.00025	U	NS		700	J	620	J	Dry		590		Dry		<0.0025	U	0.0023	
	EVM S Dump Seep	MDS026	<0.00025	U	NS		645	J	470	J	620	J	810		<0.50	U	<0.0025	U	0.071	
	Hedin Spring	MSG001-Avg	NS		NS		NS		9.8		11	J	10		11		NS		NS	
		MSG001	NS		NS		NS		9.8		11	J	10		NA		NS		NS	
		MSG001-R1	NS		NS		NS		NA		NA		NA		10		NS		NS	
		MSG001-R2	NS		NS		NS		NA		NA		NA		11		NS		NS	
		MSG001-R3	NS		NS		NS		NA		NA		NA		11		NS		NS	
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS		NS		NS		Dry		Dry		Dry		Dry		NS		NS	
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS		NS		NS		Dry		Dry		Dry		Dry		NS		NS	
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS		NS		NS		Dry		Dry		Dry		Dry		NS		NS	
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS		NA		NS		150		Dry		140		Dry		NS		NS	
	W Pond Creek Headwaters, below W Pond	MST144	NS		NA		NS		Dry		Dry		340		Dry		NS		NS	
	E Fork Rasmussen Creek Headwaters	MST269	NS		NS		NS		Dry		55	J	Dry		Dry		NS		NS	
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS		NS		NS		34		18	J	37		16		NS		NS	
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS		NS		NS		Dry		NA		8.6		2.2		NS		NS	
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS		NS		NS		Dry		Dry		350		Dry		NS		NS	
	S Pit Overburden Limestone Drain	MDS022-Avg	<0.00025	U	NS		76	J	57	J	38	J	60		49		<0.0025	U	0.0067	
		MDS022	<0.00025	U	NS		76	J	NA		38	J	60		49		<0.0025	U	0.0067	
		MDS022-R1	NA		NS		NA		65		NA		NA		NA		NA		NA	
		MDS022-R2	NA		NS		NA		55		NA		NA		NA		NA		NA	
		MDS022-R3	NA		NS		NA		51		NA		NA		NA		NA		NA	
	Taylor Spring	MSG002	NS		NS		NS		Dry		Dry		Dry		Dry		NS		NS	
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS		NS		NS		NS		13	J	19		34		NS		NS	
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS		NS		NS		37		27	J	40		39		NS		NS	
		MST064	NS		NS		NS		37		27	J	40		NA		NS		NS	
		MST064-R1	NS		NS		NS		NA		NA		NA		39		NS		NS	
		MST064-R2	NS		NS		NS		NA		NA		NA		39		NS		NS	
		MST064-R3	NS		NS		NS		NA		NA		NA		39		NS		NS	
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS		9.0		NS		8.2		Dry		Dry		Dry		NS		NS	
	Tributary Above W Fork Lone Pine Creek	MST276	NS		NS		NS		59		39	J	40		47		NS		NS	
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS		NS		NS		NS		NS		3.6		Dry		NS		NS	
		MST277	NS		NS		NS		NS		NS		NA		Dry		NS		NS	
		MST277-R1	NS		NS		NS		NS		NS		3.5		Dry		NS		NS	
		MST277-R2	NS		NS		NS		NS		NS		3.6		Dry		NS		NS	
		MST277-R3	NS		NS		NS		NS		NS		3.7		Dry		NS		NS	

Table 6 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)†

Station			Silver		Sulfate												Thallium		Uranium	
			2001		2000		2001		2002				2004				2001		2001	
Mine	Station Name	Station ID	Spring	Flag	Spring	Flag	Spring	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Fall	Flag	Spring	Flag	Spring	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS		NS		NS		NS		NS		140		15		NS		NS	
	Pit #2 Lower Dump Seep S	MDS031	NS		NS		NS		NS		NS		160		200		NS		NS	
	Pit #2 Lower Dump Seep N	MDS032	NS		NS		NS		NS		NS		570		440		NS		NS	
	Goat Seep	MDS033	NS		NS		NS		NS		NS		720		Dry		NS		NS	
	Garden Hose Spring	MSG003	<0.00025	U	NS		160		120		120	J	120		110		<0.0025	U	0.0022	
	Holmgren Spring	MSG004	NS		NS		NS		NS		45	J	34		46		NS		NS	
	Cattle Spring	MSG005-Avg	NS		NS		NS		NS		31	J	34		30		NS		NS	
		MSG005	NS		NS		NS		NS		31	J	34		NA		NS		NS	
		MSG005-R1	NS		NS		NS		NS		NA		NA		30		NS		NS	
		MSG005-R2	NS		NS		NS		NS		NA		NA		30		NS		NS	
		MSG005-R3	NS		NS		NS		NS		NA		NA		30		NS		NS	
	SE Spring	MSG006	NS		NS		NS		NS		NS		390		440		NS		NS	
	Ballard Creek, Headwaters	MST067	NS		NS		NS		780		Dry		810		Dry		NS		NS	
	W Fork Ballard Creek, Headwaters	MST068	NS		NS		NS		Dry		Dry		Dry		Dry		NS		NS	
	Short Creek, Below BM	MST069-Avg	NS		NS		NS		1000		NA		1200		760		NS		NS	
		MST069	NS		NS		NS		NA		NA		1200		760		NS		NS	
		MST069-R1	NS		NS		NS		1000		NA		NA		NA		NS		NS	
		MST069-R2	NS		NS		NS		1000		NA		NA		NA		NS		NS	
		MST069-R3	NS		NS		NS		1000		NA		NA		NA		NS		NS	
	N Fork Wooley Valley Creek, Above BM	MST093	NS		NS		NS		18	J	Dry		17		Dry		NS		NS	
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS		Dry		NS		7.7	J	Dry		13		Dry		NS		NS	
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS		69		NS		290	J	Dry		270		Dry		NS		NS	
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS		110		NS		110	J	Dry		100		59		NS		NS	

Notes:

† All data has been censored at the reporting limit.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

Data qualifier definitions are:

(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.

(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 7
Ponds - Filtered Results - COPC (mg/L)†

Station			Cadmium																						Chromium			
			2001		2002								2003										2004		2001		2002	
Mine	Name	ID	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	Jan.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Spring	Flag	Spring	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	<0.00070	U	0.00070		NS		<0.00010	U	NS		NS		NS		NS		NS		NS		0.00030		<0.0080	U	<0.010	U
		MSP017	<0.00070	U	0.00070		NS		<0.00010	U	NS		NS		NS		NS		NS		NS		NA		<0.0080	U	<0.010	U
		MSP017-R1	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		0.00030		NA		NA	
		MSP017-R2	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		0.00030		NA		NA	
		MSP017-R3	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		0.00030		NA		NA	
	EVM Keyhole Pond	MSP018	0.050		0.10		0.0067		0.0090		0.056		0.016		0.089		0.095		0.028		0.0026		0.074		<0.0080	U	<0.010	U
	EVM Bat Cave Pond	MSP019	<0.00070	U	0.00010		NS		<0.00010	U	NS		NS		NS		NS		NS		NS		0.00010		<0.0080	U	<0.010	U
	EVM West Pond	MSP020	<0.00070	U	0.00040		NS		<0.0011	U	NS		NS		NS		NS		NS		NS		0.0020		<0.0080	U	<0.010	U
	EVM Stock Pond	MSP021-Avg	0.0046		0.015		NS		<0.0011	U	NS		NS		NS		NS		NS		NS		0.0098		<0.0080	U	<0.010	U
		MSP021	0.0046		NA		NS		<0.0011	U	NS		NS		NS		NS		NS		NS		0.0098		<0.0080	U	NA	
		MSP021-R1	NA		0.014		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		<0.010	U
		MSP021-R2	NA		0.015		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		<0.010	U
		MSP021-R3	NA		0.015		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		<0.010	U
	EVM Tipple Pond	MSP022	<0.00070	U	0.0010		NS		0.0013		NS		NS		NS		NS		NS		NS		0.00010		<0.0080	U	<0.010	U
	EVM Haul Road Pond	MSP023	<0.00070		0.00010		NS		0.0030		NS		NS		NS		NS		NS		NS		0.00020		<0.0080	U	<0.010	U
	EVM Shop Pond	MSP031	0.0016		0.0017		NS		0.0080		NS		NS		NS		NS		NS		NS		<0.00010	U	<0.0080	U	<0.010	U
Henry Mine	HM Henry Pond	MSP014	<0.00070	U	0.00010		NS		<0.00010	U	NS		NS		NS		NS		NS		NS		0.00020		<0.0080	U	<0.010	U
	HM Smith Pond	MSP015	<0.00070	U	0.00020		NS		0.00016		NS		NS		NS		NS		NS		NS		<0.00010	U	0.012		<0.010	U
	HM Center Henry Pond	MSP016-Avg	<0.00070	U	<0.00010	U	NS		<0.0011	U	NS		NS		NS		NS		NS		NS		<0.00010	U	<0.0080	U	<0.010	U
		MSP016	<0.00070	U	<0.00010	U	NS		NA		NS		NS		NS		NS		NS		NS		NA		<0.0080	U	<0.010	U
		MSP016-D	<0.00070	U	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA		<0.0080	U	NA	
		MSP016-R1	NA		NA		NA		<0.0011	U	NA		NA		NA		NA		NA		NA		<0.00010	U	NA		NA	
		MSP016-R2	NA		NA		NA		<0.0011	U	NA		NA		NA		NA		NA		NA		<0.00010	U	NA		NA	
		MSP016-R3	NA		NA		NA		<0.0011	U	NA		NA		NA		NA		NA		NA		<0.00010	U	NA		NA	
	HM South Pit Pond	MSP055	0.039		0.0031		0.0070		NS		NS		NS		0.021		0.024		0.029		0.0069		0.030		0.014		0.010	
Ballard Mine	BM Dredge Pond	MSP010-Avg	<0.00070	U	0.0011		<0.00050	U	<0.0011	U	NS		NS		0.0010		0.00073		0.00030		<0.00010	U	0.00080		0.023		<0.010	U
		MSP010	<0.00070	U	NA		NA		<0.0011	U	NS		NS		NA		NA		0.00030		<0.00010	U	0.00080		0.023		<0.010	U
		MSP010-R1	NA		0.0011		<0.00050	U	NA		NA		NA		0.0010		0.00080		NA		NA		NA		NA		0.010	
		MSP010-R2	NA		0.0011		<0.00050	U	NA		NA		NA		0.0011		0.00070		NA		NA		NA		NA		0.010	
		MSP010-R3	NA		0.0011		<0.00050	U	NA		NA		NA		0.00090		0.00070		NA		NA		NA		NA		<0.010	U
	BM Upper Elk Pond	MSP011-Avg	0.0013		0.0012		NS		NS		NS		NS		NS		NS		NS		NS		0.0010		<0.0080	U	<0.010	U
		MSP011	0.0013		0.0012		NS		NS		NS		NS		NS		NS		NS		NS		0.0010		<0.0080	U	<0.010	U
		MSP011-D	NA		NA		NS		NS		NS		NS		NS		NS		NS		NS		NA		NA		NA	
	BM Lower Elk Pond	MSP012	0.00097		0.0012		NS		NS		NS		NS		NS		NS		NS		NS		0.0015		0.010		<0.010	U
	BM Northeast Pond	MSP013	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS	
	BM Pit #4 Stock Pond	MSP059	<0.00070	U	0.00040		NS		NS		NS		NS		NS		NS		NS		NS		0.00040		0.0088		<0.010	U
	BM Pit #6 Pond	MSP062	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		0.0021		NS		NS	

Table 7 continued
Ponds - Filtered Results - COPC (mg/L)†

Station			Nickel																			
			2001		2002								2003								2004	
Mine	Name	ID	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	May	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	0.016		0.021	J	NS		<0.028	U	NS		NS		NS		NS		NS		0.012	
		MSP017	0.016		0.021	J	NS		<0.028	U	NS		NS		NS		NS		NS		NA	
		MSP017-R1	NA		NA		NA		NA		NS		NS		NS		NS		NS		0.012	
		MSP017-R2	NA		NA		NA		NA		NS		NS		NS		NS		NS		0.012	
		MSP017-R3	NA		NA		NA		NA		NS		NS		NS		NS		NS		0.011	
	EVM Keyhole Pond	MSP018	1.5		1.7	J	1.3		0.60		0.81		1.3		1.6		1.5		1.1		1.9	
	EVM Bat Cave Pond	MSP019	0.011		0.012	J	NS		<0.028	U	NS		NS		NS		NS		NS		0.018	
	EVM West Pond	MSP020	0.011		0.011	J	NS		0.033		NS		NS		NS		NS		NS		0.032	
	EVM Stock Pond	MSP021-Avg	0.069		0.17	J	NS		0.031		NS		NS		NS		NS		NS		0.12	
		MSP021	0.069		NA		NS		0.031		NS		NS		NS		NS		NS		0.12	
		MSP021-R1	NA		0.17	J	NA		NA		NS		NS		NS		NS		NS		NA	
		MSP021-R2	NA		0.17	J	NA		NA		NS		NS		NS		NS		NS		NA	
		MSP021-R3	NA		0.18	J	NA		NA		NS		NS		NS		NS		NS		NA	
	EVM Tipple Pond	MSP022	<0.0033	U	0.0050	J	NS		<0.028	U	NS		NS		NS		NS		NS		<0.0050	U
	EVM Haul Road Pond	MSP023	<0.0033	U	<0.0035	J	NS		<0.028	U	NS		NS		NS		NS		NS		0.0058	
	EVM Shop Pond	MSP031	0.022		0.015	J	NS		0.058		NS		NS		NS		NS		NS		<0.0050	U
Henry Mine	HM Henry Pond	MSP014	<0.0033	U	0.0090	J	NS		<0.028	U	NS		NS		NS		NS		NS		0.011	
	HM Smith Pond	MSP015	0.0060		0.0046	J	NS		<0.028	U	NS		NS		NS		NS		NS		<0.0050	U
	HM Center Henry Pond	MSP016-Avg	0.0046		0.0035	J	NS		<0.028	U	NS		NS		NS		NS		NS		<0.0050	U
		MSP016	0.0046		0.0035	J	NS		NA		NS		NS		NS		NS		NS		NA	
		MSP016-D	0.0046		NA		NS		NA		NS		NS		NS		NS		NS		NA	
		MSP016-R1	NA		NA		NS		0.028		NS		NS		NS		NS		NS		<0.0050	U
		MSP016-R2	NA		NA		NS		<0.028	U	NS		NS		NS		NS		NS		<0.0050	U
		MSP016-R3	NA		NA		NS		<0.028	U	NS		NS		NS		NS		NS		<0.0050	U
	HM South Pit Pond	MSP055	0.96		0.15	J	0.49		NS		NS		0.38		0.47		0.79		0.65		0.57	
Ballard Mine	BM Dredge Pond	MSP010-Avg	0.031		0.017	J	0.052		0.12		NS		0.023		0.024		0.055		0.071		0.025	
		MSP010	0.031		NA		NA		0.12		NS		NA		NA		0.055		0.071		0.025	
		MSP010-R1	NA		0.018	J	0.050		NA		NA		0.024		0.023		NA		0.071		NA	
		MSP010-R2	NA		0.018	J	0.053		NA		NA		0.023		0.023		NA		0.071		NA	
		MSP010-R3	NA		0.016	J	0.052		NA		NA		0.023		0.025		NA		0.071		NA	
	BM Upper Elk Pond	MSP011-Avg	0.0091		0.0078	J	NS		NS		NS		NS		NS		NS		NS		0.0099	
		MSP011	0.0091		0.0078	J	NS		NS		NS		NS		NS		NS		NS		NA	
		MSP011-R1	NA		NA		NS		NS		NS		NS		NS		NS		NS		0.0099	
		MSP011-R2	NA		NA		NS		NS		NS		NS		NS		NS		NS		0.0099	
		MSP011-R3	NA		NA		NS		NS		NS		NS		NS		NS		NS		0.0099	
	BM Lower Elk Pond	MSP012	0.0080		0.0086	J	NS		NS		NS		NS		NS		NS		NS		0.0081	
	BM Northeast Pond	MSP013	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS	
	BM Pit #4 Stock Pond	MSP059	0.0098		0.0060	J	NS		NS		NS		NS		NS		NS		NS		0.0072	
	BM Pit #6 Pond	MSP062	NS		NS		NS		NS		NS		NS		NS		NS		NS		0.015	

Table 7 continued
Ponds - Filtered Results - COPC (mg/L)†

Station			Vanadium																						Zinc									
			2001		2002								2003										2004		2001		2002							
	Name	ID	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	Jan.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	May	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	<0.0095	UJ	<0.0050	U	NS		<0.0050	U	NS		NS		NS		NS		NS		NS		0.0025		0.019	J	0.015		NS		<0.075	U	NS	
		MSP017	<0.0095	UJ	<0.0050	U	NS		<0.0050	U	NS		NS		NS		NS		NS		NS		0.0025		0.019	J	0.015		NS		<0.075	U	NS	
		MSP017-R1	NA		NA		NS		NA		NS		NS		NS		NS		NS		NS		NA		NA		NA		NS		NA		NS	
		MSP017-R2	NA		NA		NS		NA		NS		NS		NS		NS		NS		NS		NA		NA		NA		NS		NA		NS	
		MSP017-R3	NA		NA		NS		NA		NS		NS		NS		NS		NS		NS		NA		NA		NA		NS		NA		NS	
	EVM Keyhole Pond	MSP018	0.061	J	0.083		0.048		0.022		0.040		0.030		0.093		0.076		0.055		0.035		0.086		6.6	J	6.6		2.6		0.92		4.0	J
	EVM Bat Cave Pond	MSP019	0.019	J	0.014		NS		0.013		NS		NS		NS		NS		NS		NS		0.018		<0.010	UJ	<0.015	U	NS		<0.075	U	NS	
	EVM West Pond	MSP020	0.013	J	0.013		NS		0.0089		NS		NS		NS		NS		NS		NS		0.017		<0.010	UJ	<0.015	U	NS		<0.075	U	NS	
	EVM Stock Pond	MSP021-Avg	0.022	J	0.029		NS		0.016		NS		NS		NS		NS		NS		NS		0.036		0.16	J	0.88		NS		<0.075	U	NS	
		MSP021	0.022	J	NA		NS		0.016		NS		NS		NS		NS		NS		NS		0.036		0.16	J	NA		NS		<0.075	U	NS	
		MSP021-R1	NA		0.031		NS		NA		NS		NS		NS		NS		NS		NS		NA		NA		0.88		NA		NA		NS	
		MSP021-R2	NA		0.029		NS		NA		NS		NS		NS		NS		NS		NS		NA		NA		0.86		NA		NA		NS	
		MSP021-R3	NA		0.028		NS		NA		NS		NS		NS		NS		NS		NS		NA		NA		0.89		NA		NA		NS	
	EVM Tipple Pond	MSP022	0.024	J	0.019		NS		0.043		NS		NS		NS		NS		NS		NS		0.0093		<0.010	UJ	<0.015	U	NS		<0.075	U	NS	
	EVM Haul Road Pond	MSP023	0.026	J	0.040		NS		0.032		NS		NS		NS		NS		NS		NS		0.056		<0.010	UJ	<0.0020	U	NS		<0.075	U	NS	
	EVM Shop Pond	MSP031-Avg	<0.0095	UJ	<0.0050	U	NS		0.040		NS		NS		NS		NS		NS		NS		0.0041		0.024	J	0.022		NS		0.079		NS	
		MSP031	<0.0095	UJ	<0.0050	U	NS		0.040		NS		NS		NS		NS		NS		NS		0.0041		0.025	J	0.022		NS		0.079		NS	
		MSP031-D	NA		NA		NS		NA		NS		NS		NS		NS		NS		NS		NA		0.023	J	NA		NA		NA		NS	
Henry Mine	HM Henry Pond	MSP014	<0.0095	UJ	<0.0050	U	NS		<0.0050	U	NS		NS		NS		NS		NS		NS		0.0028		<0.010	UJ	<0.015	U	NS		<0.075	U	NS	
	HM Smith Pond	MSP015	<0.0095	UJ	<0.0050	U	NS		0.0078		NS		NS		NS		NS		NS		NS		0.0026		0.012	J	<0.015	U	NS		<0.075	U	NS	
	HM Center Henry Pond	MSP016-Avg	<0.0095	UJ	<0.0050	U	NS		0.019		NS		NS		NS		NS		NS		NS		0.0045		<0.010	UJ	<0.015	U	NS		<0.075	U	NS	
		MSP016	<0.0095	UJ	<0.0050	U	NS		NA		NS		NS		NS		NS		NS		NS		NA		<0.010	UJ	<0.015	U	NS		NA		NS	
		MSP016-D	<0.0095	UJ	NA		NS		NA		NS		NS		NS		NS		NS		NS		NA		NA		NA		NS		NA		NS	
		MSP016-R1	NA		NA		NS		0.020		NS		NS		NS		NS		NS		NS		0.0045		NA		NA		NS		<0.075	U	NS	
		MSP016-R2	NA		NA		NS		0.018		NS		NS		NS		NS		NS		NS		0.0044		NA		NA		NS		<0.075	U	NS	
		MSP016-R3	NA		NA		NS		0.019		NS		NS		NS		NS		NS		NS		0.0046		NA		NA		NS		<0.075	U	NS	
	HM South Pit Pond	MSP055	0.038	J	0.029		0.040		NS		NS		NS		0.041		0.043		0.033		0.031		0.038		4.0	J	0.33		0.59		NS		NS	
Ballard Mine	BM Dredge Pond	MSP010-Avg	0.012	J	0.013		0.025		0.023		NS		NS		0.016		0.015		0.039		0.029		0.016		0.025	J	<0.015	U	<0.070	U	<0.075	U	NS	
		MSP010	0.012	J	NA		NA		0.023		NS		NS		NA		NA		0.039		0.029		0.016		0.025	J	NA		NA		<0.075	U	NS	
		MSP010-R1	NA		0.012		0.024		NA		NA		NA		0.016		0.015		NA		NA		NA		NA		<0.015	U	<0.070	U	NA		NS	
		MSP010-R2	NA		0.014		0.026		NA		NA		NA		0.016		0.015		NA		NA		NA		NA		<0.015	U	<0.070	U	NA		NS	
		MSP010-R3	NA		0.013		0.026		NA		NA		NA		0.016		0.015		NA		NA		NA		NA		<0.015	U	<0.070	U	NA		NS	
	BM Upper Elk Pond	MSP011-Avg	0.048	J	0.024		NS		NS		NS		NS		NS		NS		NS		NS		0.013		<0.010	UJ	<0.015	U	NS		NS		NS	
		MSP011	0.048	J	0.024		NS		NS		NS		NS		NS		NS		NS		NS		NA		<0.010	UJ	<0.015	U	NS		NS		NS	
		MSP011-D	NA		NA		NS		NS		NS		NS		NS		NS		NS		NS		NA		<0.010	UJ	NA		NS		NS		NS	
		MSP011-R1	NA		NA		NS		NS		NS		NS		NS		NS		NS		NS		0.012		NA		NA		NS		NS		NS	
		MSP011-R2	NA		NA		NS		NS		NS		NS		NS		NS		NS		NS		0.013		NA		NA		NS		NS		NS	
		MSP011-R3	NA		NA		NS		NS		NS		NS		NS		NS		NS		NS		0.013		NA		NA		NS		NS		NS	
	BM Lower Elk Pond	MSP012	0.040	J	0.039		NS		NS		NS		NS		NS		NS		NS		NS		0.027		0.010	J	<0.015	U	NS		NS		NS	
	BM Northeast Pond	MSP013	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS	
	BM Pit #4 Stock Pond	MSP059	<0.0095	UJ	<0.0050	U	NS		NS		NS		NS		NS		NS		NS		NS		0.012		<0.010	UJ	<0.015	U	NS		NS		NS	
	BM Pit #6 Pond	MSP062	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		0.0062		NS		NS		NS		NS		NS	

Table 7 continued
Ponds - Filtered Results - COPC (mg/L)†

Station			Zinc											
			2003										2004	
Mine	Name	ID	Jan.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	NS		NS		NS		NS		NS		0.012	
		MSP017	NS		NS		NS		NS		NS		NA	
		MSP017-R1	NS		NS		NS		NS		NS		0.012	
		MSP017-R2	NS		NS		NS		NS		NS		0.012	
		MSP017-R3	NS		NS		NS		NS		NS		0.012	
	EVM Keyhole Pond	MSP018	3.8		5.7		6.5		4.3		1.9		7.2	
	EVM Bat Cave Pond	MSP019	NS		NS		NS		NS		NS		0.0060	
	EVM West Pond	MSP020	NS		NS		NS		NS		NS		0.032	
	EVM Stock Pond	MSP021-Avg	NS		NS		NS		NS		NS		0.40	
		MSP021	NS		NS		NS		NS		NS		0.40	
		MSP021-R1	NS		NS		NS		NS		NS		NA	
		MSP021-R2	NS		NS		NS		NS		NS		NA	
		MSP021-R3	NS		NS		NS		NS		NS		NA	
	EVM Tipple Pond	MSP022	NS		NS		NS		NS		NS		<0.0020	U
	EVM Haul Road Pond	MSP023	NS		NS		NS		NS		NS		0.0060	
	EVM Shop Pond	MSP031-Avg	NS		NS		NS		NS		NS		<0.0020	U
		MSP031	NS		NS		NS		NS		NS		<0.0020	U
		MSP031-D	NS		NS		NS		NS		NS		NA	
Henry Mine	HM Henry Pond	MSP014	NS		NS		NS		NS		NS		0.0040	
	HM Smith Pond	MSP015	NS		NS		NS		NS		NS		<0.0040	U
	HM Center Henry Pond	MSP016-Avg	NS		NS		NS		NS		NS		<0.0020	U
		MSP016	NS		NS		NS		NS		NS		NA	
		MSP016-R1	NS		NS		NS		NS		NS		<0.0020	U
		MSP016-R2	NS		NS		NS		NS		NS		<0.0020	U
		MSP016-R3	NS		NS		NS		NS		NS		<0.0020	U
	HM South Pit Pond	MSP055	NS		1.7		1.6		1.7		0.65		1.9	
Ballard Mine	BM Dredge Pond	MSP010-Avg	NS		<0.045	U	<0.070	U	<0.080	U	<0.075	U	0.0090	
		MSP010	NS		NA		NA		<0.080	U	<0.075	U	0.0090	
		MSP010-R1	NS		<0.045	U	0.021		NA		NA		NA	
		MSP010-R2	NS		<0.045	U	0.019		NA		NA		NA	
		MSP010-R3	NS		<0.045	U	0.022		NA		NA		NA	
	BM Upper Elk Pond	MSP011-Avg	NS		NS		NS		NS		NS		0.011	
		MSP011	NS		NS		NS		NS		NS		NA	
		MSP011-D	NS		NS		NS		NS		NS		NA	
		MSP011-R1	NS		NS		NS		NS		NS		0.010	
		MSP011-R2	NS		NS		NS		NS		NS		0.011	
		MSP011-R3	NS		NS		NS		NS		NS		0.011	
	BM Lower Elk Pond	MSP012	NS		NS		NS		NS		NS		0.010	
	BM Northeast Pond	MSP013	NS		NS		NS		NS		NS		NS	
	BM Pit #4 Stock Pond	MSP059	NS		NS		NS		NS		NS		0.0070	
	BM Pit #6 Pond	MSP062	NS		NS		NS		NS		NS		0.020	

Notes:
† All data has been censored at the reporting limit.
Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004). Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.
Data qualifier definitions are:
(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.
(J) - The result is an estimated quantity.
(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 8
Ponds - Filtered Results - Screening Analytes (mg/L)†

Station			Aluminum		Antimony		Arseinc		Barium		Beryllium		Calcium																					
			2001		2001		2001		2001		2001		2001		2002								2003										2004	
Mine	Name	ID	May	Flag	May	Flag	May	Flag	May	Flag	May	Flag	Spring	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	Jan.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	May	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	<0.034	UJ	<0.0025	U	0.0010		<0.065	UJ	<0.0050	U	250		220	J	NS		320		NS		NS		NS		NS		NS		NS		200	
		MSP017	<0.034	UJ	<0.0025	U	0.0010		<0.065	UJ	<0.0050	U	250		220	J	NS		320		NS		NS		NS		NS		NS		NS		NA	
		MSP017-R1	NA		NA		NA		NA		NA		NA		NA		NA		NA		NS		NS		NS		NS		NS		NS		200	
		MSP017-R2	NA		NA		NA		NA		NA		NA		NA		NA		NA		NS		NS		NS		NS		NS		NS		200	
		MSP017-R3	NA		NA		NA		NA		NA		NA		NA		NA		NA		NS		NS		NS		NS		NS		NS		200	
	EVM Keyhole Pond	MSP018	0.074	J	<0.0025	U	0.00082		<0.065	UJ	<0.0050	U	390		370	J	430		430		320		360		310		350		390		420		280	
	EVM Bat Cave Pond	MSP019	<0.034	UJ	<0.0025	U	0.0033		<0.065	UJ	<0.0050	U	99		77	J	NS		81		NS		NS		NS		NS		NS		NS		78	
	EVM West Pond	MSP020	<0.034	UJ	<0.0025	U	0.0015		<0.065	UJ	<0.0050	U	62		88	J	NS		190		NS		NS		NS		NS		NS		NS		88	
	EVM Stock Pond	MSP021-Avg	<0.034	UJ	<0.0025	U	0.0016		<0.065	UJ	<0.0050	U	180		200	J	NS		230		NS		NS		NS		NS		NS		NS		250	
		MSP021	<0.034	UJ	<0.0025	U	0.0016		<0.065	UJ	<0.0050	U	180		NA		NS		230		NS		NS		NS		NS		NS		NS		250	
		MSP021-R1	NA		NA		NA		NA		NA		NA		200	J	NA		NA		NS		NS		NS		NS		NS		NS		NA	
		MSP021-R2	NA		NA		NA		NA		NA		NA		200	J	NA		NA		NS		NS		NS		NS		NS		NS		NA	
		MSP021-R2	NA		NA		NA		NA		NA		NA		190	J	NA		NA		NS		NS		NS		NS		NS		NS		NA	
	EVM Tipple Pond	MSP022	<0.034	UJ	<0.0025	U	0.0018		0.068	J	<0.0050	U	140		140	J	NS		270		NS		NS		NS		NS		NS		NS		150	
	EVM Haul Road Pond	MSP023	<0.034	UJ	<0.0025	U	0.0036		<0.065	UJ	<0.0050	U	120		85	J	NS		410		NS		NS		NS		NS		NS		NS		83	
	EVM Shop Pond	MSP031-Avg	<0.034	UJ	<0.0025	U	0.0027		<0.065	UJ	<0.0050	U	83		47	J	NS		67		NS		NS		NS		NS		NS		NS		49	
		MSP031	<0.034	UJ	<0.0025	U	0.0027		<0.065	UJ	<0.0050	U	83		47	J	NS		67		NS		NS		NS		NS		NS		NS		49	
		MSP031-D	NA		NA		NA		<0.065	UJ	<0.0050	U	82		NA		NA		NA		NS		NS		NS		NS		NS		NS		NA	
Henry Mine	HM Henry Pond	MSP014	<0.034	UJ	<0.0025	U	0.0016		<0.065	UJ	<0.0050	U	90		130	J	NS		230		NS		NS		NS		NS		NS		NS		190	
	HM Smith Pond	MSP015	<0.034	UJ	<0.0025	U	0.0021		<0.065	UJ	<0.0050	U	120		130	J	NS		86		NS		NS		NS		NS		NS		NS		140	
	HM Center Henry Pond	MSP016-Avg	<0.034	UJ	<0.0025	U	0.0013		<0.065	UJ	<0.0050	U	91		100	J	NS		68		NS		NS		NS		NS		NS		NS		96	
		MSP016	<0.034	UJ	<0.0025	U	0.0013		<0.065	UJ	<0.0050	U	91		100	J	NS		NA		NS		NS		NS		NS		NS		NS		NA	
		MSP016-D	<0.034	UJ	<0.0025	U	0.0012		NA		NA		NA		NA		NA		NA		NS		NS		NS		NS		NS		NS		NA	
		MSP016-R1	NA		NA		NA		NA		NA		NA		NA		NA		69		NS		NS		NS		NS		NS		NS		96	
		MSP016-R2	NA		NA		NA		NA		NA		NA		NA		NA		68		NS		NS		NS		NS		NS		NS		97	
		MSP016-R3	NA		NA		NA		NA		NA		NA		NA		NA		68		NS		NS		NS		NS		NS		NS		96	
	HM South Pit Pond	MSP055	0.0023	UJ	<0.0025	U	0.00080		<0.065	UJ	<0.0050	U	260		67	J	320		NS		NS		NS		110		140		290		370		180	
Ballard Mine	BM Dredge Pond	MSP010-Avg	<0.034	UJ	<0.0025	U	0.0033		<0.065	UJ	<0.0050	U	240		150	J	200		380		NS		NS		170		160		240		270		200	
		MSP010	<0.034	UJ	<0.0025	U	0.0033		<0.065	UJ	<0.0050	U	240		NA		NA		380		NS		NS		NA		NA		240		270		200	
		MSP010-R1	NA		NA		NA		NA		NA		NA		150	J	180		NA		NS		NS		170		170		NA		NA		NA	
		MSP010-R2	NA		NA		NA		NA		NA		NA		150	J	210		NA		NS		NS		170		160		NA		NA		NA	
		MSP010-R3	NA		NA		NA		NA		NA		NA		150	J	210		NA		NS		NS		170		160		NA		NA		NA	
	BM Upper Elk Pond	MSP011-Avg	<0.034	UJ	<0.0025	U	0.0061		<0.065	UJ	<0.0050	U	<46	U	28	J	NS		NS		NS		NS		NS		NS		NS		NS		32	
		MSP011	<0.034	UJ	<0.0025	U	0.0061		<0.065	UJ	<0.0050	U	<46	U	28	J	NS		NS		NS		NS		NS		NS		NS		NS		NA	
		MSP011-D	NA		NA		NA		<0.065	UJ	<0.0050	U	<46	U	NA		NS		NS		NS		NS		NS		NS		NS		NS		NA	
		MSP011-R1	NA		NA		NA		NA		NA		NA		NA		NS		NS		NS		NS		NS		NS		NS		NS		32	
		MSP011-R2	NA		NA		NA		NA		NA		NA		NA		NS		NS		NS		NS		NS		NS		NS		NS		33	
		MSP011-R3	NA		NA		NA		NA		NA		NA		NA		NS		NS		NS		NS		NS		NS		NS		NS		32	
	BM Lower Elk Pond	MSP012	<0.034	UJ	<0.0025	U	0.0039		<0.065	UJ	<0.0050	U	NS		34	J	NS		NS		NS		NS		NS		NS		NS		NS		34	
	BM Northeast Pond	MSP013	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS	
	BM Pit #4 Stock Pond	MSP059	0.038	J	<0.0025	U	0.0030		<0.065	UJ	<0.0050	U	<46	U	12	J	NS		NS		NS		NS		NS		NS		NS		NS		22	
	BM Pit #6 Pond	MSP062	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		46	

Table 8 continued
Ponds - Filtered Results - Screening Analytes (mg/L)†

Station			Chloride								Cobalt		Copper				Iron		Lead		Manganese		Mercury		Molybdenum		Nitrate/Nitrite		Silver	
			2001		2002				2004		2002		2001		2002		2001		2001		2001		2001		2001		2001		2001	
Mine	Name	ID	May	Flag	May	Flag	Sept.	Flag	May	Flag	May	Flag	May	Flag	May	Flag	Spring	Flag	May	Flag	May	Flag	May	Flag	May	Flag	May	Flag	May	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	49		14	J	90		18		<0.010	U	0.0024		<0.0045	U	<0.010	U	<0.0027	U	0.42		<0.00050	U	0.0040	J	<2.1	UJ	<0.0021	U
		MSP017	49		14	J	90		NA		<0.010	U	0.0024		<0.0045	U	<0.010	U	<0.0027	U	0.42		<0.00050	U	0.0040	J	<2.1	UJ	<0.0021	U
		MSP017-R1	NA		NA		NA		18		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
		MSP017-R2	NA		NA		NA		18		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
		MSP017-R3	NA		NA		NA		18		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
	EVM Keyhole Pond	MSP018	<12	U	0.55	J	4.0		3.3		0.020		0.0030		<0.0045	U	<0.010	U	<0.0027	U	3.4		<0.00050	U	0.022	J	<2.1	U	<0.0021	U
	EVM Bat Cave Pond	MSP019	<12	U	3.2	J	12		3.0		<0.010	U	0.0021		<0.0045	U	<0.010	U	<0.0027	U	<0.0020	U	<0.00050	U	0.0086	J	<2.1	U	<0.0021	U
	EVM West Pond	MSP020	<12	U	5.7	J	11		17		<0.010	U	0.0012		<0.0045	U	<0.010	U	<0.0027	U	0.0085		<0.00050	U	0.0047	J	<2.1	U	<0.0021	U
	EVM Stock Pond	MSP021-Avg	29		15	J	NS		34		<0.010	U	0.0016		<0.0045	U	<0.010	U	<0.0027	U	<0.0020	U	<0.00050	U	0.015	J	<2.1	U	<0.0021	U
		MSP021	29		NA		NS		34		NA		0.0016		NA		<0.010	U	<0.0027	U	<0.0020	U	<0.00050	U	0.015	J	<2.1	U	<0.0021	U
		MSP021-R1	NA		15	J	NA		NA		<0.010	U	NA		<0.0045	U	NA		NA		NA		NA		NA		NA		NA	
		MSP021-R2	NA		15	J	NA		NA		<0.010	U	NA		<0.0045	U	NA		NA		NA		NA		NA		NA		NA	
		MSP021-R2	NA		15	J	NA		NA		<0.010	U	NA		<0.0045	U	NA		NA		NA		NA		NA		NA		NA	
	EVM Tipple Pond	MSP022	140		160	J	600		180		<0.010	U	0.0013		<0.0045	U	<0.010	U	<0.0027	U	<0.0020	U	<0.00050	U	0.0086	J	<2.1	U	<0.0021	U
	EVM Haul Road Pond	MSP023	210		130	J	1200		57		<0.010	U	0.0020		<0.0045	U	<0.010	U	<0.0027	U	<0.0020	U	<0.00050	U	0.024	J	<2.1	U	<0.0021	U
	EVM Shop Pond	MSP031-Avg	210		120	J	240		98		<0.010	U	0.0021		<0.0045	U	0.080		<0.0027	U	0.036		<0.00050	U	0.0093	J	<2.1	U	<0.0021	U
		MSP031	210		120	J	240		98		NA		NA		NA		0.079		NA		0.036		<0.00050	U	NA		NA		<0.0021	U
		MSP031-D	200		NA		NA		NA		NA		NA		NA		0.081		NA		0.036		NA		NA		NA		NA	
Henry Mine	HM Henry Pond	MSP014	<12	U	3.5	J	11		3.2		<0.010	U	0.0013		<0.0045	U	<0.010	U	<0.0027	U	0.017		<0.00050	U	0.0040	J	<2.1	U	<0.0021	U
	HM Smith Pond	MSP015	<12	U	4.0	J	6.0		4.1		<0.010	U	0.0020		<0.0045	U	<0.010	U	<0.0027	U	0.18		<0.00050	U	0.0072	J	<2.1	U	<0.0021	U
	HM Center Henry Pond	MSP016-Avg	<12	U	4.6	J	18		4.3		<0.010	U	<0.0012	U	<0.0045	U	<0.010	U	<0.0027	U	0.0077		<0.00050	U	<0.0025	UJ	<2.1	U	<0.0021	U
		MSP016	<12	U	4.6		NA		NA		<0.010	U	<0.0012	U	NA		<0.010	U	<0.0027	U	NA		<0.00050	U	0.0020		<2.1	U	<0.0021	U
		MSP016-D	NA		NA		NA		NA		NA		<0.0012	U	NA		NA		<0.0027	U	NA		<0.00050	U	0.0019		<2.1	U	<0.0021	U
		MSP016-R1	NA		NA		19		4.3		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
		MSP016-R2	NA		NA		18		4.3		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
		MSP016-R3	NA		NA		16		4.2		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
	HM South Pit Pond	MSP055	<12	U	0.90	J	NS		1.5		<0.010	U	0.0017		<0.0045	U	<0.010	U	<0.0027	U	<0.0020	U	<0.00050	U	0.036	J	<2.1	U	<0.0021	U
Ballard Mine	BM Dredge Pond	MSP010-Avg	<12	U	1.7	J	30		2.3		<0.010	U	0.0043		<0.0045	U	<0.010	U	<0.0027	U	0.024		<0.00050	U	0.046	J	<2.1	U	<0.0021	U
		MSP010	<12	U	NA		30		2.3		NA		0.0043		NA		<0.010	U	<0.0027	U	0.024		<0.00050	U	0.046	J	<2.1	U	<0.0021	U
		MSP010-R1	NA		1.7	J	NA		NA		<0.010	U	NA		<0.0045	U	NA		NA		NA		NA		NA		NA		NA	
		MSP010-R2	NA		1.8	J	NA		NA		<0.010	U	NA		<0.0045	U	NA		NA		NA		NA		NA		NA		NA	
		MSP010-R3	NA		1.7	J	NA		NA		<0.010	U	NA		<0.0045	U	NA		NA		NA		NA		NA		NA		NA	
	BM Upper Elk Pond	MSP011-Avg	<12	U	1.2	J	NS		1.2		<0.010	U	0.0041		<0.0045	U	<0.010	U	<0.0027	U	0.0036		<0.00050	U	0.019	J	<2.1	UJ	<0.0021	U
		MSP011	<12	U	1.2	J	NS		1.2		<0.010	U	0.0041		<0.0045	U	<0.010	U	NA		0.0036		<0.00050	U	NA		NA		<0.0021	U
		MSP011-D	<12	U	NA		NA		NA		NA		NA		NA		<0.010	U	NA		0.0036		NA		NA		NA		NA	
		MSP011-R1	NA		NA		NA		1.1		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
		MSP011-R2	NA		NA		NA		1.2		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
		MSP011-R3	NA		NA		NA		1.2		NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
	BM Lower Elk Pond	MSP012	<12	U	0.80	J	NS		1.2		<0.010	U	0.0034		<0.0045	U	<0.010	U	<0.0027	U	0.0021		<0.00050	U	0.025	J	<2.1	UJ	<0.0021	U
	BM Northeast Pond	MSP013	NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS	
	BM Pit #4 Stock Pond	MSP059	<12	U	0.60	J	NS		1.7		<0.010	U	0.0021		<0.0045	U	<0.010	U	<0.0027	U	0.0045		<0.00050	U	0.0090	J	<2.1	U	<0.0021	U
	BM Pit #6 Pond	MSP062	NS		NS		NS		4.8		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS	

Table 8 continued
Ponds - Filtered Results - Screening Analytes (mg/L)[T]

Station			Magnesium																							Potassium								Thallium	
			2001			2002								2003										2004		2001		2002				2004		2001	
Mine	Name	ID	Spring	RL	Flag	May	Flag	July	Flag	Sept.	Flag	Nov.	Flag	Jan.	Flag	April	Flag	May	Flag	June	Flag	July	Flag	Spring	Flag	Spring	Flag	May	Flag	Sept.	Flag	May	Flag	May	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	78			69		NS		120		NS		NS		NS		NS		NS		NS		71		<9.5	U	3.7		<4.5	U	3.7		<0.0025	U
		MSP017	78			69		NS		120		NS		NS		NS		NS		NS		NS		71		<9.5	U	3.7		<4.5	U	NA		<0.0025	U
		MSP017-R1	NA			NA		NS		NA		NS		NS		NS		NS		NS		NS		NA		NA		NA		NA		3.6		NA	
		MSP017-R2	NA			NA		NS		NA		NS		NS		NS		NS		NS		NS		NA		NA		NA		NA		3.6		NA	
		MSP017-R3	NA			NA		NS		NA		NS		NS		NS		NS		NS		NS		NA		NA		NA		NA		3.8		NA	
	EVM Keyhole Pond	MSP018	140			120		150		130		100		100		94		120		130		140		120		<9.5	U	2.6		<4.5	U	2.8		<0.0025	U
	EVM Bat Cave Pond	MSP019	29			25		NS		<61	U	NS		NS		NS		NS		NS		NS		27		<9.5	U	3.9		<4.5	U	4.5		<0.0025	U
	EVM West Pond	MSP020	<21	21	U	22		NS		<61	U	NS		NS		NS		NS		NS		NS		26		<9.5	U	2.1		5.3		2.4		<0.0025	U
	EVM Stock Pond	MSP021-Avg	51			56		NS		66		NS		NS		NS		NS		NS		NS		64		<9.5	U	1.6		<4.5	U	1.7		<0.0025	U
		MSP021	51			NA		NS		66		NS		NS		NS		NS		NS		NS		64		<9.5	U	NA		<4.5	U	1.7		<0.0025	U
		MSP021-R1	NA			57		NA		NA		NS		NS		NS		NS		NS		NS		NA		NA		1.5		NA		NA		NA	
		MSP021-R2	NA			56		NA		NA		NS		NS		NS		NS		NS		NS		NA		NA		1.6		NA		NA		NA	
		MSP021-R3	NA			55		NA		NA		NS		NS		NS		NS		NS		NS		NA		NA		1.7		NA		NA		NA	
	EVM Tipple Pond	MSP022	26			28		NS		120		NS		NS		NS		NS		NS		NS		28		<9.5	U	2.8		10		2.6		<0.0025	U
	EVM Haul Road Pond	MSP023	47			25		NS		218		NS		NS		NS		NS		NS		NS		19		<9.5	U	2.4		8.3		1.4		<0.0025	U
	EVM Shop Pond	MSP031-Avg	<21	21	U	11		NS		<61	U	NS		NS		NS		NS		NS		NS		9.4		<9.5	U	5.5		9.3		5.7		<0.0025	U
		MSP031	<21	21	U	11		NS		<61	U	NS		NS		NS		NS		NS		NS		9.4		<9.5	U	5.5		9.3		5.7		NA	
		MSP031-D	<21	21	U	NA		NA		NA		NS		NS		NS		NS		NS		NS		NA		<9.5	U	NA		NA		NA		NA	
Henry Mine	HM Henry Pond	MSP014	56			45		NS		110		NS		NS		NS		NS		NS		NS		52		<9.5	U	6.9		20		9.3		<0.0025	U
	HM Smith Pond	MSP015	35			37		NS		<61	U	NS		NS		NS		NS		NS		NS		38		<9.5	U	2.5		13		1.7		<0.0025	U
	HM Center Henry Pond	MSP016-Avg	<21	21	U	30		NS		<61	U	NS		NS		NS		NS		NS		NS		30		<9.5	U	2.5		22		2.5		<0.0025	U
		MSP016	<21	21	U	30		NS		NA		NS		NS		NS		NS		NS		NS		NA		<9.5	U	2.5		NA		NA		<0.0025	U
		MSP016-D	NA			NA		NS		NA		NS		NS		NS		NS		NS		NS		NA		NA		NA		NA		NA		<0.0025	U
		MSP016-R1	NA			NA		NS		<61	U	NS		NS		NS		NS		NS		NS		30		NA		NA		23		2.4		NA	
		MSP016-R2	NA			NA		NS		<61	U	NS		NS		NS		NS		NS		NS		31		NA		NA		22		2.6		NA	
		MSP016-R3	NA			NA		NS		<61	U	NS		NS		NS		NS		NS		NS		30		NA		NA		22		2.4		NA	
	HM South Pit Pond	MSP055	63			15		83		NS		NS		NS		25		32		72		95		45		<9.5	U	0.40		NS		1.0		<0.0025	U
Ballard Mine	BM Dredge Pond	MSP010-Avg	57			34		60		82		NS		NS		41		38		76		120		47		9.8		4.7		120		5.9		<0.0025	U
		MSP010	57			NA		NA		82		NS		NS		NA		NA		76		120		47		9.8		NA		120		5.9		<0.0025	U
		MSP010-R1	NA			34		57		NA		NA		NA		41		39		NA		NA		NA		NA		4.8		NA		NA		NA	
		MSP010-R2	NA			34		61		NA		NA		NA		41		38		NA		NA		NA		NA		4.5		NA		NA		NA	
		MSP010-R3	NA			34		62		NA		NA		NA		41		38		NA		NA		NA		NA		4.7		NA		NA		NA	
	BM Upper Elk Pond	MSP011-Avg	<21	21	U	5.9		NS		NS		NS		NS		NS		NS		NS		NS		6.5		<9.5	U	3.2		NS		3.8		<0.0025	U
		MSP011	<21	21	U	5.9		NS		NS		NS		NS		NS		NS		NS		NS		NA		<9.5	U	3.2		NS		NA		NA	
		MSP011-D	<21	21	U	NA		NA		NS		NS		NS		NS		NS		NS		NS		NA		<9.5	U	NA		NA		NA		NA	
		MSP011-R1	NA			NA		NA		NS		NS		NS		NS		NS		NS		NS		6.4		NA		NA		NA		3.7		NA	
		MSP011-R2	NA			NA		NA		NS		NS		NS		NS		NS		NS		NS		6.5		NA		NA		NA		3.9		NA	
		MSP011-R3	NA			NA		NA		NS		NS		NS		NS		NS		NS		NS		6.5		NA		NA		NA		3.8		NA	
	BM Lower Elk Pond	MSP012	<21	21	U	8.1		NS		NS		NS		NS		NS		NS		NS		NS		7.3		<9.5	U	2.4		NS		3.0		<0.0025	U
	BM Northeast Pond	MSP013	NS			NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS		NS	
	BM Pit #4 Stock Pond	MSP059	<21	21	U	3.5		NS		NS		NS		NS		NS		NS		NS		NS		6.7		<9.5	U	2.0		NS		3.7		<0.0025	U
	BM Pit #6 Pond	MSP062	NS			NS		NS		NS		NS		NS		NS		NS		NS		NS		15		NS		NS		NS		10		NS	

Table 8 continued
Ponds - Filtered Results - Screening Analytes (mg/L)[T]

Station			Sulfate								Sodium								Uranium	
			2001		2002				2004		2001		2002				2004		2001	
Mine	Name	ID	May	Flag	May	Flag	Sept.	Flag	May	Flag	May	Flag	May	Flag	Sept.	Flag	May	Flag	May	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	700	J	720	J	1100	J	610		<22	UJ	8.1		<17	UJ	8.1		0.011	
		MSP017	700	J	720	J	1100	J	NA		<22	UJ	8.1		<17	UJ	NA		0.011	
		MSP017-R1	NA		NA		NA		610		NA		NA		NA		7.9		NA	
		MSP017-R2	NA		NA		NA		610		NA		NA		NA		8.0		NA	
		MSP017-R3	NA		NA		NA		610		NA		NA		NA		8.4		NA	
	EVM Keyhole Pond	MSP018	1500	J	1300	J	1500	J	1400		<22	UJ	13		17	J	14		0.010	
	EVM Bat Cave Pond	MSP019	220	J	190	J	230	J	240		<22	UJ	4.9		<17	UJ	4.5		<0.0080	U
	EVM West Pond	MSP020	280	J	250	J	500	J	230		<22	UJ	4.1		<17	UJ	4.3		<0.0080	U
	EVM Stock Pond	MSP021-Avg	480	J	470	J	NS		700		<22	UJ	8.4		<17	UJ	9.9		0.0084	
		MSP021	480	J	NA		NS		700		<22	UJ	NA		<17	UJ	9.9		0.0084	
		MSP021-R1	NA		490	J	NA		NA		NA		8.7		NA		NA		NA	
		MSP021-R2	NA		450	J	NA		NA		NA		8.4		NA		NA		NA	
		MSP021-R3	NA		470	J	NA		NA		NA		8.2		NA		NA		NA	
	EVM Tipple Pond	MSP022	320	J	140	J	340	J	170		<22	UJ	9.5		18	J	9.7		<0.0080	U
	EVM Haul Road Pond	MSP023	160	J	93	J	500		140		<22	UJ	5.3		17	J	4.3		0.011	
	EVM Shop Pond	MSP031-Avg	120	J	39	J	85	J	24		90	J	58		140		47		<0.0080	U
		MSP031	120	J	39	J	85	J	24		90		58		140		47		<0.0080	U
		MSP031-D	120	J	NA		NA		NA		90		NA		NA		NA		NA	
Henry Mine	HM Henry Pond	MSP014	430	J	390	J	940	J	560		<22	UJ	8.4		23	J	11		<0.0080	U
	HM Smith Pond	MSP015	500	J	230	J	300	J	230		<22	UJ	8.3		<17	UJ	8.5		<0.0080	U
	HM Center Henry Pond	MSP016-Avg	230	J	180	J	260	J	170		<22	UJ	7.9		17	J	7.8		<0.0080	U
		MSP016	230	J	180	J	NA		NA		<22	UJ	7.9		17	J	7.8		<0.0080	U
		MSP016-D	NA		NA		NA		NA		NA		NA		NA		NA		<0.0080	U
		MSP016-R1	NA		NA		260	J	170		NA		NA		17	J	7.7		NA	
		MSP016-R2	NA		NA		260	J	170		NA		NA		17	J	7.9		NA	
		MSP016-R3	NA		NA		250	J	160		NA		NA		17	J	7.7		NA	
	HM South Pit Pond	MSP055	700	J	230	J	NS		510		<22	UJ	58		NS		2.9		<0.0080	U
Ballard Mine	BM Dredge Pond	MSP010-Avg	630	J	150	J	1400	J	420		<22	UJ	7.2		28	J	9.4		0.059	
		MSP010	630	J	NA		1400	J	420		<22	UJ	NA		28	J	9.4		0.059	
		MSP010-R1	NA		150	J	NA		NA		NA		7.3		NA		NA		NA	
		MSP010-R2	NA		150	J	NA		NA		NA		7.0		NA		NA		NA	
		MSP010-R3	NA		150	J	NA		NA		NA		7.2		NA		NA		NA	
	BM Upper Elk Pond	MSP011-Avg	13	J	12	J	NS		9		<22	UJ	1.8		NS		1.8		<0.0080	U
		MSP011	13	J	12	J	NS		NA		<22	UJ	1.8		NS		NA		<0.0080	U
		MSP011-D	13	J	NA		NA		NA		<22	UJ	NA		NS		1.8		NA	
		MSP011-R1	NA		NA		NA		9.1		NA		NA		NS		1.8		NA	
		MSP011-R2	NA		NA		NA		9.1		NA		NA		NS		1.8		NA	
		MSP011-R3	NA		NA		NA		9.0		NA		NA		NS		1.8		NA	
	BM Lower Elk Pond	MSP012	42	J	29	J	NS		23		<22	UJ	1.6		NS		1.7		<0.0080	U
	BM Northeast Pond	MSP013	NS		NS		NS		NS		NS		NS		NS		NS		NS	
	BM Pit #4 Stock Pond	MSP059	13	J	2.0	J	NS		8.8		<22	UJ	1.2		NS		2.4		<0.0080	U
	BM Pit #6 Pond	MSP062	NS		NS		NS		0.6		NS		NS		NS		2.7		NS	

Notes:

[T] All data has been censored at the reporting limit.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Results have been averaged using a Minimum Variance Unbiased Estimator method assuming a lognormal distribution of the data. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

Data qualifier definitions are:

(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.

(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Appendix D
Unfiltered and Filtered Results[‡]

[‡] All data has been reported uncensored.

Appendix D: Unfiltered and Filtered Results[‡]

Table 1: Domestic and Agricultural Wells – Unfiltered Results

Table 2: Monitoring and Production Wells – Unfiltered Results – COPC

Table 3: Monitoring and Production Wells – Unfiltered Results – Screening Analytes

Table 4: Seeps, Springs, and Headwater Streams – Unfiltered Results – COPC

Table 5: Seeps, Springs, and Headwater Streams – Unfiltered Results – Screening Analytes

Table 6: Ponds – Unfiltered Results – COPC

Table 7: Ponds – Unfiltered Results – Screening Analytes

Table 8: Domestic and Agricultural Wells – Filtered Results – COPC

Table 9: Domestic and Agricultural Wells – Filtered Results – Screening Analytes

Table 10: Monitoring and Production Wells – Filtered Results – COPC

Table 11: Monitoring and Production Wells – Filtered Results – Screening Analytes

Table 12: Seeps, Springs, and Headwater Streams – Filtered Results – COPC

Table 13: Seeps, Springs, and Headwater Streams – Filtered Results – Screening Analytes

Table 14: Ponds – Filtered Results – COPC

Table 15: Ponds – Filtered Results – Screening Analytes

[‡] All data has been reported uncensored.

Table 1
Domestic and Agricultural Wells - Unfiltered Results (mg/L)‡

Station		Selenium						Cadmium						Chromium						Nickel					
		2004						2004						2004						2004					
Well Name	Well ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
School Bus Well	MAW001-Avg	0.00053	0.0010	U	NS			0.00014	0.00020	U	NS			0.00087			NS			0.0014	0.0025	U	NS		
	MAW001	NA			NS			NA			NS			NA			NS			NA			NS		
	MAW001-R1	0.00043	0.0010	U	NS			0.000090	0.00020	U	NS			0.00090			NS			0.0016	0.0025	U	NS		
	MAW001-R2	0.00066	0.0010	U	NS			0.00018	0.00020	U	NS			0.0010			NS			0.0015	0.0025	U	NS		
	MAW001-R3	0.00049	0.0010	U	NS			0.00016	0.00020	U	NS			0.00070			NS			0.0012	0.0025	U	NS		
(b) (6) Field Well	MAW002	-0.00064	0.0010	U	NS			0.000040	0.00020	U	NS			0.000060	0.00020	U	NS			0.0016	0.0025	U	NS		
(b) (6) Field Well	MAW003	-0.00061	0.0010	U	NS			0.00040			NS			0.0044			NS			0.0028			NS		
(b) (6) Field Well	MAW004	-0.00094	0.0010	U	NS			-0.000040	0.00020	U	NS			0.00020			NS			0.0049			NS		
(b) (6) Windmill Field Well	MAW005	-0.00016	0.0010	U	NS			0.0016			NS			0.0048			NS			0.0038			NS		
(b) (6) Field Well West	MAW006	NS			-0.00020	0.0010	U	NS			0.00016	0.00020	U	NS			0.0031			NS			0.0049		
(b) (6) Field Well North	MAW007	NS			-0.000080	0.0010	U	NS			0.000090	0.00010	U	NS			0.00070			NS			0.0029		
(b) (6) House Well	MDW001	0.00055	0.0010	U	NS			0.000050	0.00020	U	NS			0.00040			NS			0.0010	0.0025	U	NS		
(b) (6) House Well	MDW002	-0.00054	0.0010	U	NS			0.000050	0.00020	U	NS			0.00060			NS			0.00090	0.0025	U	NS		
(b) (6) House Well	MDW003	0.0020			NS			0.000070	0.00020	U	NS			0.00070			NS			0.0013	0.0025	U	NS		
(b) (6) House Well	MDW004	-0.00020	0.0010	U	NS			0.000020	0.00020	U	NS			0.0017			NS			0.0015	0.0025	U	NS		
Cedar Bay RV Park Well	MDW005	0.00022	0.0010	U	NS			-0.000030	0.00020	U	NS			0.00040			NS			0.0025	0.0025	U	NS		
(b) (6) House Well	MDW006	-0.00014	0.0010	U	NS			-0.000040	0.00020	U	NS			0.00090			NS			0.0011	0.0025	U	NS		

Station		Vanadium						Zinc						Total Alkalinity					
		2004						2004						2004					
Well Name	Well ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
School Bus Well	MAW001-Avg	0.00073			NS			0.024	0.16	U	NS			170			NS		
	MAW001	NA			NS			NA			NS			NA			NS		
	MAW001-R1	0.00070			NS			0.030	0.16	U	NS			180			NS		
	MAW001-R2	0.00090			NS			0.023	0.16	U	NS			180			NS		
	MAW001-R3	0.00060			NS			0.018	0.16	U	NS			150			NS		
(b) (6) Field Well	MAW002	0.00010	0.0010	U	NS			0.038	0.16	U	NS			250			NS		
(b) (6) Field Well	MAW003	0.0070			NS			0.30			NS			110			NS		
(b) (6) Field Well	MAW004	0.00070			NS			0.037	0.16	U	NS			700			NS		
(b) (6) Windmill Field Well	MAW005	0.0024			NS			21			NS			150			NS		
(b) (6) Field Well West	MAW006	NS			0.011			NS			0.036			NS			120		
(b) (6) Field Well North	MAW007	NS			0.00090			NS			0.087			NS			240		
(b) (6) House Well	MDW001	0.00040			NS			0.021	0.16	U	NS			190			NS		
(b) (6) House Well	MDW002	0.0041			NS			0.045	0.16	U	NS			150			NS		
(b) (6) House Well	MDW003	0.00070			NS			0.0050	0.16	U	NS			190			NS		
(b) (6) House Well	MDW004	0.0018			NS			0.078	0.16	U	NS			150			NS		
Cedar Bay RV Park Well	MDW005	0.00040			NS			0.052	0.16	U	NS			460			NS		
(b) House Well	MDW006	0.0028			NS			0.035	0.16	U	NS			150			NS		

Notes:

‡ All data has been reported uncensored.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

Data qualifier definitions are:

(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.

(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 2
Monitoring and Production Wells - Unfiltered Results - COPC (mg/L)‡

Station			Selenium									Cadmium									Chromium		
			1998[a]						2005			1998[a]						2005			2005		
Mine	Name	ID	Spring	RL	Flag	Fall	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Fall	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	0.00020	0.00070	U	0.00026	0.00070	U	NS			0.0021			-0.0010	0.0020	U	NS			NS		
	EVM Shop Well	MPW019	0.00082			0.0016	0.00070	U	NS			-0.00030	0.0020	U	-0.0012	0.0020	U	NS			NS		
	Degerstrom Well at EVM	MPW020	0.00010	0.00070	U	0.0017	0.00070	U	NS			0.0033			0.0013	0.0020	U	NS			NS		
Henry Mine	Henry North Pit Well S	MMW003	NS			NS			NS			NS			NS			NS			NS		
	Henry North Pit Well N	MMW004-Avg	NS			NS			-0.0012	0.0010	U	NS			NS			0.0029	0.083	U	0.042	0.083	U
		MMW004	NS			NS			NA			NS			NS			NA			NA		
		MMW004-R1	NS			NS			-0.0033	0.0010	U	NS			NS			0.0068	0.050	U	-0.0031	0.050	U
		MMW004-R2	NS			NS			-0.00025	0.0010	U	NS			NS			0.0017	0.10	U	-0.0081	0.10	U
		MMW004-R3	NS			NS			-0.00014	0.0010	U	NS			NS			0.00017	0.10	U	-0.011	0.10	U
	Henry South Pit Well	MPW022	NS			NS			-0.0013	0.0010	U	NS			NS			0.00085	0.10	U		0.10	U
	Henry Center Pit Well	MPW023	NS			NS			NS			NS			NS			NS			NS		
Ballard Mine	Ballard Pit East Well	MMW001-Avg	NS			NS			0.069			NS			NS			-0.027	0.050	U	-0.0051	0.050	U
	Ballard Pit West Well	MMW002-Avg	NS			NS			0.022			NS			NS			-0.032	0.050	U	0.0046	0.050	U

Station			Nickel									Vanadium									Zinc								
			1998[a]						2005			1998[a]						2005			1998[a]						2005		
Mine	Name	ID	Spring	RL	Flag	Fall	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	0.0095	0.010	U	0.010	0.010	U	NS			0.021			0.0077			NS			0.14			0.068			NS		
	EVM Shop Well	MPW019	-0.0084	0.010	U	-0.0027	0.010	U	NS			0.011			-0.0073	0.0043	U	NS			0.051			0.073			NS		
	Degerstrom Well at EVM	MPW020	0.17			0.12			NS			0.0092			0.0042	0.0043	U	NS			0.99			0.71			NS		
Henry Mine	Henry North Pit Well S	MMW003	NS			NS			NS			NS			NS			NS			NS			NS			NS		
	Henry North Pit Well N	MMW004-Avg	NS			NS			-0.0035	0.50	U	NS			NS			-0.13	0.17	U	NS			NS			480		
		MMW004	NS			NS			NA			NS			NS			NA			NS			NS			NA		
		MMW004-R1	NS			NS			-0.00056	0.30	U	NS			NS			-0.00091	0.10	U	NS			NS			280		
		MMW004-R2	NS			NS			-0.0039	0.60	U	NS			NS			-0.19	0.20	U	NS			NS			620		
		MMW004-R3	NS			NS			-0.0059	0.60	U	NS			NS			-0.19	0.20	U	NS			NS			530		
	Henry South Pit Well	MPW022	NS			NS			0.0022	0.60	U	NS			NS			-0.19	0.20	U	NS			NS			550		
	Henry Center Pit Well	MPW023	NS			NS			NS			NS			NS			NS			NS			NS			NS		
Ballard Mine	Ballard Pit East Well	MMW001	NS			NS			0.059	0.30	U	NS			NS			-0.057	0.10	U	NS			NS			450		
	Ballard Pit West Well	MMW002	NS			NS			0.023	0.30	U	NS			NS			-0.051	0.10	U	NS			NS			460		

Notes:

‡ All data has been reported uncensored.

[a] Data from 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1998.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

Data qualifier definitions are:

(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.

(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

COPC - Constituent of Potential Concern

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 3
Monitoring and Production Wells - Unfiltered Results - Screening Analytes (mg/L)‡

Station			Calcium						Iron									Magnesium						Manganese								
			1998[a]						1998[a]						2005			1998[a]						1998[a]						2005		
Mine	Name	ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	48			46			0.0046			0.095			NS			17			18			0.28			0.21			NS		
	EVM Shop Well	MPW019	73			63			0.0073			0.22			NS			9.3			9.0			0.040			0.032			NS		
	Degerstrom Well at EVM	MPW020	60			59			-0.0071	0.0015	U	0.089			NS			15			17			0.17			0.11			NS		
Henry Mine	Henry North Pit Well S	MMW003	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		
	Henry North Pit Well N	MMW004-Avg	NS			NS			NS			NS			0.63			NS			NS			NS			NS			0.053	0.43	U
		MMW004	NS			NS			NS			NS			NA			NS			NS			NS			NS			NA		
		MMW004-R1	NS			NS			NS			NS			0.70			NS			NS			NS			NS			0.040	0.30	U
		MMW004-R2	NS			NS			NS			NS			0.50			NS			NS			NS			NS			0.060	0.50	U
		MMW004-R3	NS			NS			NS			NS			0.70			NS			NS			NS			NS			0.060	0.50	U
	Henry South Pit Well	MPW022	NS			NS			NS			NS			8.1			NS			NS			NS			NS			0.37	0.50	U
	Henry Center Pit Well	MPW023	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		
Ballard Mine	Ballard Pit East Well	MMW001	NS			NS			NS			NS			0.20	0.24	U	NS			NS			NS			NS			0.15	0.30	U
	Ballard Pit West Well	MMW002	NS			NS			NS			NS			1.00			NS			NS			NS			NS			0.15	0.30	U

Station			Nitrate/Nitrite as N						Potassium						Sodium					
			2005						1998[a]						1998[a]					
Mine	Name	ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	NS			NS			2.0			1.8			13			14		
	EVM Shop Well	MPW019	0.060			NS			1.4			0.88			6.5			6.2		
	Degerstrom Well at EVM	MPW020	NS			NS			1.1			1.2			4.7			4.5		
Henry Mine	Henry North Pit Well S	MMW003	0.12			NS			NS			NS			NS			NS		
	Henry North Pit Well N	MMW004-Avg	1.4			1.4			NS			NS			NS			NS		
		MMW004	1.4			NA			NS			NS			NS			NS		
		MMW004-R1	NA			1.4			NS			NS			NS			NS		
		MMW004-R2	NA			1.3			NS			NS			NS			NS		
		MMW004-R3	NA			1.4			NS			NS			NS			NS		
	Henry South Pit Well	MPW022	0.10			0.0098	0.020	U	NS			NS			NS			NS		
	Henry Center Pit Well	MPW023	-0.0093	0.020	U	NS			NS			NS			NS			NS		
Ballard Mine	Ballard Pit East Well	MMW001	0.33			0.69			NS			NS			NS			NS		
	Ballard Pit West Well	MMW002	0.040			0.0076	0.020	U	NS			NS			NS			NS		

Table 3 continued
Monitoring and Production Wells - Unfiltered Results - Screening Analytes (mg/L)‡

Station			Total Alkalinity																	
			1998[a]						2004						2005					
Mine	Name	ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	180			200			160			170			NS			NS		
	EVM Shop Well	MPW019	200			190			220			220			190			NS		
	Degerstrom Well at EVM	MPW020	160			190			NS			94			NS			NS		
Henry Mine	Henry North Pit Well S	MMW003	NS			NS			120			160			150			NS		
	Henry North Pit Well N	MMW004-Avg	NS			NS			140			130			160			170		
		MMW004	NS			NS			NA			130			160			NA		
		MMW004-R1	NS			NS			140			NA			NA			170		
		MMW004-R2	NS			NS			140			NA			NA			170		
		MMW004-R3	NS			NS			140			NA			NA			170		
	Henry South Pit Well	MPW022	NS			NS			NS			200			180			180		
	Henry Center Pit Well	MPW023	NS			NS			NS			190			180			NS		
Ballard Mine	Ballard Pit East Well	MMW001-Avg	NS			NS			270			270			240			260		
		MMW001	NS			NS			270			NA			240			260		
		MMW001-R1	NS			NS			NA			270			NA			NA		
		MMW001-R2	NS			NS			NA			270			NA			NA		
		MMW001-R3	NS			NS			NA			270			NA			NA		
	Ballard Pit West Well	MMW002-Avg	NS			NS			300			310			280			290		
		MMW002	NS			NS			300			NA			280			290		
		MMW002-R1	NS			NS			NA			310			NA			NA		
		MMW002-R2	NS			NS			NA			310			NA			NA		
		MMW002-R3	NS			NS			NA			320			NA			NA		

Notes:
‡ All data has been reported uncensored.
[a] Data from 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1998.
Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).
Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.
Data qualifier definitions are:
(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.
(J) - The result is an estimated quantity.
(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 4
Seeps, Springs, and Headwater Streams - Unfiltered Results - COPC (mg/L)‡

Station			Selenium																										
			1997[a]			1998[a]						2000			2001			2002											
Mine	Station Name	Station ID	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			NS			NS			NS			0.0026		J	0.00060	0.0010	U	NS			Dry			NS		
	EVM S Dump Seep	MDS026	NS			NS			NS			NS			0.049		J	0.12			NS			0.020		J	NS		
	Hedin Spring	MSG001	NS			NS			NS			NS			NS			0.0010	0.015	U	NS			0.0042		J	NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			NS			Dry			NS			Dry			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			NS			Dry			NS			Dry			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			NS			Dry			NS			Dry			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS			NS			NS			NA			NS			0.014	0.015	U	Dry			Dry			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			NA			NS			Dry			NS			Dry			NS		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			NS			Dry			NS			NA			NS		
	W Fork Rasmussen Creek above Rasmussen Creek	MST274	NS			NS			NS			NS			NS			0.0040	0.015	U	0.0030			-0.00039	0.0010	UJ	NS		
	N Fork Lone Pine Creek above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			NS			Dry			NS			0.00010	0.0010	UJ	NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			NS			NS			Dry			NS			Dry			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	0.0011			0.00038			-0.00024	0.00020	U	0.0060			0.00071	0.0010	U	0.00047	0.0010	U	NS			-0.0016	0.0010	UJ	NS		
		MDS022	0.0011			0.00038			-0.00024	0.00020	U	0.0060			0.00071	0.0010	U	NA			NS			-0.0016	0.0010	UJ	NS		
		MDS022-R1	NA			NA			NA			NA			NA			0.00080	0.0010	U	NS			NA			NS		
		MDS022-R2	NA			NA			NA			NA			NA			0.00040	0.0010	U	NS			NA			NS		
		MDS022-R3	NA			NA			NA			NA			NA			0.00020	0.0010	U	NS			NA			NS		
	Taylor Spring	MSG002	NS			NS			NS			NS			NS			Dry			NS			Dry			NS		
	Lone Pine Creek above W Fork Lone Pine Creek	MST058	NS			NS			NS			NS			NS			NS			NS			-0.00079	0.0010	UJ	NS		
	W Fork Lone Pine Creek above Tributary	MST064	NS			NS			NS			NS			NS			0.0040	0.015	U	0.0040			0.00040	0.0010	UJ	0.000090	0.0010	U
	E Fork Lone Pine Creek below Wooley Valley Mine	MST226	NS			NS			NS			-0.00051	0.0010	U	NS			0.00010	0.0010	U	NS			Dry			NS		
	Tributary above W Fork Lone Pine Creek	MST276	NS			NS			NS			NS			NS			0.010	0.015	U	0.0030			0.0020		J	0.0013		
	Lone Pine Creek, Spring Fed Tributary	MST277	NS			NS			NS			NS			NS			NS			NS			NS			NS		
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			NS			NS			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			NS			NS			NS		
	Garden Hose Spring	MSG003	NS			NS			NS			NS			0.44		J	0.47			NS			0.42		J	NS		
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			NS			NS			0.0080		J	NS		
	Cattle Spring	MSG005	NS			NS			NS			NS			NS			NS			NS			0.0030		J	NS		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			NS			NS			NS		
	Ballard Creek, Headwaters	MST067	NS			NS			NS			NS			NS			0.13			Dry			Dry			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			NS			NS			Dry			NS			Dry			NS		
	Short Creek, below BM	MST069-Avg	NS			NS			NS			NS			NS			0.58			0.49			0.27		J	0.55		
		MST069	NS			NS			NS			NS			NS			NA			0.49			0.27			0.55		
		MST069-R1	NS			NS			NS			NS			NS			0.57			NA			NA			NA		
		MST069-R2	NS			NS			NS			NS			NS			0.61			NA			NA			NA		
		MST069-R3	NS			NS			NS			NS			NS			0.56			NA			NA			NA		
	N Fork Wooley Valley Creek, above BM	MST093	NS			NS			NS			NS			NS			0.00070	0.0010	U	NS			Dry			NS		
	Spring Fed Tributary #1 above N Fork Wooley Valley Creek below BM	MST094	NS			NS			NS			Dry			NS			0.021			Dry			Dry			Dry		
	Spring Fed Tributary #2 above N Fork Wooley Valley Creek below BM	MST095	NS			NS			NS			0.047			NS			0.16			Dry			Dry			Dry		
	Spring Fed Tributary #3 above N Fork Wooley Valley Creek below BM	MST096	NS			NS			NS			0.098			NS			0.025			Dry			Dry			Dry		

Table 4 continued
Seeps, Springs, and Headwater Streams - Unfiltered Results - COPC (mg/L)‡

Station			Selenium																							
			2003																		2004					
Mine	Station Name	Station ID	Jan.	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			NS			NS			NS			NS			NS			0.016			Dry		
	EVM S Dump Seep	MDS026	NS			NS			NS			NS			NS			NS			0.43			0.0060		
	Hedin Spring	MSG001-Avg	NS			NS			NS			NS			NS			NS			0.00049	0.0010	U	0.00026	0.0010	U
		MSG001	NS			NS			NS			NS			NS			NS			0.00049	0.0010	U	NA		
		MSG001-R1	NS			NS			NS			NS			NS			NS			NA			0.00070	0.0010	U
		MSG001-R2	NS			NS			NS			NS			NS			NS			NA			0.00013	0.0010	U
		MSG001-R3	NS			NS			NS			NS			NS			NS			NA			-0.000040	0.0010	U
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	Dry			Dry			0.037			0.0070			Dry			Dry			0.016			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			NS			NS			NS			0.23			Dry		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			NS			NS			NS			0.0030			-0.00069		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			NS			NS			0.00019	0.0010	U	0.0080		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			NS			NS			NS			-0.00021	0.0010	U	Dry		
	S Pit Overburden Limestone Drain	MDS022	NS			NS			NS			NS			NS			NS			-0.00066	0.0010	U	-0.00034	0.0010	U
	Taylor Spring	MSG002	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			-0.00059	0.0010	U	NS			NS			-0.00046	0.0010	U	-0.00048	0.0010	U
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	0.00029	0.0010	U	NA			0.0020			0.0057			0.0030			0.0020			0.0020			0.0020		
		MST064	0.00029	0.0010	U	NA			0.0020			0.0057			0.0030			0.0020			0.0020			NA		
		MST064-R1	NA			NA			NA			NA			NA			NA			NA			0.0020		
		MST064-R2	NA			NA			NA			NA			NA			NA			NA			0.0020		
		MST064-R3	NA			NA			NA			NA			NA			NA			NA			0.0020		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Tributary Above W Fork Lone Pine Creek	MST276	0.0023			0.0020			0.0090			0.0030			0.0030			0.0023			0.0030			0.013		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			NS			NS			-0.00065	0.0010	U	Dry		
		MST277	NS			NS			NS			NS			NS			NS			NA			Dry		
		MST277-R1	NS			NS			NS			NS			NS			NS			-0.00061	0.0010	U	Dry		
		MST277-R2	NS			NS			NS			NS			NS			NS			-0.00071	0.0010	U	Dry		
		MST277-R3	NS			NS			NS			NS			NS			NS			-0.00064	0.0010	U	Dry		

Table 4 continued
Seeps, Springs, and Headwater Streams - Unfiltered Results - COPC (mg/L)‡

Station			Selenium																							
			2003																		2004					
Mine	Station Name	Station ID	Jan.	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			0.52			0.57		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			0.38			0.38		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			0.50			0.29		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			1.5			Dry		
	Garden Hose Spring	MSG003	NS			NS			NS			NS			NS			NS			0.47			0.44		
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			NS			0.016			0.031		
	Cattle Spring	MSG005-Avg	NS			NS			NS			NS			NS			NS			0.0070			0.0040		
		MSG005	NS			NS			NS			NS			NS			NS			0.0070			NA		
		MSG005-R1	NS			NS			NS			NS			NS			NS			NA			0.0040		
		MSG005-R2	NS			NS			NS			NS			NS			NS			NA			0.0040		
		MSG005-R3	NS			NS			NS			NS			NS			NS			NA			0.0040		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			0.22			0.28		
	Ballard Creek, Headwaters	MST067	Dry			Dry			0.15			0.052			Dry			Dry			0.029			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Short Creek, Below BM	MST069	Dry			Dry			0.58			0.47			0.51			0.51			0.60			0.48		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			NS			NS			NS			0.00091	0.0010	U	Dry		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry			Dry			0.0020			Dry			Dry			Dry			0.023			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	Dry			Dry			0.22			0.080			Dry			Dry			0.059			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	Dry			Dry			Dry			Dry			Dry			Dry			0.020			0.027		

Notes:
‡ All data has been reported uncensored.
[a] Data from 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1998.
Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).
Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.
Data qualifier definitions are:
(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.
(J) - The result is an estimated quantity.
(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
COPC - Constituent of Potential Concern
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 5

Seeps, Springs, and Headwater Streams - Unfiltered Results - Screening Analytes (mg/L)‡

Station			Mercury			Nitrate/Nitrite as N			Phosphorus			Total Alkalinity														
			2001			2001			2001			2000			2002						2004					
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	0.000012	0.00050	U	-0.055	0.10	U	1.7			NS			150			Dry			180			Dry		
	EVM S Dump Seep	MDS026	0.000013	0.00050	U	0.18		J	0.28			NS			310			290			330			300		
	Hedin Spring	MSG001-Avg	NS			NS			NS			NS			200			190			200			200		
		MSG001	NS			NS			NS			NS			200			190			200			NA		
		MSG001-R1	NS			NS			NS			NS			NA			NA			NA			190		
		MSG001-R2	NS			NS			NS			NS			NA			NA			NA			200		
		MSG001-R3	NS			NS			NS			NS			NA			NA			NA			200		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			Dry			Dry			Dry			Dry		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			Dry			Dry			Dry			Dry		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			Dry			Dry			Dry			Dry		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS			NS			NS			NA			61			Dry			60			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			NA			Dry			Dry			110			Dry		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			Dry			Dry			Dry			Dry		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			NS			150			170			150			180		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			Dry			NA			59			630		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			NS			Dry			Dry			270			Dry		
	S Pit Overburden Limestone Drain	MDS022-Avg	0.0000060	0.00050	U	-0.014	0.10	U	0.22			NS			360			530			410			570		
		MDS022	0.0000060	0.00050	U	-0.014	0.10	U	0.22			NS			NA			530			410			570		
		MDS022-R1	NA			NA			NA			NS			390			NA			NA			NA		
		MDS022-R2	NA			NA			NA			NS			340			NA			NA			NA		
		MDS022-R3	NA			NA			NA			NS			340			NA			NA			NA		
	Taylor Spring	MSG002	NS			NS			NS			NS			Dry			Dry			Dry			Dry		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			NS			NS			NA			220			310		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS			NS			NS			NS			240			230			220			250		
		MST064	NS			NS			NS			NS			240			230			220			NA		
		MST064-R1	NS			NS			NS			NS			NA			NA			NA			250		
		MST064-R2	NS			NS			NS			NS			NA			NA			NA			250		
		MST064-R3	NS			NS			NS			NS			NA			NA			NA			250		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			87			NA			Dry			Dry			Dry		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			NS			NS			NS			79			210			190			230		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			NS			NS			280			Dry		
		MST277	NS			NS			NS			NS			NS			NS			NA			Dry		
		MST277-R1	NS			NS			NS			NS			NS			NS			290			Dry		
		MST277-R2	NS			NS			NS			NS			NS			NS			280			Dry		
		MST277-R3	NS			NS			NS			NS			NS			NS			280			Dry		

Table 5 continued

Seeps, Springs, and Headwater Streams - Unfiltered Results - Screening Analytes (mg/L)‡

Station			Mercury			Nitrate/Nitrite as N			Phosphorus			Total Alkalinity														
			2001			2001			2001			2000			2002						2004					
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			320			300		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			240			230		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			180			320		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			290			Dry		
	Garden Hose Spring	MSG003	0.000012	0.00050	U	5.0		J	0.031			NS			220			270			280			270		
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			260			230			250		
	Cattle Spring	MSG005-Avg	NS			NS			NS			NS			NS			260			260			270		
		MSG005	NS			NS			NS			NS			NS			260			260			NA		
		MSG005-R1	NS			NS			NS			NS			NS			NA			NA			280		
		MSG005-R2	NS			NS			NS			NS			NS			NA			NA			270		
		MSG005-R3	NS			NS			NS			NS			NS			NA			NA			270		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			230			250		
	Ballard Creek, Headwaters	MST067	NS			NS			NS			NS			240			Dry			250			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			NS			Dry			Dry			Dry			Dry		
	Short Creek, Below BM	MST069-Avg	NS			NS			NS			NS			180			270			110			300		
		MST069	NS			NS			NS			NS			NA			270			110			300		
		MST069-R1	NS			NS			NS			NS			220			NA			NA			NA		
		MST069-R2	NS			NS			NS			NS			170			NA			NA			NA		
		MST069-R3	NS			NS			NS			NS			170			NA			NA			NA		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			NS			78			Dry			98			Dry		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS			NS			NS			Dry			130			Dry			160			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS			NS			NS			160			140			Dry			220			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS			NS			NS			180			190			Dry			190			230		

Notes:

‡ All data has been reported uncensored.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

Data qualifier definitions are:

(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.

(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 6
Ponds - Unfiltered Results - COPC (mg/L)‡

Station			Selenium																																			
			1997[a]			1998[a]			2001			2002												2003														
	Name	ID	Fall	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag	Jan.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	0.0091			NS			0.22		J	0.44			NS			0.021		J	NS			NS			NS			NS			NS			NS		
		MSP017	0.0091			NS			0.22		J	0.44			NS			0.021		J	NS			NS			NS			NS			NS			NS		
		MSP017-R1	NA			NS			NA			NA			NS			NA			NS			NS			NS			NS			NS			NS		
		MSP017-R2	NA			NS			NA			NA			NS			NA			NS			NS			NS			NS			NS			NS		
		MSP017-R3	NA			NS			NA			NA			NS			NA			NS			NS			NS			NS			NS			NS		
	EVM Keyhole Pond	MSP018	NS			NS			0.20		J	0.30			0.13			0.032		J	0.023			0.0020			0.30			0.26			0.19			0.090		
	EVM Bat Cave Pond	MSP019	0.016			NS			0.025		J	0.025			NS			0.013		J	NS			NS			NS			NS			NS			NS		
	EVM West Pond	MSP020	0.021			NS			0.037		J	0.16			NS			0.025		J	NS			NS			NS			NS			NS			NS		
	EVM Stock Pond	MSP021-Avg	0.026			NS			0.11		J	0.15			NS			0.038		J	NS			NS			NS			NS			NS			NS		
		MSP021	NA			NS			0.11		J	NA			NS			0.038		J	NS			NS			NS			NS			NS			NS		
		MSP021-R1	0.028			NS			NA			0.16			NS			NA			NS			NS			NS			NS			NS			NS		
		MSP021-R2	0.025			NS			NA			0.14			NS			NA			NS			NS			NS			NS			NS			NS		
		MSP021-R2-D	0.025			NS			NA			NA			NS			NA			NS			NS			NS			NS			NS			NS		
		MSP021-R3	0.025			NS			NA			0.14			NS			NA			NS			NS			NS			NS			NS			NS		
	EVM Tipple Pond	MSP022	0.071			NS			0.040		J	0.043			NS			0.029		J	NS			NS			NS			NS			NS			NS		
	EVM Haul Road Pond	MSP023	0.0022			NS			0.024		J	0.037			NS			0.069		J	NS			NS			NS			NS			NS			NS		
	EVM Shop Pond	MSP031	0.0051			NS			0.0025		J	0.0020	0.015	U	NS			0.012		J	NS			NS			NS			NS			NS			NS		
Henry Mine	HM Henry Pond	MSP014	0.0067			NS			0.0042		J	0.035			NS			0.0020		J	NS			NS			NS			NS			NS			NS		
	HM Smith Pond	MSP015-Avg	0.042			NS			0.13		J	0.36			NS			0.088		J	NS			NS			NS			NS			NS			NS		
		MSP015	NA			NS			0.13		J	0.36			NS			0.088		J	NS			NS			NS			NS			NS			NS		
		MSP015-R1	0.044			NS			NA			NA			NS			NA			NS			NS			NS			NS			NS			NS		
		MSP015-R2	0.041			NS			NA			NA			NS			NA			NS			NS			NS			NS			NS			NS		
		MSP015-R2-D	0.041			NS			NA			NA			NS			NA			NS			NS			NS			NS			NS			NS		
		MSP015-R3	0.041			NS			NA			NA			NS			NA			NS			NS			NS			NS			NS			NS		
	HM Center Henry Pond	MSP016-Avg	0.025			NS			0.060		J	0.18			NS			0.024		J	NS			NS			NS			NS			NS			NS		
		MSP016	NA			NS			0.062		J	NA			NS			NA			NS			NS			NS			NS			NS			NS		
		MSP016-D	NA			NS			0.058		J	NA			NS			NA			NS			NS			NS			NS			NS			NS		
		MSP016-R1	NA			NS			NA			NA			NS			0.024			NS			NS			NS			NS			NS			NS		
		MSP016-R2	NA			NS			NA			NA			NS			0.024			NS			NS			NS			NS			NS			NS		
		MSP016-R3	NA			NS			NA			NA			NS			0.023			NS			NS			NS			NS			NS			NS		
	HM South Pit Pond	MSP055	NS			NS			0.67		J	0.22			0.43			NS			NS			NS			0.54			0.64			0.55			0.28		
Ballard Mine	BM Dredge Pond	MSP010-Avg	0.15			NS			0.58		J	0.67			0.11			0.86		J	NS			NS			0.63			0.44			0.099			0.10		
		MSP010	0.15			NS			0.58		J	NA			NA			0.86		J	NS			NS			NA			NA			NS			0.10		
		MSP010-R1	NA			NS			NA			0.67			0.11			NA			NA			NA			0.60			0.43			NA			NA		
		MSP010-R2	NA			NS			NA			0.67			0.11			NA			NA			NA			0.65			0.44			NA			NA		
		MSP010-R3	NA			NS			NA			0.68			0.11			NA			NA			NA			0.64			0.45			NA			NA		
	BM Upper Elk Pond	MSP011-Avg	NS			0.11			0.094		J	0.094			NS			NS			NS			NS			NS			NS			NS			NS		
		MSP011	NS			0.11			0.094		J	0.094			NS			NS			NS			NS			NS			NS			NS			NS		
		MSP011-R1	NS			NA			NA			NA			NS			NS			NS			NS			NS			NS			NS			NS		
		MSP011-R2	NS			NA			NA			NA			NS			NS			NS			NS			NS			NS			NS			NS		
		MSP011-R3	NS			NA			NA			NA			NS			NS			NS			NS			NS			NS			NS			NS		
	BM Lower Elk Pond	MSP012-Avg	NS			NS			0.22		J	0.17			NS			NS			NS			NS			NS			NS			NS			NS		
		MSP012	NS			NS			0.22		J	NA			NS			NS			NS			NS			NS			NS			NS			NS		
		MSP012-D	NS			NS			0.21		J	NA			NS			NS			NS			NS			NS			NS			NS			NS		
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	NS			NS			0.024		J	0.012	0.015	U	NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		

Table 6 continued
Ponds - Unfiltered Results - COPC (mg/L)‡

Station			Selenium			Cadmium			Nickel			Vanadium			Zinc		
			2004			1998[a]			1998[a]			1998[a]			1998[a]		
	Name	ID	Spring	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	0.52			NS			NS			NS			NS		
		MSP017	NA			NS			NS			NS			NS		
		MSP017-R1	0.49			NS			NS			NS			NS		
		MSP017-R2	0.53			NS			NS			NS			NS		
		MSP017-R3	0.54			NS			NS			NS			NS		
	EVM Keyhole Pond	MSP018	0.43			NS			NS			NS			NS		
	EVM Bat Cave Pond	MSP019	0.049			NS			NS			NS			NS		
	EVM West Pond	MSP020	0.090			NS			NS			NS			NS		
	EVM Stock Pond	MSP021-Avg	0.18			NS			NS			NS			NS		
		MSP021	0.18			NS			NS			NS			NS		
		MSP021-R1	NA			NS			NS			NS			NS		
		MSP021-R2	NA			NS			NS			NS			NS		
		MSP021-R2-D	NA			NS			NS			NS			NS		
		MSP021-R3	NA			NS			NS			NS			NS		
	EVM Tipple Pond	MSP022	0.041			NS			NS			NS			NS		
	EVM Haul Road Pond	MSP023	0.041			NS			NS			NS			NS		
	EVM Shop Pond	MSP031	0.00067	0.0010	U	NS			NS			NS			NS		
Henry Mine	HM Henry Pond	MSP014	0.035			NS			NS			NS			NS		
	HM Smith Pond	MSP015-Avg	0.15			NS			NS			NS			NS		
		MSP015	0.15			NS			NS			NS			NS		
		MSP015-R1	NA			NS			NS			NS			NS		
		MSP015-R2	NA			NS			NS			NS			NS		
		MSP015-R2-D	NA			NS			NS			NS			NS		
		MSP015-R3	NA			NS			NS			NS			NS		
	HM Center Henry Pond	MSP016-Avg	0.12			NS			NS			NS			NS		
		MSP016	NA			NS			NS			NS			NS		
		MSP016-D	NA			NS			NS			NS			NS		
		MSP016-R1	0.12			NS			NS			NS			NS		
		MSP016-R2	0.12			NS			NS			NS			NS		
		MSP016-R3	0.13			NS			NS			NS			NS		
	HM South Pit Pond	MSP055	0.97			NS			NS			NS			NS		
Ballard Mine	BM Dredge Pond	MSP010-Avg	0.63			NS			NS			NS			NS		
		MSP010	0.63			NS			NS			NS			NS		
		MSP010-R1	NA			NS			NS			NS			NS		
		MSP010-R2	NA			NS			NS			NS			NS		
		MSP010-R3	NA			NS			NS			NS			NS		
	BM Upper Elk Pond	MSP011-Avg	0.048			0.0037			0.019			0.047			0.0061		
		MSP011	0.048			0.0037			0.019			0.047			0.0061		
		MSP011-R1	NA			NA			NA			NA			NA		
		MSP011-R2	NA			NA			NA			NA			NA		
		MSP011-R3	NA			NA			NA			NA			NA		
	BM Lower Elk Pond	MSP012-Avg	0.12			NS			NS			NS			NS		
		MSP012	0.12			NS			NS			NS			NS		
		MSP012-D	NA			NS			NS			NS			NS		
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	0.029			NS			NS			NS			NS		
	BM Pit #6 Pond	MSP062	0.0020			NS			NS			NS			NS		

Notes:

‡ All data has been reported uncensored.

[a] Data from 1997 and 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1997 and 1998.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

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(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 7

Ponds - Unfiltered Results - Screening Analytes (mg/L)‡

Station			Calcium			Chloride			Iron			Magnesium			Manganese			Potassium			Sodium			Sulfate		
			1998[a]			1998[a]			1998[a]			1998[a]			1998[a]			1998[a]			1998[a]			1998[a]		
Mine	Name	ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP017	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP017-R1	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP017-R2	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP017-R3	NS			NS			NS			NS			NS			NS			NS			NS		
	EVM Keyhole Pond	MSP018	NS			NS			NS			NS			NS			NS			NS			NS		
	EVM Bat Cave Pond	MSP019	NS			NS			NS			NS			NS			NS			NS			NS		
	EVM West Pond	MSP020	NS			NS			NS			NS			NS			NS			NS			NS		
	EVM Stock Pond	MSP021-Avg	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP021	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP021-R1	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP021-R2	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP021-R3	NS			NS			NS			NS			NS			NS			NS			NS		
	EVM Tipple Pond	MSP022	NS			NS			NS			NS			NS			NS			NS			NS		
	EVM Haul Road Pond	MSP023	NS			NS			NS			NS			NS			NS			NS			NS		
	EVM Shop Pond	MSP031-Avg	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP031	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP031-D	NS			NS			NS			NS			NS			NS			NS			NS		
Henry Mine	HM Henry Pond	MSP014	NS			NS			NS			NS			NS			NS			NS			NS		
	HM Smith Pond	MSP015	NS			NS			NS			NS			NS			NS			NS			NS		
	HM Center Henry Pond	MSP016-Avg	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP016	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP016-D	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP016-R1	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP016-R2	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP016-R3	NS			NS			NS			NS			NS			NS			NS			NS		
	HM South Pit Pond	MSP055	NS			NS			NS			NS			NS			NS			NS			NS		
Ballard Mine	BM Dredge Pond	MSP010-Avg	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP010	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP010-R1	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP010-R2	NS			NS			NS			NS			NS			NS			NS			NS		
		MSP010-R3	NS			NS			NS			NS			NS			NS			NS			NS		
	BM Upper Elk Pond	MSP011-Avg	30			0.55			0.0082			5.8			0.0053			1.6			1.1			17		
		MSP011	30			0.55			0.0082			5.8			0.0053			1.6			1.1			17		
		MSP011-D	NA			NA			NA			NA			NA			NA			NA			NA		
		MSP011-R1	NA			NA			NA			NA			NA			NA			NA			NA		
		MSP011-R2	NA			NA			NA			NA			NA			NA			NA			NA		
		MSP011-R3	NA			NA			NA			NA			NA			NA			NA			NA		
	BM Lower Elk Pond	MSP012	NS			NS			NS			NS			NS			NS			NS			NS		
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			NS			NS			NS			NS		

Table 7 continued

Ponds - Unfiltered Results - Screening Analytes (mg/L)‡

Station			Total Alkalinity														
			1998[a]			2001			2002						2004		
Mine	Name	ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	NS			110			90			49			110		
		MSP017	NS			110			90			49			NA		
		MSP017-R1	NS			NA			NA			NA			110		
		MSP017-R2	NS			NA			NA			NA			110		
		MSP017-R3	NS			NA			NA			NA			100		
	EVM Keyhole Pond	MSP018	NS			130			110			130			130		
	EVM Bat Cave Pond	MSP019	NS			99			100			61			80		
	EVM West Pond	MSP020	NS			43			54			150			59		
	EVM Stock Pond	MSP021-Avg	NS			120			100			160			150		
		MSP021	NS			120			NA			160			150		
		MSP021-R1	NS			NA			100			NA			NA		
		MSP021-R2	NS			NA			100			NA			NA		
		MSP021-R3	NS			NA			100			NA			NA		
	EVM Tipple Pond	MSP022	NS			73			79			110			51		
	EVM Haul Road Pond	MSP023	NS			56			46			46			70		
	EVM Shop Pond	MSP031	NS			91			66			110			90		
Henry Mine	HM Henry Pond	MSP014	NS			110			56			120			92		
	HM Smith Pond	MSP015	NS			250			180			98			240		
	HM Center Henry Pond	MSP016-Avg	NS			150			150			140			180		
		MSP016	NS			150			150			NA			180		
		MSP016-D	NS			150			NA			NA			NA		
		MSP016-R1	NS			NA			NA			140			180		
		MSP016-R2	NS			NA			NA			140			180		
		MSP016-R3	NS			NA			NA			140			180		
	HM South Pit Pond	MSP055	NS			140			58			NS			85		
Ballard Mine	BM Dredge Pond	MSP010-Avg	NS			230			210			110			240		
		MSP010	NS			230			NA			110			240		
		MSP010-R1	NS			NA			210			NA			NA		
		MSP010-R2	NS			NA			210			NA			NA		
		MSP010-R3	NS			NA			220			NA			NA		
	BM Upper Elk Pond	MSP011-Avg	82			86			69			NS			96		
		MSP011	82			86			69			NS			NA		
		MSP011-R1	NA			NA			NA			NA			95		
		MSP011-R2	NA			NA			NA			NA			96		
		MSP011-R3	NA			NA			NA			NA			97		
	BM Lower Elk Pond	MSP012	NS			80			70			NS			89		
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	NS			60			56			NS			73		
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			170		

Notes:

‡ All data has been reported uncensored.

[a] Data from 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1998.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

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(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 8
Domestic and Agricultural Wells - Filtered Results - COPC (mg/L)‡

Station		Selenium						Cadmium						Chromium					
		2004						2004						2004					
Well Name	Well ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
School Bus Well	MAW001-Avg	0.00020	0.0010	U	NS			0.000060	0.00020	U	NS			0.00013	0.000067<x<0.00020	U	NS		
	MAW001	NA			NS			NA			NS			NA			NS		
	MAW001-R1	0.00040	0.0010	U	NS			0.000060	0.00020	U	NS			0.00012	0.00020	U	NS		
	MAW001-R2	0.000020	0.0010	U	NS			0.00010	0.00020	U	NS			0.00020			NS		
	MAW001-R3	0.00018	0.0010	U	NS			0.000020	0.00020	U	NS			0.000080	0.00020	U	NS		
(b) (6) Field Well	MAW002	-0.0011	0.0010	U	NS			0.000020	0.00020	U	NS			-0.000040	0.00020	U	NS		
(b) (6) Field Well	MAW003	-0.00083	0.0010	U	NS			0.000020	0.00020	U	NS			0.0013			NS		
(b) (6) Field Well	MAW004	0.00020	0.0010	U	NS			0	0.00020	U	NS			0.00013	0.00020	U	NS		
(b) (6) Windmill Field Well	MAW005	-0.00061	0.0010	U	NS			0.00060			NS			-0.000080	0.00020	U	NS		
(b) (6) Field Well West	MAW006	NS			-0.00049	0.0010	U	NS			0.000050	0.00010	U	NS			0.0010	0.0015	U
(b) (6) Field Well North	MAW007	NS			-0.00042	0.0010	U	NS			0.000010	0.0025	U	NS			0.00010	0.075	U
(b) (6) House Well	MDW001	0.00018	0.0010	U	NS			0.000020	0.00020	U	NS			0.00016	0.00020	U	NS		
(b) (6) House Well	MDW002	-0.00080	0.0010	U	NS			0.000040	0.00020	U	NS			0.00060			NS		
(b) (6) House Well	MDW003	0.0010			NS			-0.000020	0.00020	U	NS			0.00040			NS		
(b) (6) House Well	MDW004	-0.000040	0.0010	U	NS			0.000050	0.00020	U	NS			0.0011			NS		
Cedar Bay RV Park Well	MDW005	0.00019	0.0010	U	NS			0.000020	0.00020	U	NS			0.00040			NS		
(b) House Well	MDW006	-0.00048	0.0010	U	NS			0.000020	0.00020	U	NS			0.00070			NS		

Station		Nickel						Vanadium						Zinc					
		2004						2004						2004					
Well Name	Well ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
School Bus Well	MAW001-Avg	0.00066	)57<x<0.0	U	NS			0.00020			NS			0.017			NS		
	MAW001	NA			NS			NA			NS			NA			NS		
	MAW001-R1	0.00023	0.00040	U	NS			0.00020			NS			0.021			NS		
	MAW001-R2	0.0010			NS			0.00020			NS			0.015			NS		
	MAW001-R3	0.00070			NS			0.00020			NS			0.015			NS		
(b) (6) Field Well	MAW002	0.0012			NS			0.000060	0.0010	U	NS			0.026			NS		
(b) (6) Field Well	MAW003	0.00014	0.00040	U	NS			0.0017			NS			0.18			NS		
(b) (6) Field Well	MAW004	0.0028			NS			0.00070			NS			0.0080			NS		
(b) (6) Windmill Field Well	MAW005	0.0019			NS			0.00020			NS			2.9			NS		
(b) (6) Field Well West	MAW006	NS			0.0023			NS			0.0081			NS			0.022		
(b) (6) Field Well North	MAW007	NS			0.00070	0.065	U	NS			-0.0015	0.000050	U	NS			0.053	5.4	U
(b) (6) House Well	MDW001	0.0011			NS			0.00020			NS			0.02			NS		
(b) (6) House Well	MDW002	0.0016			NS			0.0039			NS			0.06			NS		
(b) (6) House Well	MDW003	0.0012			NS			0.00020			NS			0.0022	0.0040	U	NS		
(b) (6) House Well	MDW004	0.00040			NS			0.0018			NS			0.085			NS		
Cedar Bay RV Park Well	MDW005	0.0016			NS			0.00050			NS			0.056			NS		
(b) House Well	MDW006	0.00060			NS			0.0026			NS			0.033			NS		

Notes:

‡ All data has been reported uncensored.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

Data qualifier definitions are:

(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.

(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

COPC - Constituent of Potential Concern

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 9
Domestic and Agricultural Wells - Filtered Results - Screening Analytes (mg/L)‡

Station		Calcium						Chloride						Magnesium						Potassium					
		2004						2004						2004						2004					
Well Name	Well ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
School Bus Well	MAW001-Avg	66			NS			11			NS			12			NS			0.57			NS		
	MAW001	NA			NS			NA			NS			NA			NS			NA			NS		
	MAW001-R1	62			NS			12			NS			11			NS			0.60			NS		
	MAW001-R2	68			NS			8.0			NS			13			NS			0.50			NS		
	MAW001-R3	69			NS			12			NS			13			NS			0.60			NS		
(b) (6) Field Well	MAW002	62			NS			3.2			NS			22			NS			2.0			NS		
(b) (6) Field Well	MAW003	34			NS			4.8			NS			8.6			NS			0.40			NS		
(b) (6) Field Well	MAW004	180			NS			7.5			NS			61			NS			4.8			NS		
(b) (6) Windmill Field Well	MAW005	110			NS			140			NS			38			NS			5.7			NS		
(b) (6) Field Well West	MAW006	NS			38			NS			9.2			NS			10			NS			1.6		
(b) (6) Field Well North	MAW007	NS			58			NS			12			NS			20			NS			2.8	3.0	U
(b) (6) House Well	MDW001	67			NS			13			NS			13			NS			0.50			NS		
(b) (6) House Well	MDW002	54			NS			32			NS			19			NS			2.4			NS		
(b) (6) House Well	MDW003	74			NS			7.8			NS			6.5			NS			0.50			NS		
(b) (6) House Well	MDW004	73			NS			7.8			NS			20			NS			2.2			NS		
Cedar Bay RV Park Well	MDW005	150			NS			17			NS			38			NS			2.4			NS		
(b) House Well	MDW006	66			NS			58			NS			27			NS			2.8			NS		

Station		Sodium						Sulfate					
		2004						2004					
Well Name	Well ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
School Bus Well	MAW001-Avg	5.9			NS			11			NS		
	MAW001	NA			NS			NA			NS		
	MAW001-R1	5.7			NS			11			NS		
	MAW001-R2	6.0			NS			12			NS		
	MAW001-R3	6.0			NS			11			NS		
(b) (6) Field Well	MAW002	22			NS			0.091	0.50	U	NS		
(b) (6) Field Well	MAW003	9.0			NS			6.4			NS		
(b) (6) Field Well	MAW004	10			NS			7.7			NS		
(b) (6) Windmill Field Well	MAW005	100			NS			270			NS		
(b) (6) Field Well West	MAW006	NS			8.7			NS			10		
(b) (6) Field Well North	MAW007	NS			13	320	U	NS			24		
(b) (6) House Well	MDW001	5.9			NS			11			NS		
(b) (6) House Well	MDW002	21			NS			44			NS		
(b) (6) House Well	MDW003	6.0			NS			6.4			NS		
(b) (6) House Well	MDW004	15			NS			15			NS		
Cedar Bay RV Park Well	MDW005	16			NS			44			NS		
(b) House Well	MDW006	45			NS			100			NS		

Notes:

‡ All data has been reported uncensored.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

Data qualifier definitions are:

(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.

(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

Table 10
Monitoring and Production Wells - Filtered Results - COPC (mg/L)‡

Station			Selenium												Cadmium											
			2004						2005						2004						2005					
Mine	Name	ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	-0.00038	0.0010	U	-0.00088	0.0010	U	NS			NS			0.000020	0.00020	U	0.00010			NS			NS		
	EVM Shop Well	MPW019	0.00083	0.0010	U	0.00094	0.0010	U	0.0010			NS			0.000040	0.00020	U	0.000070	0.00075	U	0.000020	0.00010	U	NS		
	Degerstrom Well at EVM	MPW020	NS			-0.00036	0.0010	U	NS			NS			NS			0.000050	0.0025	U	NS			NS		
Henry Mine	Henry North Pit Well S	MMW003	0.0050			0.058			0.033			NS			0.000040	0.00020	U	0.00020			0.000070	0.00010	U	NS		
	Henry North Pit Well N	MMW004-Avg	-0.00061	0.0010	U	0.00012	0.0010	U	0.0013			0.0013			0.000040	0.00020	U	0.000010	0.0025	U	0.000017	0.00010	U	0.0000067	0.00010	U
		MMW004	NA			0.00012	0.0010	U	0.0013			NA			NA			0.000010	0.0025	U	0.000017	0.00010	U	NA		
		MMW004-R1	-0.00075	0.0010	U	NA			NA			0.0020			0.000020	0.00020	U	NA			NA			0.000010	0.00010	U
		MMW004-R2	-0.00051	0.0010	U	NA			NA			0.0010			0.000080	0.00020	U	NA			NA			0.000010	0.00010	U
		MMW004-R3	-0.00057	0.0010	U	NA			NA			0.0010			0.000020	0.00020	U	NA			NA			0	0.00010	U
	Henry South Pit Well	MPW022	0.0030			0.000040	0.0010	U	-0.00038	0.0010	U	-0.00035	0.0010	U	0	0.00020	U	0	0.0025	U	0	0.00010	U	0.000010	0.00010	U
	Henry Center Pit Well	MPW023	NS			-0.00022	0.0010	U	-0.00029	0.0010	U	NS			NS			0.000060	0.0025	U	0.000040	0.00010	U	NS		
Ballard Mine	Ballard Pit East Well	MMW001-Avg	0.046			0.017			0.067			0.072			0.0033			0.0059			0.0061			0.0029		
		MMW001	0.046			NA			0.067			0.072			0.0033			NA			0.0061			0.0029		
		MMW001-R1	NA			0.017			NA			NA			NA			0.0060			NA			NA		
		MMW001-R2	NA			0.017			NA			NA			NA			0.0058			NA			NA		
		MMW001-R3	NA			0.017			NA			NA			NA			0.0060			NA			NA		
	Ballard Pit West Well	MMW002-Avg	0.00033	0.0010	U	0.024			0.031			0.022			0.000090	0.00020	U	0.00010	0.0025	U	0.000080	0.00010	U	0.000060	0.00010	U
		MMW002	0.00033	0.0010	U	NA			0.031			0.022			0.000090	0.00020	U	NA			0.000080	0.00010	U	0.000060	0.00010	U
		MMW002-R1	NA			0.024			NA			NA			NA			0.00010	0.0025	U	NA			NA		
		MMW002-R2	NA			0.023			NA			NA			NA			0.00010	0.0025	U	NA			NA		
		MMW002-R3	NA			0.024			NA			NA			NA			0.00010	0.0025	U	NA			NA		

Station			Chromium												Nickel											
			2004						2005						2004						2005					
Mine	Name	ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	-0.000020	0.00020	U	-0.00037	0.00010	U	NS			NS			0.0032			0.0072			NS			NS		
	EVM Shop Well	MPW019	0.00018	0.00020	U	-0.00046	0.015	U	0.00020	0.017	U	NS			0.00033	0.00040	U	0.0045			0.00033	0.00060	U	NS		
	Degerstrom Well at EVM	MPW020	NS			0.000060	0.075	U	NS			NS			NS			0.013	0.065	U	NS			NS		
Henry Mine	Henry North Pit Well S	MMW003	-0.00010	0.00020	U	-0.00040	0.00010	U	0.0014	0.017	U	NS			0.0045			0.010			0.0045	0.0085	U	NS		
	Henry North Pit Well N	MMW004-Avg	0.000070	0.00020	U	0.00020	0.075	U	0.00083	0.017	U	0.00047	0.0011	U	0.00051	0.00043<x<0.00057	U	0.0014	0.065	U	0.00056	0.00060	U	0.00026	0.00060	U
		MMW004	NA			0.00020	0.075	U	0.00083	0.017	U	NA			NA			0.0014	0.065	U	0.00056	0.00060	U	NA		
		MMW004-R1	0.000060	0.00020	U	NA			NA			0.00040	0.0011	U	0.00022	0.00040	U	NA			NA			0.00028	0.00060	U
		MMW004-R2	0.00012	0.00020	U	NA			NA			0.00050	0.0011	U	0.00080			NA			NA			0.00023	0.00060	U
		MMW004-R3	0.000040	0.00020	U	NA			NA			0.00050	0.0011	U	0.00050			NA			NA			0.00028	0.00060	U
	Henry South Pit Well	MPW022	0.00015	0.00020	U	0.0012	0.075	U	0.0010	0.017	U	0.00010	0.0011	U	0.00070			0.0010	0.065	U	0.00070	0.0085	U	0.00023	0.0060	U
	Henry Center Pit Well	MPW023	NS			0.000040	0.075	U	0.00010	0.017	U	NS			NS			0.016	0.065	U	0.015			NS		
Ballard Mine	Ballard Pit East Well	MMW001-Avg	0.000020	0.00020	U	0.00047	0.075	U	0.0042	0.017	U	0.00020	0.0011	U	0.052			0.056	0.065	U	0.058			0.045		
		MMW001	0.000020			NA			0.0042	0.017	U	0.00020	0.0011	U	0.052			NA			0.058			0.045		
		MMW001-R1	NA			0.00050	0.075	U	NA			NA			NA			0.059	0.065	U	NA			NA		
		MMW001-R2	NA			0.00040	0.075	U	NA			NA			NA			0.055	0.065	U	NA			NA		
		MMW001-R3	NA			0.00050	0.075	U	NA			NA			NA			0.055	0.065	U	NA			NA		
	Ballard Pit West Well	MMW002-Avg	0.00010	0.00020	U	0.00023	0.075	U	0.0023	0.017	U	0.00020	0.0011	U	0.0017			0.012	0.065	U	0.0064	0.0085	U	0.0041		
		MMW002	0.00010			NA			0.0023	0.017	U	0.00020	0.0011	U	0.0017			NA			0.0064	0.0085	U	0.0041		
		MMW002-R1	NA			0.00020	0.075	U	NA			NA			NA			0.012	0.065	U	NA			NA		
		MMW002-R2	NA			0.00040	0.075	U	NA			NA			NA			0.011	0.065	U	NA			NA		
		MMW002-R3	NA			0.00020	0.075	U	NA			NA			NA			0.012	0.065	U	NA			NA		

Table 10 continued
Monitoring and Production Wells - Filtered Results - COPC (mg/L)‡

Station			Vanadium												Zinc											
			2004						2005						2004						2005					
Mine	Name	ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	0.0045			0.0022			NS			NS			0.051			0.32	0.015	U	NS			NS		
	EVM Shop Well	MPW019	0.00020			0.00018	0.00079	U	-0.0010	0.00020	U	NS			0.036			0.012	0.015	U	0.026	0.95	U	NS		
	Degerstrom Well at EVM	MPW020	NS			-0.0031	0.0058	U	NS			NS			NS			0.0050	5.4	U	NS			NS		
Henry Mine	Henry North Pit Well S	MMW003	0.000010	0.0010	U	0.00071	0.00079	U	-0.00043	0.00020	U	NS			0.0036	0.0040	U	0.01	0.015	U	0.098	0.95	U	NS		
	Henry North Pit Well N	MMW004-Avg	0.0013			0.00059	0.0058	U	0.0019			0.0018	0.0019	U	0.0012	0.0040	U	0.051	5.4	U	0.072	0.95	U	0.039		
		MMW004	NA			0.00059	0.0058	U	0.0019			NA			NA			0.051	5.4	U	0.072			NA		
		MMW004-R1	0.0013			NA			NA			0.0018	0.0019	U	0.00096	0.0040	U	NA			NA			0.040		
		MMW004-R2	0.0014			NA			NA			0.0018	0.0019	U	0.0016	0.0040	U	NA			NA			0.038		
		MMW004-R3	0.0013			NA			NA			0.0019	0.0019	U	0.0012	0.0040	U	NA			NA			0.040		
	Henry South Pit Well	MPW022	0.00030			-0.0012	0.0058	U	-0.00087	0.00020	U	-0.00050	0.00020	U	0.0014	0.0040	U	0.10	5.4	U	0.043	0.95	U	0.13		
	Henry Center Pit Well	MPW023	NS			-0.0032	0.0058	U	-0.0011	0.00020	U	NS			NS			0.74	5.4	U	0.59	0.95	U	NS		
Ballard Mine	Ballard Pit East Well	MMW001-Avg	0.0055			0.011			0.0091			0.0053			0.28			0.56	5.4	U	0.51	0.95	U	0.25		
		MMW001	0.0055			NA			0.0091			0.0053			0.28			NA			0.51	0.95	U	0.25		
		MMW001-R1	NA			0.011			NA			NA			NA			0.56	5.4	U	NA			NA		
		MMW001-R2	NA			0.011			NA			NA			NA			0.56	5.4	U	NA			NA		
		MMW001-R3	NA			0.011			NA			NA			NA			0.56	5.4	U	NA			NA		
	Ballard Pit West Well	MMW002-Avg	0.00010	0.0010	U	-0.0014	0.0058	U	-0.00099	0.00020	U	-0.00010	0.00020	U	0.0039	0.0040	U	0.25	5.4	U	0.13	0.95	U	0.16		
		MMW002	0.00010	0.0010	U	NA			-0.00099	0.00020	U	-0.00010	0.00020	U	0.0039	0.0040	U	NA			0.13	0.95	U	0.16		
		MMW002-R1	NA			-0.0014	0.0058	U	NA			NA			NA			0.26	5.4	U	NA			NA		
		MMW002-R2	NA			-0.0015	0.0058	U	NA			NA			NA			0.25	5.4	U	NA			NA		
		MMW002-R3	NA			-0.0014	0.0058	U	NA			NA			NA			0.25	5.4	U	NA			NA		

Notes:
‡ All data has been reported uncensored.
Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).
Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.
Data qualifier definitions are:
(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.
(J) - The result is an estimated quantity.
(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
COPC - Constituent of Potential Concern
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 11
Monitoring and Production Wells - Filtered Results - Screening Analytes (mg/L)‡

Station			Aluminum						Calcium												Iron						Manganese					
			2005						2004						2005						2005						2005					
Mine	Name	ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	NS			NS			72			71			NS			NS			NS			NS			NS			NS		
	EVM Shop Well	MPW019	-0.0030	0.030	U	NS			72			69			71			NS			0.16	1.6	U	NS			0.047			NS		
	Degerstrom Well at EVM	MPW020	NS			NS			NS			51			NS			NS			NS			NS			NS			NS		
Henry Mine	Henry North Pit Well S	MMW003	-0.0050	0.030	U	NS			54			66			62			NS			0.010	0.010	U	NS			0.0056	0.023	U	NS		
	Henry North Pit Well N	MMW004-Avg	-0.0090	0.030	U	0.018	0.013<x<0.033	U	76			70			71			77			0.42	1.6	U	0.0067	0.020	U	0.013	0.023	U	0.0028		
		MMW004	-0.0090	0.030	U	NA			NA			70			71			NA			0.42	1.6	U	NA			0.013	0.023	U	NA		
		MMW004-R1	NA			0.0090	0.030	U	76			NA			NA			77			NA			0.0060	0.020	U	NA			0.0030		
		MMW004-R2	NA			0.040			76			NA			NA			77			NA			0.0080	0.020	U	NA			0.0028		
		MMW004-R3	NA			0.0060	0.030	U	76			NA			NA			75			NA			0.0060	0.020	U	NA			0.0026		
	Henry South Pit Well	MPW022	-0.015	0.030	U	-0.019	0.030	U	NS			52			57			50			0.13	1.6	U	4.3			0.016	0.023	U	0.23		
	Henry Center Pit Well	MPW023	-0.0070	0.030	U	NS			NS			63			61			NS			0.20	1.6	U	NS			0.19			NS		
Ballard Mine	Ballard Pit East Well	MMW001-Avg	0.014	0.030	U	0.0090	0.030	U	120			110			110			110			-0.0020	0.010	U	-0.0010	0.020	U	0.031			0.059		
		MMW001	0.014	0.030	U	0.0090	0.030	U	120			NA			110			110			-0.0020	0.010	U	-0.0010	0.020	U	0.031			0.059		
		MMW001-R1	NA			NA			NA			110			NA			NA			NA			NA			NA			NA		
		MMW001-R2	NA			NA			NA			110			NA			NA			NA			NA			NA			NA		
		MMW001-R3	NA			NA			NA			100			NA			NA			NA			NA			NA			NA		
	Ballard Pit West Well	MMW002-Avg	0.0090	0.030	U	0.010	0.030	U	78			69			74			73			0.0090	0.010	U	0.0020	0.020	U	0.022	0.023	U	0.0074		
		MMW002	0.0090	0.030	U	0.010	0.030	U	78			NA			74			73			0.0090	0.010	U	0.0020	0.020	U	0.022	0.023	U	0.0074		
		MMW002-R1	NA			NA			NA			69			NA			NA			NA						NA			NA		
		MMW002-R2	NA			NA			NA			69			NA			NA			NA						NA			NA		
		MMW002-R3	NA			NA			NA			69			NA			NA			NA						NA			NA		

Station			Chloride																		Magnesium											
			1998[a]						2004						2005						2004						2005					
Mine	Name	ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	4.8			5.0			3.9			4.0			NS			NS			28			30			NS			NS		
	EVM Shop Well	MPW019	5.7			5.0			6.1			6.7			8.0			NS			9.9			9.5			10			NS		
	Degerstrom Well at EVM	MPW020	5.5			5.0			NS			6.2			NS			NS			NS			17			NS			NS		
Henry Mine	Henry North Pit Well S	MMW003	NS			NS			34			55			41			NS			21			28			25			NS		
	Henry North Pit Well N	MMW004-Avg	NS			NS			67			64			57			57		J	26			37			26			27		
		MMW004	NS			NS			NA			64			57			NA			NA			37			26			NA		
		MMW004-R1	NS			NS			66			NA			NA			56			27			NA			NA			28		
		MMW004-R2	NS			NS			67			NA			NA			55		J	26			NA			NA			28		
		MMW004-R3	NS			NS			67			NA			NA			61		J	26			NA			NA			27		
	Henry South Pit Well	MPW022	NS			NS			NS			5.8			2.8	5.5	U	5.0			NS			12			13			13		
	Henry Center Pit Well	MPW023	NS			NS			NS			6.6			6.8			NS			NS			24			23			NS		
Ballard Mine	Ballard Pit East Well	MMW001-Avg	NS			NS			5.8			6.6			6.6			6.0			22			21			23			22		
		MMW001	NS			NS			5.8			NA			6.6			6.0			22			NA			23			22		
		MMW001-R1	NS			NS			NA			6.6			NA			NA			NA			22			NA			NA		
		MMW001-R2	NS			NS			NA			6.6			NA			NA			NA			21			NA			NA		
		MMW001-R3	NS			NS			NA			6.7			NA			NA			NA			21			NA			NA		
	Ballard Pit West Well	MMW002-Avg	NS			NS			12			12			15			14			45			36			40			40		
		MMW002	NS			NS			12			NA			15			14.0			45			NA			40			40		
		MMW002-R1	NS			NS			NA			12			NA			NA			NA			36			NA			NA		
		MMW002-R2	NS			NS			NA			12			NA			NA			NA			36			NA			NA		
		MMW002-R3	NS			NS			NA			12			NA			NA			NA			36			NA			NA		

Table 11 continued

Monitoring and Production Wells - Filtered Results - Screening Analytes (mg/L)‡

Station			Potassium												Sulfate																	
			2004						2005						1998[a]						2004						2005					
Mine	Name	ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	Agrium Production Well	MPW006	1.3			1.1			NS			NS			20			20			120			170			NS			NS		
	EVM Shop Well	MPW019	0.80			0.60			0.60			NS			8.9			8.0			8.3			9.8			8.3			NS		
	Degerstrom Well at EVM	MPW020	NS			0.60	3.0	U	NS			NS			43			36			NS			98			NS			NS		
Henry Mine	Henry North Pit Well S	MMW003	2.2			2.7			2.6			NS			NS			NS			81			120			99			NS		
	Henry North Pit Well N	MMW004-Avg	3.6			1.6	3.0	U	3.4			3.6			NS			NS			130			140			120			130		
		MMW004	NA			1.6	3.0	U	3.4			NA			NS			NS			NA			140			120			NA		
		MMW004-R1	3.6			NA			NA			3.6			NS			NS			130			NA			NA			130		
		MMW004-R2	3.6			NA			NA			3.6			NS			NS			140			NA			NA			120		
		MMW004-R3	3.6			NA			NA			3.5			NS			NS			120			NA			NA			140		
	Henry South Pit Well	MPW022	NS			1.1	3.0	U	1.2			1.3			NS			NS			NS			3.1	8.0	U	2.8	7.5	U	0.38	0.50	U
	Henry Center Pit Well	MPW023	NS			0.80	3.0	U	0.80			NS			NS			NS			NS			70			63			NS		
Ballard Mine	Ballard Pit East Well	MMW001-Avg	0.90			0.77	3.0	U	0.90			0.90			NS			NS			100			99			120		J	98		
		MMW001	0.90			NA			0.90			0.90			NS			NS			100			NA			120			98		
		MMW001-R1	NA			0.70	3.0	U	NA			NA			NS			NS			NA			100			NA			NA		
		MMW001-R2	NA			0.90	3.0	U	NA			NA			NS			NS			NA			100			NA			NA		
		MMW001-R3	NA			0.70	3.0	U	NA			NA			NS			NS			NA			98			NA			NA		
	Ballard Pit West Well	MMW002-Avg	1.9			1.4	3.0	U	1.7			1.6			NS			NS			54			49		J	50			59		
		MMW002	1.9			NA			1.7			1.6			NS			NS			54			NA			50			59		
		MMW002-R1	NA			1.4	3.0	U	NA			NA			NS			NS			NA			49		J	NA			NA		
		MMW002-R2	NA			1.4	3.0	U	NA			NA			NS			NS			NA			49		J	NA			NA		
		MMW002-R3	NA			1.5	3.0	U	NA			NA			NS			NS			NA			49		J	NA			NA		

Notes:

‡ All data has been reported uncensored.

[a] Data from 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1998.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

Data qualifier definitions are:

(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.

(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 12
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Selenium						Cadmium											
			2004						1998[a]						2000			2001		
Mine	Station Name	Station ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	0.013			Dry			NS			NS			NS			0.00080		
	EVM S Dump Seep	MDS026	0.32			0.0060			NS			NS			NS			0.0048		
	Hedin Spring	MSG001-Avg	0.000060	0.0010	U	0.0012	0.00067<x<0.0013	U	NS			NS			NS			NS		
		MSG001	0.000060	0.0010	U	NA			NS			NS			NS			NS		
		MSG001-R1	NA			0.0020			NS			NS			NS			NS		
		MSG001-R2	NA			0.00086	0.0010	U	NS			NS			NS			NS		
		MSG001-R3	NA			0.00070	0.0010	U	NS			NS			NS			NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	Dry			Dry			NS			NS			NS			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	Dry			Dry			NS			NS			NS			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	Dry			Dry			NS			NS			NS			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	0.016			Dry			NS			NS			NS			NS		
	W Pond Creek Headwaters, below W Pond	MST144	0.18			Dry			NS			NS			NS			NS		
	E Fork Rasmussen Creek Headwaters	MST269	Dry			Dry			NS			NS			NS			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	0.0030			0.000040	0.0010	U	NS			NS			NS			NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	-0.00030	0.0010	U	-0.00011	0.0010	U	NS			NS			NS			NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	-0.00034	0.0010	U	Dry			NS			NS			NS			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	NA			0.00044	0.0010	U	0.0027			0	0.0020	U	NS			0.00017		
		MDS022	NA			0.00044	0.0010	U	0.0027			0	0.0020	U	NS			0.00017		
		MDS022-R1	NA			NA			NA			NA			NS			NA		
		MDS022-R2	NA			NA			NA			NA			NS			NA		
		MDS022-R3	NA			NA			NA			NA			NS			NA		
	Taylor Spring	MSG002	Dry			Dry			NS			NS			NS			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	-0.00045	0.0010	U	-0.00093	0.0010	U	NS			NS			NS			NS		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	0.0030			0.0013			NS			NS			NS			NS		
		MST064	0.0030			NA			NS			NS			NS			NS		
		MST064-R1	NA			0.0010			NS			NS			NS			NS		
		MST064-R2	NA			0.0020			NS			NS			NS			NS		
		MST064-R3	NA			0.0010			NS			NS			NS			NS		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	Dry			Dry			NS			NS			0.000082	0.00025	U	NS		
	Tributary Above W Fork Lone Pine Creek	MST276	0.0030			0.0020			NS			NS			NS			NS		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	-0.00088	0.0010	U	Dry			NS			NS			NS			NS		
		MST277	NA			Dry			NS			NS			NS			NS		
		MST277-R1	-0.00086	0.0010	U	Dry			NS			NS			NS			NS		
		MST277-R2	-0.00097	0.0010	U	Dry			NS			NS			NS			NS		
		MST277-R3	-0.00081	0.0010	U	Dry			NS			NS			NS			NS		

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Selenium						Cadmium											
			2004						1998[a]						2000			2001		
Mine	Station Name	Station ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Spring	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	0.42			0.59			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep S	MDS031	0.45			0.43			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep N	MDS032	0.45			0.29			NS			NS			NS			NS		
	Goat Seep	MDS033	1.4			Dry			NS			NS			NS			NS		
	Garden Hose Spring	MSG003	0.39			0.46			NS			NS			NS			0.000041	0.00013	U
	Holmgren Spring	MSG004	0.0090			0.018			NS			NS			NS			NS		
	Cattle Spring	MSG005-Avg	0.0070			0.0040			NS			NS			NS			NS		
		MSG005	0.0070			NA			NS			NS			NS			NS		
		MSG005-R1	NA			0.0040			NS			NS			NS			NS		
		MSG005-R2	NA			0.0040			NS			NS			NS			NS		
		MSG005-R3	NA			0.0040			NS			NS			NS			NS		
	SE Spring	MSG006	0.21			0.26			NS			NS			NS			NS		
	Ballard Creek, Headwaters	MST067	0.01			Dry			NS			NS			NS			NS		
	W Fork Ballard Creek, Headwaters	MST068	Dry			Dry			NS			NS			NS			NS		
	Short Creek, Below BM	MST069-Avg	0.64			0.49			NS			NS			NS			NS		
		MST069	0.64			0.49			NS			NS			NS			NS		
		MST069-R1	NA			NA			NS			NS			NS			NS		
		MST069-R2	NA			NA			NS			NS			NS			NS		
		MST069-R3	NA			NA			NS			NS			NS			NS		
	N Fork Wooley Valley Creek, Above BM	MST093	0.0010			Dry			NS			NS			NS			NS		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	0.021			Dry			NS			NS			Dry			NS		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NA			Dry			NS			NS			0.000032	0.00025	U	NS		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	0.016			0.027			NS			NS			0.00015	0.00025	U	NS		

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Cadmium																	
			2002												2003					
Mine	Station Name	Station ID	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag	Jan	RL	Flag	Mar.	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	0.0014			NS			Dry			NS			NS			NS		
	EVM S Dump Seep	MDS026	0.00050			NS			0.00030	0.0011	U	NS			NS			NS		
	Hedin Spring	MSG001	0.000020	0.00010	U	NS			0.000040	0.00010	U	NS			NS			NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	Dry			NS			Dry			NS			NS			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	Dry			NS			Dry			NS			NS			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	Dry			NS			Dry			NS			NS			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	0.00030			Dry			Dry			Dry			Dry			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	Dry			NS			Dry			NS			NS			NS		
	E Fork Rasmussen Creek Headwaters	MST269	Dry			NS			NA			NS			NS			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	0	0.00010	U	NA			0.000020	0.00010	U	NS			NS			NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	Dry			NS			0.00079	0.0010	U	NS			NS			NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	Dry			NS			Dry			NS			NS			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	0.000020	0.00010	U	NS			0.00010	0.00010	U	NS			NS			NS		
		MDS022	NA			NS			0.00010	0.00010	U	NS			NS			NS		
		MDS022-R1	0.000020	0.00010	U	NS			NA			NS			NS			NS		
		MDS022-R2	0.000010	0.00010	U	NS			NA			NS			0	0.00010	U	NA		
		MDS022-R3	0.000030	0.00010	U	NS			NA			NS			0	0.00010	U	NA		
	Taylor Spring	MSG002	Dry			NS			Dry			NS			NA			NA		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			0.00020	0.0011	U	NS			NA			NA		
	W Fork Lone Pine Creek Above Tributary	MST064	-0.000010	0.00010	U	0	0.00020	U	0.000070	0.00010	U	-0.000030	0.00010	U	NA			NA		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	0.000060	0.00010	U	NS			Dry			NS			NS			NS		
	Tributary Above W Fork Lone Pine Creek	MST276	0.000023	0.00010	U	NA			0.000060	0.00010	U	-0.000040	0.00010	U	0.000030	0.00010	U	0.000027	0.00010	U
	Lone Pine Creek, Spring Fed Tributary	MST277	NS			NS			NS			NS			NS			NS		
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS		
	Garden Hose Spring	MSG003	0.000020	0.00010	U	NS			0.000020	0.00010	U	NS			NS			NS		
	Holmgren Spring	MSG004	NS			NS			0	0.00010	U	NS			NS			NS		
	Cattle Spring	MSG005	NS			NS			-0.000040	0.00010	U	NS			NS			NS		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS		
	Ballard Creek, Headwaters	MST067	0.0022			Dry			Dry			Dry			NS			NS		
	W Fork Ballard Creek, Headwaters	MST068	Dry			NS			Dry			NS			NS			NS		
	Short Creek, Below BM	MST069-Avg	0.00011	0.000067<x<0.00013	U	0.000050	0.00020	U	0.000060	0.00010	U	-0.000040	0.00010	U	NS			NS		
		MST069	NA			0.000050	0.00020	U	0.000060	0.00010	U	-0.000040	0.00010	U	NS			NS		
		MST069-R1	0.00014	0.00020	U	NA			NA			NA			Dry			Dry		
		MST069-R2	0.00010			NA			NA			NA			NS			NS		
		MST069-R3	0.00010			NA			NA			NA			Dry			Dry		
	N Fork Wooley Valley Creek, Above BM	MST093	0.000060	0.00010	U	NS			Dry			NS			NS			NS		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	0.000070	0.00010	U	Dry			Dry			Dry			Dry			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	0.00020			Dry			Dry			Dry			Dry			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	0.000050	0.00010	U	Dry			Dry			Dry			Dry			Dry		

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Cadmium																	
			2003												2004					
Mine	Station Name	Station ID	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			NS			NS			NS			0.00050			Dry		
	EVM S Dump Seep	MDS026	NS			NS			NS			NS			0.0017			0.00010		
	Hedin Spring	MSG001-Avg	NS			NS			NS			NS			-0.000010	0.00010	U	0.000013	0.00075	U
		MSG001	NS			NS			NS			NS			-0.000010	0.00010	U	NA		
		MSG001-R1	NS			NS			NS			NS			NA			0.000050	0.00075	U
		MSG001-R2	NS			NS			NS			NS			NA			0	0.00075	U
		MSG001-R3	NS			NS			NS			NS			NA			-0.000010	0.00075	U
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			Dry			Dry		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	0.00020			0.00020			NS			NS			0.00010			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			NS			0.00010			Dry		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			Dry			Dry		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			NS			0.000010	0.00010	U	0.000010	0.00075	U
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			0.000050	0.00020	U	0.00025	0.00075	U
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			NS			0.00010	0.00020	U	Dry		
	S Pit Overburden Limestone Drain	MDS022	NS			NS			NS			NS			0.000010	0.00010	U	0.000020	0.00075	U
	Taylor Spring	MSG002	NS			NS			NS			NS			Dry			Dry		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			-0.000020	0.00010	U	NS			NS			0.000010	0.00010	U	0.000060	0.00075	U
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	0.000030	0.00010	U	0.000017	0.00010	U	-0.000010	0.00010	U	-0.000010	0.00010	U	0.000010	0.00010	U	0.000010	0.00075	U
		MST064	0.000030	0.00010	U	0.000017	0.00010	U	-0.000010	0.00010	U	-0.000010	0.00010	U	0.000010	0.00010	U	NA		
		MST064-R1	NA			NA			NA			NA			NA			0.000010	0.00075	U
		MST064-R2	NA			NA			NA			NA			NA			0.000010	0.00075	U
		MST064-R3	NA			NA			NA			NA			NA			0.000010	0.00075	U
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			NS			Dry			Dry		
	Tributary Above W Fork Lone Pine Creek	MST276	0.00016			0.000010	0.00010	U	0	0.00010	U	-0.0000067	0.00010	U	0.000020	0.00010	U	-0.000010	0.00075	U
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			0.0000067	0.00050	U	Dry		
		MST277	NS			NS			NS			NS			NA			Dry		
		MST277-R1	NS			NS			NS			NS			0.000020	0.00050	U	Dry		
		MST277-R2	NS			NS			NS			NS			0.000020	0.00050	U	Dry		
		MST277-R3	NS			NS			NS			NS			-0.000020	0.00050	U	Dry		

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Cadmium																	
			2003												2004					
Mine	Station Name	Station ID	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			0.000040	0.00010	U	0.000030	0.00075	U
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			0.000060	0.00010	U	0.000050	0.00075	U
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			0.000030	0.00010	U	0.00010	0.00075	U
	Goat Seep	MDS033	NS			NS			NS			NS			0.00020			Dry		
	Garden Hose Spring	MSG003	NS			NS			NS			NS			0.000010	0.00010	U	-0.000010	0.00075	U
	Holmgren Spring	MSG004	NS			NS			NS			NS			0.000020	0.00010	U	0.000050	0.00075	U
	Cattle Spring	MSG005-Avg	NS			NS			NS			NS			0.000010	0.00010	U	-0.0000067	0.00075	U
		MSG005	NS			NS			NS			NS			0.000010	0.00010	U	NA		
		MSG005-R1	NS			NS			NS			NS			NA			0	0.00075	U
		MSG005-R2	NS			NS			NS			NS			NA			-0.000010	0.00075	U
		MSG005-R3	NS			NS			NS			NS			NA			-0.000010	0.00075	U
	SE Spring	MSG006	NS			NS			NS			NS			0	0.00010	U	0.000010	0.00075	U
	Ballard Creek, Headwaters	MST067	0.0017			0.0019			NS			NS			0.0013			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			NS			Dry			Dry		
	Short Creek, Below BM	MST069	0.00010	0.00010	U	0.000040	0.00010	U	0.000020	0.00010	U	-0.000080	0.00010	U	0.00010			0.000030	0.00075	U
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			NS			0.000070	0.00020	U	Dry		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	0.000050	0.00010	U	NS			NS			NS			0.000020	0.00020	U	Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	0.00030			0.00030			NS			NS			0.00020			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	Dry			NS			NS			NS			0.000050	0.00010	U	0.000010	0.00075	U

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Chromium														
			2001			2002						2004					
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	0.019			0.0030	0.010	U	Dry			0.00020			Dry		
	EVM S Dump Seep	MDS026	0.0085			0.0010	0.010	U	NA			0.00040			0.00012	0.0015	U
	Hedin Spring	MSG001-Avg	NS			-0.0010	0.010	U	NA			0.00020			-0.0028	0.0015	U
		MSG001	NS			-0.0010	0.010	U	NA			0.00020			NA		
		MSG001-R1	NS			NA			NA			NA			-0.0028	0.0015	U
		MSG001-R2	NS			NA			NA			NA			-0.0028	0.0015	U
		MSG001-R3	NS			NA			NA			NA			-0.0029	0.0015	U
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			Dry			Dry			Dry			Dry		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			Dry			Dry			Dry			Dry		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			Dry			Dry			Dry			Dry		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS			-0.0050	0.010	U	Dry			0.00010			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			Dry			Dry			0.00020			Dry		
	E Fork Rasmussen Creek Headwaters	MST269	NS			Dry			NA			Dry			Dry		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			0.0010	0.010	U	NA			0.00020			-0.00017	0.0015	U
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			Dry			NA			0.00050			-0.0016	0.0015	U
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			Dry			Dry			0.00015	0.00020	U	Dry		
	S Pit Overburden Limestone Drain	MDS022-Avg	0.0024			-0.0027	0.010	U	NA			NA			-0.0029	0.0015	U
		MDS022	0.0024			NA			NA			NA			-0.0029	0.0015	U
		MDS022-R1	NA			-0.0090	0.010	U	NA			NA			NA		
		MDS022-R2	NA			0.0020	0.010	U	NA			NA			NA		
		MDS022-R3	NA			-0.0010	0.010	U	NA			NA			NA		
	Taylor Spring	MSG002	NS			Dry			Dry			Dry			Dry		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			0.000020	0.00010	U	-0.00011	0.0015	U
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS			0	0.010	U	NA			0.000080	0.00010	U	-0.00010	0.0015	U
		MST064	NS			0	0.010	U	NA			0.000080	0.00010	U	NA		
		MST064-R1	NS			NA			NA			NA			-0.00011	0.0015	U
		MST064-R2	NS			NA			NA			NA			-0.00012	0.0015	U
		MST064-R3	NS			NA			NA			NA			-0.00008	0.0015	U
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			-0.0020	0.010	U	Dry			Dry			Dry		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			0.0050	0.010	U	NA			0.00020			-0.000050	0.0015	U
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			0.00020	0.00050	U	Dry		
		MST277	NS			NS			NS			NA			Dry		
		MST277-R1	NS			NS			NS			0.00022	0.00050	U	Dry		
		MST277-R2	NS			NS			NS			0.00023	0.00050	U	Dry		
		MST277-R3	NS			NS			NS			0.00015	0.00050	U	Dry		

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Chromium														
			2001			2002						2004					
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			0.0015			-0.0024	0.0015	U
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			0.0011			-0.0023	0.0015	U
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			0.00050			-0.0028	0.0015	U
	Goat Seep	MDS033	NS			NS			NS			0.00070			Dry		
	Garden Hose Spring	MSG003	0.023			0.0060	0.010	U	NA			0.00090			0.00050	0.0015	U
	Holmgren Spring	MSG004	NS			NS			NS			0.00060			0.00030	0.0015	U
	Cattle Spring	MSG005-Avg	NS			NS			NS			0.00050			0.00053	0.0015	U
		MSG005	NS			NS			NS			0.00050			NA		
		MSG005-R1	NS			NS			NS			NA			0.00050	0.0015	U
		MSG005-R2	NS			NS			NS			NA			0.00050	0.0015	U
		MSG005-R3	NS			NS			NS			NA			0.00060	0.0015	U
	SE Spring	MSG006	NS			NS			NS			0.00080			-0.0025	0.0015	U
	Ballard Creek, Headwaters	MST067	NS			0.0025	0.010	U	Dry			0.00060			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			Dry			Dry			Dry			Dry		
	Short Creek, Below BM	MST069-Avg	NS			0.00033	0.010	U	NA			0.00070			0.00020	0.0015	U
		MST069	NS			NA			NA			0.00070			0.00020	0.0015	U
		MST069-R1	NS			-0.0020	0.010	U	NA			NA			NA		
		MST069-R2	NS			0.0020	0.010	U	NA			NA			NA		
		MST069-R3	NS			0.0010	0.010	U	NA			NA			NA		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			0.0020	0.010	U	Dry			0.00016	0.00010	U	Dry		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS			0.0030	0.010	U	Dry			NA			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS			0.0030	0.010	U	Dry			NA			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS			0.00050	0.010	U	Dry			0.00020			-0.0028	0.0015	U

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Nickel																				
			1998[a]						2001			2002											
Mine	Station Name	Station ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			NS			0.17			0.17			NS			Dry			NS		
	EVM S Dump Seep	MDS026	NS			NS			0.021			0.0093		J	NS			0.024	0.028	U	NS		
	Hedin Spring	MSG001	NS			NS			NS			0.0011	0.0035	UJ	NS			0.0034	0.028	U	NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			Dry			NS			Dry			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			Dry			NS			Dry			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			Dry			NS			Dry			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS			NS			NS			0.0031	0.0035	UJ	Dry			Dry			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			Dry			NS			Dry			NS		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			Dry			NS			NA			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			0.0014	0.0035	UJ	NA			0.0039	0.028	U	NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			Dry			Dry			0.024	0.028	U	NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			Dry			NS			Dry			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	0.034			0.018			0.0032			0.0065	0.0056<x<0.0067	J	NS			0.014	0.028	U	NS		
		MDS022	0.034			0.018			0.0032			NA			NS			0.014	0.028	U	NS		
		MDS022-R1	NA			NA			NA			0.0022	0.0035	UJ	NS			NA			NS		
		MDS022-R2	NA			NA			NA			0.0086		J	NS			NA			NS		
		MDS022-R3	NA			NA			NA			0.0081		J	NS			NA			NS		
	Taylor Spring	MSG002	NS			NS			NS			Dry			NS			Dry			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			NS			NS			0.0027	0.028	U	NS		
	W Fork Lone Pine Creek Above Tributary	MST064	NS			NS			NS			0.0017	0.0035	UJ	0.00090	0.0045	U	0.0021	0.028	U	0.045		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			0.0010	0.0035	UJ	NS			Dry			NS		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			NS			NS			0.0025	0.0035	UJ	NA			0.0023	0.028	U	0.037		
	Lone Pine Creek, Spring Fed Tributary	MST277	NS			NS			NS			NS			NS			NS			NS		
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			NS		
	Garden Hose Spring	MSG003	NS			NS			0.0011			0.0010	0.0035	UJ	NS			0.0068	0.028	U	NS		
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			0.0086	0.028	U	NS		
	Cattle Spring	MSG005	NS			NS			NS			NS			NS			0.0052	0.028	U	NS		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			NS		
	Ballard Creek, Headwaters	MST067	NS			NS			NS			0.014		J	Dry			Dry			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			Dry			NS			Dry			NS		
	Short Creek, Below BM	MST069-Avg	NS			NS			NS			0.027		J	0.018			0.033			0.0066		
		MST069	NS			NS			NS			NA			0.018			0.033			0.0066		
		MST069-R1	NS			NS			NS			0.026		J	NA			NA			NA		
		MST069-R2	NS			NS			NS			0.027		J	NA			NA			NA		
		MST069-R3	NS			NS			NS			0.027		J	NA			NA			NA		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			0.0016	0.0035	UJ	NS			Dry			NS		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS			NS			NS			0.00090	0.0035	UJ	Dry			Dry			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS			NS			NS			0.0074		J	Dry			Dry			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS			NS			NS			0.0026	0.0035	UJ	Dry			Dry			Dry		

Table 12 continued

Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Nickel																							
			2003																		2004					
Mine	Station Name	Station ID	Jan	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			NS			NS			NS			NS			NS			0.19			Dry		
	EVM S Dump Seep	MDS026	NS			NS			NS			NS			NS			NS			0.014			0.0087		
	Hedin Spring	MSG001-Avg	NS			NS			NS			NS			NS			NS			0.00050	0.0050	U	0.0020		
		MSG001	NS			NS			NS			NS			NS			NS			0.00050	0.0050	U	NA		
		MSG001-R1	NS			NS			NS			NS			NS			NS			NA			0.0021		
		MSG001-R2	NS			NS			NS			NS			NS			NS			NA			0.0019		
		MSG001-R3	NS			NS			NS			NS			NS			NS			NA			0.0020		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	Dry			Dry			0.0032			0.0026			Dry			Dry			0.0031	0.0050	U	Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			NS			NS			NS			0.0015	0.0050	U	Dry		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			NS			NS			NS			0.00020	0.0050	U	0.0019		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			NS			NS			0.0053			0.020		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			NS			NS			NS			0.013			Dry		
	S Pit Overburden Limestone Drain	MDS022	NS			NS			NS			NS			NS			NS			0.0057			0.0085		
	Taylor Spring	MSG002	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			0.0013	0.0015	U	NS			NS			0.00080	0.0050	U	0.0032		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	0.0028			NA			0.0018	0.0020	U	0.0013	0.0015	U	0.0012	0.013	U	0.00090	0.0030	U	0.00040	0.0050	U	0.0016		
		MST064	0.0028			NA			0.0018	0.0020	U	0.0013	0.0015	U	0.0012	0.013	U	0.00090	0.0030	U	0.00040	0.0050	U	NA		
		MST064-R1	NA			NA			NA			NA			NA			NA			NA			0.0021		
		MST064-R2	NA			NA			NA			NA			NA			NA			NA			0.0019		
		MST064-R3	NA			NA			NA			NA			NA			NA			NA			0.0020		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Tributary Above W Fork Lone Pine Creek	MST276	0.0029			0.0019			0.0026			0.0022			0.0020			0.019			0.0013	0.0050	U	0.0020		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			NS			NS			0.0013	0.0050	U	Dry		
		MST277	NS			NS			NS			NS			NS			NS			NA			Dry		
		MST277-R1	NS			NS			NS			NS			NS			NS			0.0010	0.0050	U	Dry		
		MST277-R2	NS			NS			NS			NS			NS			NS			0.0020	0.0050	U	Dry		
		MST277-R3	NS			NS			NS			NS			NS			NS			0.0010	0.0050	U	Dry		

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Nickel																							
			2003																		2004					
Mine	Station Name	Station ID	Jan	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			0.0031	0.0050	U	0.005		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			0.0011	0.0050	U	0.0057		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			0.0067			0.011		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			0.011			Dry		
	Garden Hose Spring	MSG003	NS			NS			NS			NS			NS			NS			0.0025	0.0050	U	0.0066		
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			NS			0.0023	0.0050	U	0.0089		
	Cattle Spring	MSG005-Avg	NS			NS			NS			NS			NS			NS			0.00018	0.00020	U	0.0039		
		MSG005	NS			NS			NS			NS			NS			NS			0.00018	0.00020	U	NA		
		MSG005-R1	NS			NS			NS			NS			NS			NS			NA			0.0039		
		MSG005-R2	NS			NS			NS			NS			NS			NS			NA			0.0040		
		MSG005-R3	NS			NS			NS			NS			NS			NS			NA			0.0039		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			0.00010	0.00020	U	0.0072		
	Ballard Creek, Headwaters	MST067	Dry			Dry			0.010			0.010			Dry			Dry			0.013			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			NS			NS			0.0010	0.0030	U	Dry			Dry		
	Short Creek, Below BM	MST069	Dry			Dry			0.019			0.020			0.019			NA			0.025			0.037		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			NS			NS			NS			0.00080	0.0050	U	Dry		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry			Dry			0.0015	0.0020	U	Dry			Dry			Dry			0.00050	0.0050	U	Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	Dry			Dry			0.0093			0.0071			Dry			Dry			0.0068			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	Dry			Dry			Dry			Dry			Dry			Dry			0.00050	0.0050	U	0.0036		

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Vanadium																				
			1998[a]						2001			2002											
Mine	Station Name	Station ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			NS			0.0028		J	-0.0010	0.0050	U	NS			Dry			NS		
	EVM S Dump Seep	MDS026	NS			NS			0.0018		J	0	0.0050	U	NS			0.0014	0.0050	U	NS		
	Hedin Spring	MSG001	NS			NS			NS			0.0030	0.0050	U	NS			0.00029	0.0050	U	NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			Dry			NS			Dry			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			Dry			NS			Dry			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			Dry			NS			Dry			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS			NS			NS			-0.0010	0.0050	U	Dry			Dry			NS		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			Dry			NS			Dry			NS		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			Dry			NS			NA			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			-0.0020	0.0050	U	NA			0.00075	0.0050	U	NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			Dry			NS			0.0088			NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			Dry			NS			Dry			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	0.023			0.0040	0.0043	U	0.024		J	0	0.0050	U	NS			0.00016	0.0050	U	NS		
		MDS022	0.023			0.0040	0.0043	U	0.024		J	NA			NS			0.00016	0.0050	U	NS		
		MDS022-R1	NA			NA			NA			0.0020	0.0050	U	NS			NA			NS		
		MDS022-R2	NA			NA			NA			-0.0010	0.0050	U	NS			NA			NS		
		MDS022-R3	NA			NA			NA			-0.0010	0.0050	U	NS			NA			NS		
	Taylor Spring	MSG002	NS			NS			NS			Dry			NS			Dry			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			NS			NS			0.00067	0.0050	U	NS		
	W Fork Lone Pine Creek Above Tributary	MST064	NS			NS			NS			0.0020	0.0050	U	0.00070			0.00043	0.0050	U	0.00074		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			-0.0030	0.0050	U	NS			Dry			NS		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			NS			NS			0.0050	0.0050	U	NA			0.0011	0.0050	U	0.0010		
	Lone Pine Creek, Spring Fed Tributary	MST277	NS			NS			NS			NS			NS			NS			NS		
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			NS		
	Garden Hose Spring	MSG003	NS			NS			0.0028		J	0.0020	0.0050	U	NS			0.0010	0.0050	U	NS		
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			0.0016	0.0050	U	NS		
	Cattle Spring	MSG005	NS			NS			NS			NS			NS			0.00036	0.0050	U	NS		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			NS		
	Ballard Creek, Headwaters	MST067	NS			NS			NS			0.019			Dry			Dry			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			Dry			NS			Dry			NS		
	Short Creek, Below BM	MST069-Avg	NS			NS			NS			0.0010	0.0050	U	0.0016			0.0022	0.0050	U	0.0019		
		MST069	NS			NS			NS			NA			0.0016			0.0022	0.0050	U	0.0019		
		MST069-R1	NS			NS			NS			0	0.0050	U	NA			NA			NA		
		MST069-R2	NS			NS			NS			0.0010	0.0050	U	NA			NA			NA		
		MST069-R3	NS			NS			NS			0.0020	0.0050	U	NA			NA			NA		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			0.011			NS			Dry			Dry		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS			NS			NS			-0.0010	0.0050	U	Dry			Dry			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS			NS			NS			0.0030	0.0050	U	Dry			Dry			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS			NS			NS			-0.0010	0.0050	U	Dry			Dry			Dry		

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Vanadium																							
			2003																		2004					
Mine	Station Name	Station ID	Jan.	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			NS			NS			NS			NS			NS			0.0011			Dry		
	EVM S Dump Seep	MDS026	NS			NS			NS			NS			NS			NS			0.0034			0.00089		
	Hedin Spring	MSG001-Avg	NS			NS			NS			NS			NS			NS			0.00020	0.00048	U	-0.000057	0.00079	U
		MSG001	NS			NS			NS			NS			NS			NS			0.00020	0.00048	U	NA		
		MSG001-R1	NS			NS			NS			NS			NS			NS			NA			-0.000050	0.00079	U
		MSG001-R2	NS			NS			NS			NS			NS			NS			NA			-0.000060	0.00079	U
		MSG001-R3	NS			NS			NS			NS			NS			NS			NA			-0.000060	0.00079	U
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	Dry			Dry			0.0016			0.0013			Dry			Dry			0.0022			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			NS			NS			NS			0.00058			Dry		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			NS			NS			NS			0.00056			0.00047	0.00079	U
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			NS			NS			0.011			0.0034		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			NS			NS			NS			0.00040	0.00048	U	Dry		
	S Pit Overburden Limestone Drain	MDS022	NS			NS			NS			NS			NS			NS			0.00013	0.00048	U	-0.00014	0.000050	U
	Taylor Spring	MSG002	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			0.00060			NS			NS			0.00072			0.0013		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	0.0055			NA			0.00069			0.00064			0.00065			0.00093			0.00065			0.00065	0.00079	U
		MST064	0.0055			NA			0.00069			0.00064			0.00065			0.00093			0.00065			NA		
		MST064-R1	NA			NA			NA			NA			NA			NA			NA			0.00064	0.00079	U
		MST064-R2	NA			NA			NA			NA			NA			NA			NA			0.00069	0.00079	U
		MST064-R3	NA			NA			NA			NA			NA			NA			NA			0.00063	0.00079	U
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Tributary Above W Fork Lone Pine Creek	MST276	0.00085			0.00092			0.0014			0.0011			0.0010			0.0014			0.0011			0.00086		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			NS			NS			0.00036	0.00042	U	Dry		
		MST277	NS			NS			NS			NS			NS			NS			NA			Dry		
		MST277-R1	NS			NS			NS			NS			NS			NS			0.00040	0.00048	U	Dry		
		MST277-R2	NS			NS			NS			NS			NS			NS			0.00040	0.00048	U	Dry		
		MST277-R3	NS			NS			NS			NS			NS			NS			0.00029	0.00030	U	Dry		

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Vanadium																							
			2003																		2004					
Mine	Station Name	Station ID	Jan.	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			0.00090			0.00054	0.00079	U
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			0.0010			0.00075	0.00079	U
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			0.0011			0.00081		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			0.0016			Dry		
	Garden Hose Spring	MSG003	NS			NS			NS			NS			NS			NS			0.0011			0.00087		
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			NS			0.0016			0.0052		
	Cattle Spring	MSG005-Avg	NS			NS			NS			NS			NS			NS			0.00024	0.00048	U	0.00013	0.00079	U
		MSG005	NS			NS			NS			NS			NS			NS			0.00024	0.00048	U	NA		
		MSG005-R1	NS			NS			NS			NS			NS			NS			NA			0.000060	0.00079	U
		MSG005-R2	NS			NS			NS			NS			NS			NS			NA			0.00018	0.00079	U
		MSG005-R3	NS			NS			NS			NS			NS			NS			NA			0.00015	0.00079	U
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			0.00073			0.0011		
	Ballard Creek, Headwaters	MST067	Dry			Dry			0.018			0.013			Dry			Dry			0.0084			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Short Creek, Below BM	MST069	NA			Dry			0.0015			0.0020			0.0015			0.0019			0.0011			0.0011		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			NS			NS			NA			0.0062			Dry		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry			Dry			0.00080			Dry			Dry			Dry			0.0017			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	Dry			Dry			0.0038			0.0057			Dry			Dry			0.0023			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	Dry			Dry			Dry			Dry			Dry			Dry			0.00072			0.00013	0.00079	U

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Zinc																				
			1998[a]						2001			2002											
Mine	Station Name	Station ID	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			NS			0.14		J	0.12			NS			Dry			NS		
	EVM S Dump Seep	MDS026	NS			NS			0.047		J	0.0070	0.015	U	NS			0.023	0.075	U	NS		
	Hedin Spring	MSG001	NS			NS			NS			0.00064	0.0020	U	NS			0.0090	0.075	U	NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			Dry			NS			Dry			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			Dry			NS			Dry			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			Dry			NS			Dry			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS			NS			NS			0.0015	0.0020	U	Dry			Dry			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			Dry			NS			Dry			NS		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			Dry			NS			NA			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			0.00092	0.0020	U	NA			0.011	0.075	U	NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			Dry			NS			0.020	0.075	U	NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			Dry			NS			Dry			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	0.0060			-0.0010	0.0011	U	0.10			0.0018	0.0063	U	NS			0.0080	0.075	U	NS		
		MDS022	0.0060			-0.0010	0.0011	U	0.10			NA			NS			0.0080	0.075	U	NS		
		MDS022-R1	NA			NA			NA			0.0030	0.015	U	NS			NA			NS		
		MDS022-R2	NA			NA			NA			0.0014	0.0020	U	NS			NA			NS		
		MDS022-R3	NA			NA			NA			0.0010	0.0020	U	NS			NA			NS		
	Taylor Spring	MSG002	NS			NS			NS			Dry			NS			Dry			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			NS			NS			0.010	0.075	U	NS		
	W Fork Lone Pine Creek Above Tributary	MST064	NS			NS			NS			0.00081	0.0020	U	0.014	0.070	U	0.0070	0.075	U	0.0090	0.045	UJ
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			0.0030	0.015	U	NS			Dry			NS		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			NS			NS			0.0019	0.0020	U	NA			0.0060	0.075	U	0.011	0.045	UJ
	Lone Pine Creek, Spring Fed Tributary	MST277	NS			NS			NS			NS			NS			NS			NS		
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			NS		
	Garden Hose Spring	MSG003	NS			NS			0.016		J	0.00075	0.0020	U	NS			0.0090	0.075	U	NS		
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			0.011	0.075	U	NS		
	Cattle Spring	MSG005	NS			NS			NS			NS			NS			0.019	0.075	U	NS		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			NS		
	Ballard Creek, Headwaters	MST067	NS			NS			NS			0.033			Dry			Dry			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			Dry			NS			NS			NS		
	Short Creek, Below BM	MST069-Avg	NS			NS			NS			0.0073	0.015	U	0.016	0.070	U	0.011	0.075	U	0.013	0.045	UJ
		MST069	NS			NS			NS			NA			0.016	0.070	U	0.011	0.075	U	0.013	0.045	UJ
		MST069-R1	NS			NS			NS			0.0080	0.015	U	NA			NA			NA		
		MST069-R2	NS			NS			NS			0.0070	0.015	U	NA			NA			NA		
		MST069-R3	NS			NS			NS			0.0070	0.015	U	NA			NA			NA		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			0.0011	0.0020	U	NS			Dry			NS		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS			NS			NS			0.0020	0.015	U	Dry			Dry			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS			NS			NS			0.016			Dry			Dry			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS			NS			NS			0.0060	0.015	U	Dry			Dry			Dry		

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Zinc																							
			2003																		2004					
Mine	Station Name	Station ID	Jan.	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			NS			NS			NS			NS			NS			0.049	0.00040	U	NS		
	EVM S Dump Seep	MDS026	NS			NS			NS			NS			NS			NS			0.016	0.00040	U	0.0040	0.015	U
	Hedin Spring	MSG001-Avg	NS			NS			NS			NS			NS			NS			0.0013	0.00040	U	0.0017	0.015	U
		MSG001	NS			NS			NS			NS			NS			NS			0.0013	0.00040	U	NA		
		MSG001-R1	NS			NS			NS			NS			NS			NS			NA			0.0015	0.015	U
		MSG001-R2	NS			NS			NS			NS			NS			NS			NA			0.0020	0.015	U
		MSG001-R3	NS			NS			NS			NS			NS			NS			NA			0.0017	0.015	U
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	Dry			Dry			0.010	0.045	U	0.014	0.070	U	Dry			Dry			0.0018	0.0020	U	Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			NS			NS			NS			0.00400	0.00040	U	Dry		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			NS			NS			NS			0.00081	0.0020	U	0.00081	0.015	U
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			NS			NS			0.0011	0.00040	U	0.0060	0.015	U
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS						NS			NS			0.0080	0.00040	U	Dry		
	S Pit Overburden Limestone Drain	MDS022	NS			NS			NS						NS			NS			0.0012	0.0020	U	0.0020	0.015	U
	Taylor Spring	MSG002	NS			NS			NS						NS			NS			Dry			Dry		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			0.0090	0.070	U	NS			NS			0.0080	0.00040	U	0.0030	0.015	U
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	0.0060	0.065	U	NA			0.0080	0.045	U	0.010	0.070	U	0.015	0.080	U	0.012	0.075	U	0.00094	0.0020	U	0.0030	0.015	U
		MST064	0.0060	0.065	U	NA			0.0080	0.045	U	0.010	0.070	U	0.015	0.080	U	0.012	0.075	U	0.00094	0.0020	U	NA		
		MST064-R1	NA			NA			NA			NA			NA			NA			NA			0.0015	0.015	U
		MST064-R2	NA			NA			NA			NA			NA			NA			NA			0.0060	0.015	U
		MST064-R3	NA			NA			NA			NA			NA			NA			NA			0.0015	0.015	U
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Tributary Above W Fork Lone Pine Creek	MST276	0.0067	0.065	U	0.0087	0.050	U	0.012	0.045	U	0.013	0.070	U	0.013	0.080	U	0.019	0.075	U	0.0015	0.0020	U	0.00084	0.015	U
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			NS			NS			0.0013	0.010	U	Dry		
		MST277	NS			NS			NS			NS			NS			NS			NA			Dry		
		MST277-R1	NS			NS			NS			NS			NS			NS			0.00030	0.010	U	Dry		
		MST277-R2	NS			NS			NS			NS			NS			NS			0.0019	0.010	U	Dry		
		MST277-R3	NS			NS			NS			NS			NS			NS			0.0016	0.010	U	Dry		

Table 12 continued
Seeps, Springs, and Headwater Streams - Filtered Results - COPC (mg/L)‡

Station			Zinc																							
			2003																		2004					
Mine	Station Name	Station ID	Jan.	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			0.0030	0.0020	U	0.0011	0.015	U
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			0.0018	0.0020	U	0.0020	0.015	U
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			0.0040	0.0020	U	0.0060	0.015	U
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			0.0070	0.0020	U	Dry		
	Garden Hose Spring	MSG003	NS			NS			NS			NS			NS			NS			0.00084	0.0020	U	0.0014	0.015	U
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			NS			0.0030	0.00040	U	0.0015	0.015	U
	Cattle Spring	MSG005-Avg	NS			NS			NS			NS			NS			NS			0.0030	0.00040	U	0.00061	0.015	U
		MSG005	NS			NS			NS			NS			NS			NS			0.0030	0.00040	U	NA		
		MSG005-R1	NS			NS			NS			NS			NS			NS			NA			0.00068	0.015	U
		MSG005-R2	NS			NS			NS			NS			NS			NS			NA			0.00080	0.015	U
		MSG005-R3	NS			NS			NS			NS			NS			NS			NA			0.00036	0.015	U
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			0.00075	0.0020	U	0.0030	0.015	U
	Ballard Creek, Headwaters	MST067	Dry			Dry			0.031	0.045	U	0.037	0.070	U	Dry			Dry			0.027			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS						NS			NS			Dry			Dry		
	Short Creek, Below BM	MST069	Dry			Dry			0.014	0.045	U	0.014	0.070	U	0.013	0.080	U	0.017	0.075	U	0.0090	0.015	U	0.011	0.015	U
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS						NS			NS			-0.00023	0.00040	U	Dry		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry			Dry			0.012	0.045	U				Dry			Dry			0.0012	0.00040	U	Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	Dry			Dry			0.031	0.045	U	0.023	0.070	U	Dry			Dry			0.013			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	Dry			Dry			Dry						Dry			Dry			0.017	0.00040	U	0.0020	0.015	U

Notes:
‡ All data has been reported uncensored.
[a] Data from 1998 are flagged for samples below the detection limit only. Additional flags were not in use in 1998.
Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).
Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.
Data qualifier definitions are:
(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.
(J) - The result is an estimated quantity.
(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
COPC - Constituent of Potential Concern
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 13
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			2001			2001			2001			2001			2001			2001		
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	0.00086	0.0010	U	0.00012	0.0025	U	0.0081			0.031		J	0.00020	0.0050	U	0.026		
	EVM S Dump Seep	MDS026	0.00037	0.0010	U	0.00010	0.0025	U	0.00037	0.00050	U	0.023		J	-0.0030	0.0050	U	0.0052	0.025	U
	Hedin Spring	MSG001-Avg	NS			NS			NS			NS			NS			NS		
		MSG001	NS			NS			NS			NS			NS			NS		
		MSG001-R1	NS			NS			NS			NS			NS			NS		
		MSG001-R2	NS			NS			NS			NS			NS			NS		
		MSG001-R3	NS			NS			NS			NS			NS			NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			NS			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			NS			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			NS			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS			NS			NS			NS			NS			NS		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			NS			NS			NS		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			NS			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			NS			NS			NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			NS			NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			NS			NS			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	0.0041		J	0.00028	0.0025	U	0.0018			0.015		J	0.00020	0.0050	U	0.015	0.025	U
		MDS022	0.0041		J	0.00028	0.0025	U	0.0018			0.015			0.00020	0.0050	U	0.015	0.025	U
		MDS022-R1	NA			NA			NA			NA			NA			NA		
		MDS022-R2	NA			NA			NA			NA			NA			NA		
		MDS022-R3	NA			NA			NA			NA			NA			NA		
	Taylor Spring	MSG002	NS			NS			NS			NS			NS			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			NS			NS			NS		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS			NS			NS			NS			NS			NS		
		MST064	NS			NS			NS			NS			NS			NS		
		MST064-R1	NS			NS			NS			NS			NS			NS		
		MST064-R2	NS			NS			NS			NS			NS			NS		
		MST064-R3	NS			NS			NS			NS			NS			NS		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			NS			NS			NS		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			NS			NS			NS			NS			NS		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			NS			NS		
		MST277	NS			NS			NS			NS			NS			NS		
		MST277-R1	NS			NS			NS			NS			NS			NS		
		MST277-R2	NS			NS			NS			NS			NS			NS		
		MST277-R3	NS			NS			NS			NS			NS			NS		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			2001			2001			2001			2001			2001			2001		
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS		
	Garden Hose Spring	MSG003	0.000048	0.0010	U	0.00064	0.0025	U	0.00034	0.00050	U	0.039			0.00020	0.0050	U	0.016	0.025	U
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			NS		
	Cattle Spring	MSG005-Avg	NS			NS			NS			NS			NS			NS		
		MSG005	NS			NS			NS			NS			NS			NS		
		MSG005-R1	NS			NS			NS			NS			NS			NS		
		MSG005-R2	NS			NS			NS			NS			NS			NS		
		MSG005-R3	NS			NS			NS			NS			NS			NS		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS		
	Ballard Creek, Headwaters	MST067	NS			NS			NS			NS			NS			NS		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			NS			NS			NS		
	Short Creek, Below BM	MST069-Avg	NS			NS			NS			NS			NS			NS		
		MST069	NS			NS			NS			NS			NS			NS		
		MST069-R1	NS			NS			NS			NS			NS			NS		
		MST069-R2	NS			NS			NS			NS			NS			NS		
		MST069-R3	NS			NS			NS			NS			NS			NS		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			NS			NS			NS		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS			NS			NS			NS			NS			NS		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS			NS			NS			NS			NS			NS		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS			NS			NS			NS			NS			NS		

Table 13 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Chloride																		Copper			Flouride		
			2000			2001			2002						2004						2001			2001		
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			5.0			4.6		J	Dry			5.0			Dry			0.0015			0.51		
	EVM S Dump Seep	MDS026	NS			7.4			NA			21		J	0.80			6.8			0.0018			0.40		
	Hedin Spring	MSG001-Avg	NS			NS			11		J	11		J	11			11			NS			NS		
		MSG001	NS			NS			11		J	11		J	11			NA			NS			NS		
		MSG001-R1	NS			NS			NA			NA			NA			11			NS			NS		
		MSG001-R2	NS			NS			NA			NA			NA			11			NS			NS		
		MSG001-R3	NS			NS			NA			NA			NA			11			NS			NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			Dry			Dry			Dry			Dry			NS			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			Dry			Dry			Dry			Dry			NS			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			Dry			Dry			Dry			Dry			NS			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NA			NS			180		J	Dry			160			Dry			NS			NS		
	W Pond Creek Headwaters, below W Pond	MST144	NA			NS			Dry			Dry			5.5			Dry			NS			NS		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			Dry			280		J	Dry			Dry			NS			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			18		J	13		J	23			23			NS			NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			Dry			NA			5.6			37			NS			NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			Dry			Dry			1.3			Dry			NS			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	NS			3.3			12		J	7.0		J	3.6			5.5			0.0013			0.17		
		MDS022	NS			3.3			NA			7.0		J	3.6			5.5			0.0013			0.17		
		MDS022-R1	NS			NA			29		J	NA			NA			NA			NA			NA		
		MDS022-R2	NS			NA			4.7		J	NA			NA			NA			NA			NA		
		MDS022-R3	NS			NA			4.5		J	NA			NA			NA			NA			NA		
	Taylor Spring	MSG002	NS			NS			Dry			Dry			Dry			Dry			NS			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			7.0		J	3.3			5.2			NS			NS		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS			NS			4.0		J	4.4		J	4.1			4.1			NS			NS		
		MST064	NS			NS			4.0		J	4.4		J	4.1			NA			NS			NS		
		MST064-R1	NS			NS			NA			NA			NA			4.4			NS			NS		
		MST064-R2	NS			NS			NA			NA			NA			4.4			NS			NS		
		MST064-R3	NS			NS			NA			NA			NA			3.5			NS			NS		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	2.0			NS			2.6		J	Dry			Dry			Dry			NS			NS		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			NS			3.3		J	5.3		J	2.4			4.5			NS			NS		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			4.5			Dry			NS			NS		
		MST277	NS			NS			NS			NS			NA			Dry			NS			NS		
		MST277-R1	NS			NS			NS			NS			4.5			Dry			NS			NS		
		MST277-R2	NS			NS			NS			NS			4.4			Dry			NS			NS		
		MST277-R3	NS			NS			NS			NS			4.5			Dry			NS			NS		

Table 13 continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Chloride																		Copper			Flouride		
			2000			2001			2002						2004						2001			2001		
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Spring	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			3.9			4.9			NS			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			2.9			3.2			NS			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			6.6			7.4			NS			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			4.1			Dry			NS			NS		
	Garden Hose Spring	MSG003	NS			5.7			4.2		J	5.0	10	UJ	4.5			10			0.00058			0.093	0.10	U
	Holmgren Spring	MSG004	NS			NS			NS			3.2		J	2.9			3.5			NS			NS		
	Cattle Spring	MSG005-Avg	NS			NS			NS			3.1		J	3.3			2.8			NS			NS		
		MSG005	NS			NS			NS			3.1		J	3.3			NA			NS			NS		
		MSG005-R1	NS			NS			NS			NA			NA			2.7			NS			NS		
		MSG005-R2	NS			NS			NS			NA			NA			2.8			NS			NS		
		MSG005-R3	NS			NS			NS			NA			NA			2.9			NS			NS		
	SE Spring	MSG006	NS			NS			NS			NS			4.8			4.8			NS			NS		
	Ballard Creek, Headwaters	MST067	NS			NS			6.2		J	Dry			8.3			Dry			NS			NS		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			Dry			Dry			Dry			Dry			NS			NS		
	Short Creek, Below BM	MST069-Avg	NS			NS			12		J	20		J	12			17			NS			NS		
		MST069	NS			NS			NA			20		J	12			17			NS			NS		
		MST069-R1	NS			NS			12		J	NA			NA			NA			NS			NS		
		MST069-R2	NS			NS			12		J	NA			NA			NA			NS			NS		
		MST069-R3	NS			NS			12		J	NA			NA			NA			NS			NS		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			8.4		J	Dry			8.9			Dry			NS			NS		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry			NS			1.8		J	Dry			2.2			Dry			NS			NS		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	3.0			NS			3.5		J	Dry			4.1			Dry			NS			NS		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	3.0			NS			3.9		J	Dry			3.4			4.0			NS			NS		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Calcium																	
			2000			2001			2002											
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			250			250		J	NS			Dry			NS		
	EVM S Dump Seep	MDS026	NS			280			160		J	NS			250			NS		
	Hedin Spring	MSG001-Avg	NS			NS			69		J	NS			63			NS		
		MSG001	NS			NS			69		J	NS			63			NS		
		MSG001-R1	NS			NS			NA			NS			NA			NS		
		MSG001-R2	NS			NS			NA			NS			NA			NS		
		MSG001-R3	NS			NS			NA			NS			NA			NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			Dry			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			Dry			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			Dry			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NA			NS			140		J	Dry			Dry			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NA			NS			NS			NS			Dry			NS		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			48			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			63		J	NA			62			NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			NA			NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			NS			Dry			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	NS			100			130		J	NS			130			NS		
		MDS022	NS			100			NA			NS			130			NS		
		MDS022-R1	NS			NA			120		J	NS			NA			NS		
		MDS022-R2	NS			NA			130		J	NS			NA			NS		
		MDS022-R3	NS			NA			130		J	NS			NA			NS		
	Taylor Spring	MSG002	NS			NS			NS			NS			Dry			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			NS			91			NS		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS			NS			58		J	81			67			79		
		MST064	NS			NS			58		J	81			67			79		
		MST064-R1	NS			NS			NA			NA			NA			NA		
		MST064-R2	NS			NS			NA			NA			NA			NA		
		MST064-R3	NS			NS			NA			NA			NA			NA		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	33			NS			21		J	NS			Dry			NS		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			NS			69		J	NA			77			79		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			NS			NS		
		MST277	NS			NS			NS			NS			NS			NS		
		MST277-R1	NS			NS			NS			NS			NS			NS		
		MST277-R2	NS			NS			NS			NS			NS			NS		
		MST277-R3	NS			NS			NS			NS			NS			NS		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Calcium																	
			2000			2001			2002											
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS		
	Garden Hose Spring	MSG003	NS			130			140		J	NS			140			NS		
	Holmgren Spring	MSG004	NS			NS			NS			NS			75			NS		
	Cattle Spring	MSG005-Avg	NS			NS			NS			NS			78			NS		
		MSG005	NS			NS			NS			NS			78			NS		
		MSG005-R1	NS			NS			NS			NS			NA			NS		
		MSG005-R2	NS			NS			NS			NS			NA			NS		
		MSG005-R3	NS			NS			NS			NS			NA			NS		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS		
	Ballard Creek, Headwaters	MST067	NS			NS			300		J	Dry			Dry			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			NS			Dry			NS		
	Short Creek, Below BM	MST069-Avg	NS			NS			400		J	480			420			430		
		MST069	NS			NS			NA			480			420			430		
		MST069-R1	NS			NS			410		J	NA			NA			NA		
		MST069-R2	NS			NS			400		J	NA			NA			NA		
		MST069-R3	NS			NS			390		J	NA			NA			NA		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			38		J	NS			Dry			NS		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry			NS			33		J	Dry			Dry			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	7.0			NS			110		J	Dry			Dry			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	87			NS			92		J	Dry			Dry			Dry		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Calcium																							Lead		
			2003																	2004						2001		
Mine	Station Name	Station ID	Jan.	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			NS			NS			NS			NS			NS			240			Dry			-0.000070	0.00025	U
	EVM S Dump Seep	MDS026	NS			NS			NS			NS			NS			NS			360			280			-0.000021	0.00025	U
	Hedin Spring	MSG001-Avg	NS			NS			NS			NS			NS			NS			70			69			NS		
		MSG001	NS			NS			NS			NS			NS			NS			70			NA			NS		
		MSG001-R1	NS			NS			NS			NS			NS			NS			NA			69			NS		
		MSG001-R2	NS			NS			NS			NS			NS			NS			NA			69			NS		
		MSG001-R3	NS			NS			NS			NS			NS			NS			NA			69			NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			NS			NS			Dry			Dry			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			NS			NS			Dry			Dry			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			NS			NS			Dry			Dry			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	Dry			Dry			130			130			Dry			Dry			130			Dry			NS		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			NS			NS			NS			150			Dry			NS		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			NS			NS			Dry			Dry			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			NS			NS			NS			67			70			NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			NS			NS			16			75			NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			NS			NS			NS			280			Dry			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	NS			NS			NS			NS			NS			NS			120			140			-0.000060	0.00025	U
		MDS022	NS			NS			NS			NS			NS			NS			120			140			-0.000060	0.00025	U
		MDS022-R1	NS			NS			NS			NS			NS			NS			NA			NA			NA		
		MDS022-R2	NS			NS			NS			NS			NS			NS			NA			NA			NA		
		MDS022-R3	NS			NS			NS			NS			NS			NS			NA			NA			NA		
	Taylor Spring	MSG002	NS			NS			NS			NS			NS			NS			Dry			Dry			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			64			NS			NS			76			98			NS		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	74			NA			70			72			75			80			76			76			NS		
		MST064	74			NA			70			72			75			80			76			NA			NS		
		MST064-R1	NA			NA			NA			NA			NA			NA			NA			76			NS		
		MST064-R2	NA			NA			NA			NA			NA			NA			NA			75			NS		
		MST064-R3	NA			NA			NA			NA			NA			NA			NA			76			NS		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			NS			NS			NS			Dry			Dry			NS		
	Tributary Above W Fork Lone Pine Creek	MST276	71			61			57			62			82			84			76			80			NS		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			NS			NS			93			Dry			NS		
		MST277	NS			NS			NS			NS			NS			NS			NA			Dry			NS		
		MST277-R1	NS			NS			NS			NS			NS			NS			94			Dry			NS		
		MST277-R2	NS			NS			NS			NS			NS			NS			93			Dry			NS		
		MST277-R3	NS			NS			NS			NS			NS			NS			93			Dry			NS		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Calcium																							Lead		
			2003																	2004						2001		
Mine	Station Name	Station ID	Jan.	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			160			160			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			140			140			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			230			230			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			280			Dry			NS		
	Garden Hose Spring	MSG003	NS			NS			NS			NS			NS			NS			140			140			0.000013	0.00025	U
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			NS			66			78			NS		
	Cattle Spring	MSG005-Avg	NS			NS			NS			NS			NS			NS			85			84			NS		
		MSG005	NS			NS			NS			NS			NS			NS			85			NA			NS		
		MSG005-R1	NS			NS			NS			NS			NS			NS			NA			84			NS		
		MSG005-R2	NS			NS			NS			NS			NS			NS			NA			84			NS		
		MSG005-R3	NS			NS			NS			NS			NS			NS			NA			84			NS		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			220			210			NS		
	Ballard Creek, Headwaters	MST067	Dry			Dry			260			250			Dry			Dry			270			Dry			NS		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			NS			NS			NS			Dry			Dry			NS		
	Short Creek, Below BM	MST069-Avg	Dry			Dry			340			380			430			470			240			430			NS		
		MST069	Dry			Dry			340			380			430			470			240			430			NS		
		MST069-R1	Dry			Dry			NA			NA			NA			NA			NA			NA			NS		
		MST069-R2	Dry			Dry			NA			NA			NA			NA			NA			NA			NS		
		MST069-R3	Dry			Dry			NA			NA			NA			NA			NA			NA			NS		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			NS			NS			NS			24			NS			NS		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry			Dry			41			Dry			Dry			Dry			66			NS			NS		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	Dry			Dry			150			120			Dry			Dry			140			Dry			NS		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	Dry			Dry			Dry			Dry			Dry			Dry			94			100			NS		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Manganese			Molybdenum			Magnesium																	
			2001			2001			2000			2001			2002											
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	5.0			0.0033			NS			64			68			NS			Dry			NS		
	EVM S Dump Seep	MDS026	0.77			0.00078	0.00025	U	NS			79			42			NS			73			NS		
	Hedin Spring	MSG001-Avg	NS			NS			NS			NS			11			NS			10	61	U	NS		
		MSG001	NS			NS			NS			NS			11			NS			10	61	U	NS		
		MSG001-R1	NS			NS			NS			NS			NS			NS			NA			NS		
		MSG001-R2	NS			NS			NS			NS			NS			NS			NA			NS		
		MSG001-R3	NS			NS			NS			NS			NS			NS			NA			NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			Dry			NS			Dry			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			Dry			NS			Dry			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			Dry			NS			Dry			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NS			NS			NA			NS			24			Dry			Dry			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NA			NS			Dry			NS			Dry			NS		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			Dry			NS			85			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			NS			8.5			NA			8.8	61	U	NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			Dry			NS			NA			NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			NS			Dry			NS			Dry			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	0.027			0.0086			NS			44			43			NS			53	61	U	NS		
		MDS022	0.027			0.0086			NS			44			NA			NS			53	61	U	NS		
		MDS022-R1	NA			NA			NS			NA			35			NS			NA			NS		
		MDS022-R2	NA			NA			NS			NA			48			NS			NA			NS		
		MDS022-R3	NA			NA			NS			NA			48			NS			NA			NS		
	Taylor Spring	MSG002	NS			NS			NS			NS			Dry			NS			Dry			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			NS			NS			NS			20	61	U	NS		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS			NS			NS			NS			12			19			16	61	U	19		
		MST064	NS			NS			NS			NS			12			19			16			19		
		MST064-R1	NS			NS			NS			NS			NA			NA			NA			NA		
		MST064-R2	NS			NS			NS			NS			NA			NA			NA			NA		
		MST064-R3	NS			NS			NS			NS			NA			NA			NA			NA		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			5.0			NS			3.7			NS			Dry			NS		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			NS			NS			NS			9.5			NA			13	61	U	12		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			NS			NS			NS			NS		
		MST277	NS			NS			NS			NS			NS			NS			NS			NS		
		MST277-R1	NS			NS			NS			NS			NS			NS			NS			NS		
		MST277-R2	NS			NS			NS			NS			NS			NS			NS			NS		
		MST277-R3	NS			NS			NS			NS			NS			NS			NS			NS		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Manganese			Molybdenum			Magnesium																	
			2001			2001			2000			2001			2002											
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			NS			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			NS			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			NS			NS		
	Garden Hose Spring	MSG003	0.00080	0.0020	U	0.00072	0.00025	U	NS			16			16			NS			14	61	U	NS		
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			NS			25	61	U	NS		
	Cattle Spring	MSG005-Avg	NS			NS			NS			NS			NS			NS			21	61	U	NS		
		MSG005	NS			NS			NS			NS			NS			NS			21	61	U	NS		
		MSG005-R1	NS			NS			NS			NS			NS			NS			NA			NS		
		MSG005-R2	NS			NS			NS			NS			NS			NS			NA			NS		
		MSG005-R3	NS			NS			NS			NS			NS			NS			NA			NS		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			NS			NS		
	Ballard Creek, Headwaters	MST067	NS			NS			NS			NS			73			Dry			Dry			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			NS			Dry			NS			Dry			NS		
	Short Creek, Below BM	MST069-Avg	NS			NS			NS			NS			85			100			85			90		
		MST069	NS			NS			NS			NS			NA			100			85			90		
		MST069-R1	NS			NS			NS			NS			88			NA			NA			NA		
		MST069-R2	NS			NS			NS			NS			85			NA			NA			NA		
		MST069-R3	NS			NS			NS			NS			83			NA			NA			NA		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			NS			6.2			NS			Dry			NS		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	NS			NS			Dry			NS			6.5			Dry			Dry			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	NS			NS			15			NS			32			Dry			Dry			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	NS			NS			22			NS			16			Dry			Dry			Dry		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Magnesium																							
			2003																		2004					
Mine	Station Name	Station ID	Jan.	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			NS			NS			NS			NS			NS			62			NS		
	EVM S Dump Seep	MDS026	NS			NS			NS			NS			NS			NS			83			77		
	Hedin Spring	MSG001-Avg	NS			NS			NS			NS			NS			NS			10			10		
		MSG001	NS			NS			NS			NS			NS			NS			10			NA		
		MSG001-R1	NS			NS			NS			NS			NS			NS			NA			10		
		MSG001-R2	NS			NS			NS			NS			NS			NS			NA			10		
		MSG001-R3	NS			NS			NS			NS			NS			NS			NA			10		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	Dry			Dry			25			23			Dry			Dry			23			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NS			NS			NS			NS			NS			NS			36			Dry		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			NS			NS			NS			NS			Dry			Dry		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			NS			NS			NS			NS			9.3			9.9		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			NS			NS			NS			NS			4.1			22		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			NS			NS			NS			NS			52			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	NS			NS			NS			NS			NS			NS			47			56		
		MDS022	NS			NS			NS			NS			NS			NS			47			56		
		MDS022-R1	NS			NS			NS			NS			NS			NS			NA			NA		
		MDS022-R2	NS			NS			NS			NS			NS			NS			NA			NA		
		MDS022-R3	NS			NS			NS			NS			NS			NS			NA			NA		
	Taylor Spring	MSG002	NS			NS			NS			NS			NS			NS			NS			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			12			NS			NS			13			18		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	17			NA			16			16			17			80			17			17		
		MST064	17			NA			16			16			17			80			17			NA		
		MST064-R1	NA			NA			NA			NA			NA			NA			NA			17		
		MST064-R2	NA			NA			NA			NA			NA			NA			NA			17		
		MST064-R3	NA			NA			NA			NA			NA			NA			NA			17		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Tributary Above W Fork Lone Pine Creek	MST276	12			9.9			8.4			9.1			14			84			11			13		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			NS			NS			8.8			Dry		
		MST277	NS			NS			NS			NS			NS			NS			NA			Dry		
		MST277-R1	NS			NS			NS			NS			NS			NS			8.8			Dry		
		MST277-R2	NS			NS			NS			NS			NS			NS			8.8			Dry		
		MST277-R3	NS			NS			NS			NS			NS			NS			8.9			Dry		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Magnesium																							
			2003																	2004					
Mine	Station Name	Station ID	Jan.	RL	Flag	Mar.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			NS			NS			17			17		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			NS			NS			18			20		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			NS			NS			69			75		
	Goat Seep	MDS033	NS			NS			NS			NS			NS			NS			64			Dry		
	Garden Hose Spring	MSG003	NS			NS			NS			NS			NS			NS			15			15		
	Holmgren Spring	MSG004	NS			NS			NS			NS			NS			NS			24			26		
	Cattle Spring	MSG005-Avg	NS			NS			NS			NS			NS			NS			22			22		
		MSG005	NS			NS			NS			NS			NS			NS			22			NA		
		MSG005-R1	NS			NS			NS			NS			NS			NS			NA			22		
		MSG005-R2	NS			NS			NS			NS			NS			NS			NA			22		
		MSG005-R3	NS			NS			NS			NS			NS			NS			NA			22		
	SE Spring	MSG006	NS			NS			NS			NS			NS			NS			41			42		
	Ballard Creek, Headwaters	MST067	Dry			Dry			68			66			83			470			75			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			NS			NS			NS			NS			Dry			Dry		
	Short Creek, Below BM	MST069-Avg	Dry			Dry			76			83			NA			NA			87			86		
		MST069	Dry			Dry			76			83			NA			NA			87			86		
		MST069-R1	Dry			Dry			NA			NA			NA			NA			NA			NA		
		MST069-R2	Dry			Dry			NA			NA			NA			NA			NA			NA		
		MST069-R3	Dry			Dry			NA			NA			NA			NA			NA			NA		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			NS			NS			NS			NS			4.0			Dry		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry			Dry			6.8			Dry			Dry			Dry			11			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	Dry			Dry			42			31			Dry			Dry			39			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	Dry			Dry			Dry			Dry			Dry			Dry			17			19		

Table 13 Continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Potassium																		Silver		
			2000			2001			2002						2004						2001		
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			3.0			3.1			Dry			3.4			Dry			-0.000012	0.00025	U
	EVM S Dump Seep	MDS026	NS			1.6			0.90			13			5.3			1.8			-0.000028	0.00025	U
	Hedin Spring	MSG001-Avg	NS			NS			0.60			0.70	4.5	U	0.70			0.63			NS		
		MSG001	NS			NS			0.60			0.70	4.5	U	0.70			NA			NS		
		MSG001-R1	NS			NS			NA			NA			NA			0.70			NS		
		MSG001-R2	NS			NS			NA			NA			NA			0.50			NS		
		MSG001-R3	NS			NS			NA			NA			NA			0.70			NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			Dry			Dry			Dry			Dry			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			Dry			Dry			Dry			Dry			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			Dry			Dry			Dry			Dry			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NA			NS			2.0			Dry			2.5			Dry			NS		
	W Pond Creek Headwaters, below W Pond	MST144	NA			NS			Dry			Dry			1.4			Dry			NS		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			Dry			6.3			Dry			Dry			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			0.50			1.1	4.5	U	0.60			7.8			NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			Dry			NA			20			100			NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			Dry			Dry			1.1			Dry			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	NS			0.88			2.7			2.5	4.5	U	1.4			1.9			-0.000016	0.00025	U
		MDS022	NS			0.88			NA			2.5	4.5	U	1.4			1.9			-0.000016	0.00025	U
		MDS022-R1	NS			NA			2.5			NA			NA			NA			NA		
		MDS022-R2	NS			NA			2.9			NA			NA			NA			NA		
		MDS022-R3	NS			NA			2.7			NA			NA			NA			NA		
	Taylor Spring	MSG002	NS			NS			Dry			Dry			Dry			Dry			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			7.0	4.5	U	12			3.4			NS		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS			NS			0.60			0.80	4.5	U	0.60			0.73			NS		
		MST064	NS			NS			0.60			0.80			0.60			NA			NS		
		MST064-R1	NS			NS			NA			NA			NA			0.70			NS		
		MST064-R2	NS			NS			NA			NA			NA			0.80			NS		
		MST064-R3	NS			NS			NA			NA			NA			0.70			NS		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	1.0			NS			0.70			Dry			Dry			Dry			NS		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			NS			1.0			0.60	4.5	U	0.50			0.70			NS		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			9.1			Dry			NS		
		MST277	NS			NS			NS			NS			NA			Dry			NS		
		MST277-R1	NS			NS			NS			NS			9.1			Dry			NS		
		MST277-R2	NS			NS			NS			NS			9.0			Dry			NS		
		MST277-R3	NS			NS			NS			NS			9.1			Dry			NS		

Table 13 Continued

Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Potassium																		Silver		
			2000			2001			2002						2004						2001		
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			1.0			0.80			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			1.5			1.7			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			2.6			9			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			3.0			Dry			NS		
	Garden Hose Spring	MSG003	NS			2.3			0.80			0.70	4.5	U	0.80			0.90			0.0000011	0.00025	U
	Holmgren Spring	MSG004	NS			NS			NS			1.8	4.5	U	1.5			1.9			NS		
	Cattle Spring	MSG005-Avg	NS			NS			NS			0.60	4.5	U	0.50			0.63			NS		
		MSG005	NS			NS			NS			0.60	4.5	U	0.50			NA			NS		
		MSG005-R1	NS			NS			NS			NA			NA			0.60			NS		
		MSG005-R2	NS			NS			NS			NA			NA			0.70			NS		
		MSG005-R3	NS			NS			NS			NA			NA			0.60			NS		
	SE Spring	MSG006	NS			NS			NS			Dry			0.70			1.4			NS		
	Ballard Creek, Headwaters	MST067	NS			NS			2.2			Dry			1.7			Dry			NS		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			Dry			Dry			Dry			Dry			NS		
	Short Creek, Below BM	MST069-Avg	NS			NS			3.0			9.2			2.7			3.9			NS		
		MST069	NS			NS			NA			9.2			2.7			3.9			NS		
		MST069-R1	NS			NS			3.0			NA			NA			NA			NS		
		MST069-R2	NS			NS			3.0			NA			NA			NA			NS		
		MST069-R3	NS			NS			2.9			NA			NA			NA			NS		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			0.80			Dry			0.40			Dry			NS		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry			NS			0.60			Dry			1.2			Dry			NS		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	2.0			NS			0.50			Dry			0.20	0.30	U	Dry			NS		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	0.37			NS			1.6			Dry			1.2			1.6			NS		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Sodium																	
			2000			2001			2002						2004					
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			12		J	13			Dry			12			Dry		
	EVM S Dump Seep	MDS026	NS			16		J	8.7			17			17			17		
	Hedin Spring	MSG001-Avg	NS			NS			5.5			5.5	17	UJ	5.6			5.7		
		MSG001	NS			NS			5.5			5.5	17	UJ	5.6			NA		
		MSG001-R1	NS			NS			NA			NA			NA			5.7		
		MSG001-R2	NS			NS			NA			NA			NA			5.7		
		MSG001-R3	NS			NS			NA			NA			NA			5.7		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			Dry			Dry			Dry			Dry		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			Dry			Dry			Dry			Dry		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			Dry			Dry			Dry			Dry		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NA			NS			8.0			Dry			8.6			Dry		
	W Pond Creek Headwaters, below W Pond	MST144	NA			NS			Dry			Dry			6.8			Dry		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			Dry			4.5	17	UJ	Dry			Dry		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			4.5			4.1	17	UJ	4.9			4.7		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			Dry			NA			4.6			17		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			Dry			Dry			9.3			Dry		
	S Pit Overburden Limestone Drain	MDS022-Avg	NS			15		J	18			16	17	UJ	14			17		
		MDS022	NS			15			NA			16	17	UJ	14			17		
		MDS022-R1	NS			NA			24			NA			NA			NA		
		MDS022-R2	NS			NA			15			NA			NA			NA		
		MDS022-R3	NS			NA			15			NA			NA			NA		
	Taylor Spring	MSG002	NS			NS			Dry			Dry			Dry			Dry		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			12	17	UJ	6.8			9.2		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS			NS			7.1			10	17	UJ	9.4			9.5		
		MST064	NS			NS			7.1			10			9.4			NA		
		MST064-R1	NS			NS			NA			NA			NA			9.5		
		MST064-R2	NS			NS			NA			NA			NA			9.5		
		MST064-R3	NS			NS			NA			NA			NA			9.6		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	3.0			NS			2.5			Dry			Dry			Dry		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			NS			6.1			7.5	17	UJ	7.0			7.9		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			7.0			Dry		
		MST277	NS			NS			NS			NS			NA			Dry		
		MST277-R1	NS			NS			NS			NS			6.9			Dry		
		MST277-R2	NS			NS			NS			NS			6.9			Dry		
		MST277-R3	NS			NS			NS			NS			7.1			Dry		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Sodium																	
			2000			2001			2002						2004					
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			11			10		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			11			12		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			37			38		
	Goat Seep	MDS033	NS			NS			NS			NS			28			Dry		
	Garden Hose Spring	MSG003	NS			NS			10			9.2	17	UJ	9.5			9.2		
	Holmgren Spring	MSG004	NS			NS			NS			4.3	17	UJ	4.7			4.8		
	Cattle Spring	MSG005-Avg	NS			NS			NS			4.3	17	UJ	4.2			4.6		
		MSG005	NS			NS			NS			4.3	17	UJ	4.2			NA		
		MSG005-R1	NS			NS			NS			NA			NA			4.6		
		MSG005-R2	NS			NS			NS			NA			NA			4.6		
		MSG005-R3	NS			NS			NS			NA			NA			4.5		
	SE Spring	MSG006	NS			NS			NS			NS			9.0			9.9		
	Ballard Creek, Headwaters	MST067	NS			NS			25			Dry			30			Dry		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			Dry			Dry			Dry			Dry		
	Short Creek, Below BM	MST069-Avg	NS			NS			25			25		J	25			24		
		MST069	NS			NS			NA			25		J	25			24		
		MST069-R1	NS			NS			26			NA			NA			NA		
		MST069-R2	NS			NS			25			NA			NA			NA		
		MST069-R3	NS			NS			24			NA			NA			NA		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			7.6			Dry			7.0			Dry		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry			NS			2.3			Dry			5.0			Dry		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	7.0			NS			7.4			Dry			7.7			Dry		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	6.0			NS			5.6			Dry			5.4			5.7		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Sulfate																		Thallium			Uranium		
			2000			2001			2002						2004						2001			2001		
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM W Dump Seep	MDS025	NS			700		J	620		J	Dry			590			Dry			0.00029	0.0025	U	0.0023		
	EVM S Dump Seep	MDS026	NS			645		J	470		J	620		J	810			0	0.50	U	0.000081	0.0025	U	0.071		
	Hedin Spring	MSG001-Avg	NS			NS			9.8		J	11		J	10			11			NS			NS		
		MSG001	NS			NS			9.8		J	11		J	10			NA			NS			NS		
		MSG001-R1	NS			NS			NA			NA			NA			10			NS			NS		
		MSG001-R2	NS			NS			NA			NA			NA			11			NS			NS		
		MSG001-R3	NS			NS			NA			NA			NA			11			NS			NS		
	W Rasmussen Creek #1, above Lone Pine Creek	MST059	NS			NS			Dry			Dry			Dry			Dry			NS			NS		
	W Rasmussen Creek #2, above Lone Pine Creek	MST060	NS			NS			Dry			Dry			Dry			Dry			NS			NS		
	W Rasmussen Creek #3, above Lone Pine Creek	MST061	NS			NS			Dry			Dry			Dry			Dry			NS			NS		
	Rasmussen Creek, Headwaters near EVM Pond	MST136	NA			NS			150		J	Dry			140			Dry			NS			NS		
	W Pond Creek Headwaters, below W Pond	MST144	NA			NS			Dry			Dry			340			Dry			NS			NS		
	E Fork Rasmussen Creek Headwaters	MST269	NS			NS			Dry			55		J	Dry			Dry			NS			NS		
	W Fork Rasmussen Creek Above Rasmussen Creek	MST274	NS			NS			34		J	18		J	37			16		J	NS			NS		
	N Fork Lone Pine Creek Above E Fork Lone Pine Creek	MST275	NS			NS			Dry			NA			8.6			2.2		J	NS			NS		
Henry Mine	S Pit Overburden Dump Seep	MDS016	NS			NS			Dry			Dry			350			Dry			NS			NS		
	S Pit Overburden Limestone Drain	MDS022-Avg	NS			76		J	57		J	38		J	60			49		J	0.000051	0.0025	U	0.0067		
		MDS022	NS			76		J	NA			38		J	60			49		J	0.000051	0.0025	U	0.0067		
		MDS022-R1	NS			NA			65		J	NA			NA			NA			NA			NA		
		MDS022-R2	NS			NA			55		J	NA			NA			NA			NA			NA		
		MDS022-R3	NS			NA			51		J	NA			NA			NA			NA			NA		
	Taylor Spring	MSG002	NS			NS			Dry			Dry			Dry			Dry			NS			NS		
	Lone Pine Creek Above W Fork Lone Pine Creek	MST058	NS			NS			NS			13		J	19			34		J	NS			NS		
	W Fork Lone Pine Creek Above Tributary	MST064-Avg	NS			NS			37		J	27		J	40			39		J	NS			NS		
		MST064	NS			NS			37		J	27		J	40			NA			NS			NS		
		MST064-R1	NS			NS			NA			NA			NA			39		J	NS			NS		
		MST064-R2	NS			NS			NA			NA			NA			39		J	NS			NS		
		MST064-R3	NS			NS			NA			NA			NA			39		J	NS			NS		
	E Fork Lone Pine Creek Below Wooley Valley Mine	MST226	9.0			NS			8.2		J	Dry			Dry			Dry			NS			NS		
	Tributary Above W Fork Lone Pine Creek	MST276	NS			NS			59		J	39		J	40			47		J	NS			NS		
	Lone Pine Creek, Spring Fed Tributary	MST277-Avg	NS			NS			NS			NS			3.6			Dry			NS			NS		
		MST277	NS			NS			NS			NS			NA			Dry			NS			NS		
		MST277-R1	NS			NS			NS			NS			3.5			Dry			NS			NS		
		MST277-R2	NS			NS			NS			NS			3.6			Dry			NS			NS		
		MST277-R3	NS			NS			NS			NS			3.7			Dry			NS			NS		

Table 13 continued
Seeps, Springs, and Headwater Streams - Filtered Results - Screening Analytes (mg/L)‡

Station			Sulfate																		Thallium			Uranium		
			2000			2001			2002						2004						2001			2001		
Mine	Station Name	Station ID	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Fall	RL	Flag	Spring	RL	Flag	Spring	RL	Flag
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	NS			NS			NS			NS			140			15		J	NS			NS		
	Pit #2 Lower Dump Seep S	MDS031	NS			NS			NS			NS			160			200		J	NS			NS		
	Pit #2 Lower Dump Seep N	MDS032	NS			NS			NS			NS			570			440		J	NS			NS		
	Goat Seep	MDS033	NS			NS			NS			NS			720			Dry			NS			NS		
	Garden Hose Spring	MSG003	NS			160			120		J	120		J	120			110		J	0.00016	0.0025	U	0.0022		
	Holmgren Spring	MSG004	NS			NS			NS			45		J	34			46		J	NS			NS		
	Cattle Spring	MSG005-Avg	NS			NS			NS			31		J	34			30		J	NS			NS		
		MSG005	NS			NS			NS			31			34			NA			NS			NS		
		MSG005-R1	NS			NS			NS			NA			NA			30		J	NS			NS		
		MSG005-R2	NS			NS			NS			NA			NA			30		J	NS			NS		
		MSG005-R3	NS			NS			NS			NA			NA			30		J	NS			NS		
	SE Spring	MSG006	NS			NS			NS			NS			390			440		J	NS			NS		
	Ballard Creek, Headwaters	MST067	NS			NS			780		J	Dry			810			Dry			NS			NS		
	W Fork Ballard Creek, Headwaters	MST068	NS			NS			Dry			Dry			Dry			Dry			NS			NS		
	Short Creek, Below BM	MST069-Avg	NS			NS			1000		J	NA			1200			760		J	NS			NS		
		MST069	NS			NS			NA		J	NA			1200			760		J	NS			NS		
		MST069-R1	NS			NS			1000		J	NA			NA			NA			NS			NS		
		MST069-R2	NS			NS			1000		J	NA			NA			NA			NS			NS		
		MST069-R3	NS			NS			1000		J	NA			NA			NA			NS			NS		
	N Fork Wooley Valley Creek, Above BM	MST093	NS			NS			18		J	Dry			17			Dry			NS			NS		
	Spring Fed Tributary #1 Above N Fork Wooley Valley Creek Below BM	MST094	Dry			NS			7.7		J	Dry			13			Dry			NS			NS		
	Spring Fed Tributary #2 Above N Fork Wooley Valley Creek Below BM	MST095	69			NS			290		J	Dry			270			Dry			NS			NS		
	Spring Fed Tributary #3 Above N Fork Wooley Valley Creek Below BM	MST096	110			NS			110		J	Dry			100			59		J	NS			NS		

Notes:
‡ All data has been reported uncensored.
Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).
Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.
Data qualifier definitions are:
(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.
(J) - The result is an estimated quantity.
(R) - The data are unusable.
(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.
RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.
NS - Not Sampled
NA - Not Analyzed

Table 14
Ponds - Filtered Results - COPC (mg/L)‡

Station			Cadmium														
			2001			2002											
Mine	Name	ID	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	0.00039	0.00070	U	0.00070			NS			0.000060	0.00010	U	NS		
		MSP017	0.00039	0.00070	U	0.00070			NS			0.000060	0.00010	U	NS		
		MSP017-R1	NA			NA			NA			NA			NA		
		MSP017-R2	NA			NA			NA			NA			NA		
		MSP017-R3	NA			NA			NA			NA			NA		
	EVM Keyhole Pond	MSP018	0.050			0.10			0.0067			0.0090			0.056		
	EVM Bat Cave Pond	MSP019	0.00014	0.00070	U	0.00010			NS			0.000050	0.00010	U	NS		
	EVM West Pond	MSP020	0.00013	0.00070	U	0.00040			NS			0.00010	0.0011	U	NS		
	EVM Stock Pond	MSP021-Avg	0.0046			0.015			NS			0.00040	0.0011	U	NS		
		MSP021	0.0046			NA			NS			0.00040	0.0011	U	NS		
		MSP021-R1	NA			0.014			NA			NA			NA		
		MSP021-R2	NA			0.015			NA			NA			NA		
		MSP021-R3	NA			0.015			NA			NA			NA		
	EVM Tipple Pond	MSP022	0.00017	0.00070	U	0.0010			NS			0.0013			NS		
	EVM Haul Road Pond	MSP023	0.00033	0.00070		0.00010			500			0.0030			NS		
	EVM Shop Pond	MSP031	0.0016			0.0017			NS			0.0080			NS		
Henry Mine	HM Henry Pond	MSP014	0.000090	0.00070	U	0.00010			NS			-0.000040	0.00010	U	NS		
	HM Smith Pond	MSP015	0.00021	0.00070	U	0.00020			NS			0.00016			NS		
	HM Center Henry Pond	MSP016-Avg	0.000060	0.00070	U	0.000090	0.00010	U	NS			0.00017	0.0011	U	NS		
		MSP016	0.000058	0.00070	U	0.000090	0.00010	U	NS			NA			NS		
		MSP016-D	0.000062	0.00070	U	NA			NA			NA			NA		
		MSP016-R1	NA			NA			NA			0.00020	0.0011	U	NA		
		MSP016-R2	NA			NA			NA			0.00010	0.0011	U	NA		
		MSP016-R3	NA			NA			NA			0.00020	0.0011	U	NA		
	HM South Pit Pond	MSP055	0.039			0.0031			0.0070			NS			NS		
Ballard Mine	BM Dredge Pond	MSP010-Avg	0.00037	0.00070	U	0.0011			0.00022	0.00050	U	0.00080	0.0011	U	NS		
		MSP010	0.00037	0.00070	U	NA			NA			0.00080	0.0011	U	NS		
		MSP010-R1	NA			0.0011			0.00041	0.00050	U	NA			NA		
		MSP010-R2	NA			0.0011			0.000010	0.00050	U	NA			NA		
		MSP010-R3	NA			0.0011			0.00024	0.00050	U	NA			NA		
	BM Upper Elk Pond	MSP011-Avg	0.0013			0.0012			NS			NS			NS		
		MSP011	0.0013			0.0012			NS			NS			NS		
		MSP011-D	NA			NA			NS			NS			NS		
	BM Lower Elk Pond	MSP012	0.00097			0.0012			NS			NS			NS		
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	0.00057	0.00070	U	0.00040			NS			NS			NS		
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			NS		

Table 14 continued
Ponds - Filtered Results - COPC (mg/L)‡

Station			Cadmium																		Chromium					
			2003															2004			2001			2002		
Mine	Name	ID	Jan.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag	Spring	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	NS			NS			NS			NS			NS			0.00030			0.0050	0.0080	U	0	0.010	U
		MSP017	NS			NS			NS			NS			NS			NA			0.0050	0.0080	U	0	0.010	U
		MSP017-R1	NS			NS			NS			NS			NS			0.00030			NA			NA		
		MSP017-R2	NS			NS			NS			NS			NS			0.00030			NA			NA		
		MSP017-R3	NS			NS			NS			NS			NS			0.00030			NA			NA		
	EVM Keyhole Pond	MSP018	0.016			0.089			0.095			0.028			0.0026			0.074			0.0063	0.0080	U	0.0020	0.010	U
	EVM Bat Cave Pond	MSP019	NS			NS			NS			NS			NS			0.00010			0.0029	0.0080	U	-0.0050	0.010	U
	EVM West Pond	MSP020	NS			NS			NS			NS			NS			0.0020			0.0013	0.0080	U	0.0020	0.010	U
	EVM Stock Pond	MSP021-Avg	NS			NS			NS			NS			NS			0.0098			0.0055	0.0080	U	-0.0037	0.010	U
		MSP021	NS			NS			NS			NS			NS			0.0098			0.0055	0.0080	U	NA		
		MSP021-R1	NS			NS			NS			NS			NS			NA			NA			-0.0070	0.010	U
		MSP021-R2	NS			NS			NS			NS			NS			NA			NA			0.0010	0.010	U
		MSP021-R3	NS			NS			NS			NS			NS			NA			NA			-0.0050	0.010	U
	EVM Tipple Pond	MSP022	NS			NS			NS			NS			NS			0.00010			0.0024	0.0080	U	-0.0030	0.010	U
	EVM Haul Road Pond	MSP023	NS			NS			NS			NS			NS			0.00020			0.0063	0.0080	U	-0.0030	0.010	U
	EVM Shop Pond	MSP031	NS			NS			NS			NS			NS			0.000080	0.00010	U	0.0065	0.0080	U	-0.0040	0.010	U
Henry Mine	HM Henry Pond	MSP014	NS			NS			NS			NS			NS			0.00020		U	0.0066	0.0080	U	0.0070	0.010	U
	HM Smith Pond	MSP015	NS			NS			NS			NS			NS			0.000050	0.00010	U	0.012			0.0070	0.010	U
	HM Center Henry Pond	MSP016-Avg	NS			NS			NS			NS			NS			0.000083	0.00010	U	0.0078	0.0080	U	0.0030	0.010	U
		MSP016	NS			NS			NS			NS			NS			NA			0.0087	0.0080	U	0.0030	0.010	U
		MSP016-D	NS			NS			NS			NS			NS			NA			0.0068	0.0080	U	NA		
		MSP016-R1	NS			NS			NS			NS			NS			0.000080	0.00010	U	NA			NA		
		MSP016-R2	NS			NS			NS			NS			NS			0.000080	0.00010	U	NA			NA		
		MSP016-R3	NS			NS			NS			NS			NS			0.000090	0.00010	U	NA			NA		
	HM South Pit Pond	MSP055	NS			0.021			0.024			0.029			0.0069			0.030			0.014			0.010		
Ballard Mine	BM Dredge Pond	MSP010-Avg	NS			0.0010			0.00073			0.00030			0.000080	0.00010	U	0.00080			0.023			0.0087	0.010	U
		MSP010	NS			NA			NA			0.00030			0.000080	0.00010	U	0.00080			0.023			0.0087	0.010	U
		MSP010-R1	NA			0.0010			0.00080			NA			NA			NA			NA			0.010		
		MSP010-R2	NA			0.0011			0.00070			NA			NA			NA			NA			0.010		
		MSP010-R3	NA			0.00090			0.00070			NA			NA			NA			NA			0.0060	0.010	U
	BM Upper Elk Pond	MSP011-Avg	NS			NS			NS			NS			NS			0.0010			0.0064	0.0080	U	0.0040	0.010	U
		MSP011	NS			NS			NS			NS			NS			0.0010			0.0064	0.0080	U	0.0040	0.010	U
		MSP011-R1	NS			NS			NS			NS			NS			NA			NA			NA		
		MSP011-R2	NS			NS			NS			NS			NS			NA			NA			NA		
		MSP011-R3	NS			NS			NS			NS			NS			NA			NA			NA		
	BM Lower Elk Pond	MSP012	NS			NS			NS			NS			NS			0.0015			0.010			0.0060	0.010	U
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	NS			NS			NS			NS			NS			0.00040			0.0088			-0.0010	0.010	U
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			NS			0.0021			NS			NS		

Table 14 continued
Ponds - Filtered Results - COPC (mg/L)‡

Station			Nickel																												
			2001			2002												2003												2004		
Mine	Name	ID	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	May	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	0.016			0.021		J	NS			0.023	0.028	U	NS			NS			NS			NS			NS			0.012		
		MSP017	0.016			0.021		J	NS			0.023	0.028	U	NS			NS			NS			NS			NS			NA		
		MSP017-R1	NA			NA			NS			NA			NA			NS			NS			NS			NS			0.012		
		MSP017-R2	NA			NA			NS			NA			NA			NS			NS			NS			NS			0.012		
		MSP017-R3	NA			NA			NS			NA			NA			NS			NS			NS			NS			0.011		
	EVM Keyhole Pond	MSP018	1.5			1.7		J	1.3			0.60			0.81			1.3			1.6			1.5			1.1			1.9		
	EVM Bat Cave Pond	MSP019	0.011			0.012		J	NS			0.011	0.028	U	NS			NS			NS			NS			NS			0.018		
	EVM West Pond	MSP020	0.011			0.011		J	NS			0.033			NS			NS			NS			NS			NS			0.032		
	EVM Stock Pond	MSP021-Avg	0.069			0.17		J	NS			0.031			NS			NS			NS			NS			NS			0.12		
		MSP021	0.069			NA			NS			0.031			NS			NS			NS			NS			NS			0.12		
		MSP021-R1	NA			0.17		J	NS			NA			NA			NS			NS			NS			NS			NA		
		MSP021-R2	NA			0.17		J	NS			NA			NA			NS			NS			NS			NS			NA		
		MSP021-R3	NA			0.18		J	NS			NA			NA			NS			NS			NS			NS			NA		
	EVM Tipple Pond	MSP022	0.0032	0.0033	U	0.0050		J	NS			0.026	0.028	U	NS			NS			NS			NS			NS			0.0039	0.0050	U
	EVM Haul Road Pond	MSP023	0.0027	0.0033	U	0.0024	0.0035	J	500			0.027	0.028	U	NS			NS			NS			NS			NS			0.0058		
	EVM Shop Pond	MSP031	0.022			0.015		J	NS			0.058			NS			NS			NS			NS			NS			0.0020	0.0050	U
Henry Mine	HM Henry Pond	MSP014	0.0031	0.0033	U	0.0090		J	NS			0.023	0.028	U	NS			NS			NS			NS			NS			0.011		
	HM Smith Pond	MSP015	0.0060			0.0046		J	NS			0.019	0.028	U	NS			NS			NS			NS			NS			0.0035	0.0050	U
	HM Center Henry Pond	MSP016-Avg	0.0046			0.0035		J	NS			0.027	0.028	U	NS			NS			NS			NS			NS			0.0037	0.0050	U
		MSP016	0.0046			0.0035		J	NS			NA			NS			NS			NS			NS			NS			NA		
		MSP016-D	0.0046			NA			NA			NA			NA			NS			NS			NS			NS			NA		
		MSP016-R1	NA			NA			NA			0.028			NA			NS			NS			NS			NS			0.0038	0.0050	U
		MSP016-R2	NA			NA			NA			0.027	0.028	U	NA			NS			NS			NS			NS			0.0037	0.0050	U
		MSP016-R3	NA			NA			NA			0.027	0.028	U	NA			NS			NS			NS			NS			0.0037	0.0050	U
	HM South Pit Pond	MSP055	0.96			0.15		J	0.49			NS			NS			0.38			0.47			0.79			0.65			0.57		
Ballard Mine	BM Dredge Pond	MSP010-Avg	0.031			0.017		J	0.052			0.12			NS			0.023			0.024			0.055			0.071			0.025		
		MSP010	0.031			NA			NA			0.12			NS			NA			NA			0.055			0.071			0.025		
		MSP010-R1	NA			0.018		J	0.050			NA			NA			0.024			0.023			NA			0.071			NA		
		MSP010-R2	NA			0.018		J	0.053			NA			NA			0.023			0.023			NA			0.071			NA		
		MSP010-R3	NA			0.016		J	0.052			NA			NA			0.023			0.025			NA			0.071			NA		
	BM Upper Elk Pond	MSP011-Avg	0.0091			0.0078		J	NS			NS			NS			NS			NS			NS			NS			0.0099		
		MSP011	0.0091			0.0078		J	NS			NS			NS			NS			NS			NS			NS			NA		
		MSP011-R1	NA			NA			NS			NS			NS			NS			NS			NS			NS			0.0099		
		MSP011-R2	NA			NA			NS			NS			NS			NS			NS			NS			NS			0.0099		
		MSP011-R3	NA			NA			NS			NS			NS			NS			NS			NS			NS			0.0099		
	BM Lower Elk Pond	MSP012	0.0080			0.0086		J	NS			NS			NS			NS			NS			NS			NS			0.0081		
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	0.0098			0.0060		J	NS			NS			NS			NS			NS			NS			NS			0.0072		
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			NS			NS			NS			NS			NS			0.015		

Table 14 continued
Ponds - Filtered Results - COPC (mg/L)‡

Station			Vanadium																																	
			2001			2002												2003															2004		
	Name	ID	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag	Jan.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017	0.0027	0.0095	UJ	0.0030	0.0050	U	NS			0.0014	0.0050	U	NS			NS			NS			NS			NS			NS			0.0025		
	EVM Keyhole Pond	MSP018	0.061		J	0.083			0.048			0.022			0.040			0.030			0.093			0.076			0.055			0.035			0.086		
	EVM Bat Cave Pond	MSP019	0.019		J	0.014			NS			0.013			NS			NS			NS			NS			NS			NS			0.018		
	EVM West Pond	MSP020	0.013		J	0.013			NS			0.0089			NS			NS			NS			NS			NS			NS			0.017		
	EVM Stock Pond	MSP021-Avg	0.022		J	0.029			NS			0.016			NS			NS			NS			NS			NS			NS			0.036		
		MSP021	0.022		J	NA			NS			0.016			NS			NS			NS			NS			NS			NS			0.036		
		MSP021-R1	NA			0.031			NS			NA			NS			NS			NS			NS			NS			NS			NA		
		MSP021-R2	NA			0.029			NS			NA			NS			NS			NS			NS			NS			NS			NA		
		MSP021-R3	NA			0.028			NS			NA			NS			NS			NS			NS			NS			NS			NA		
	EVM Tipple Pond	MSP022	0.024		J	0.019			NS			0.043			NS			NS			NS			NS			NS			NS			0.0093		
	EVM Haul Road Pond	MSP023	0.026		J	0.040			NS			0.032			NS			NS			NS			NS			NS			NS			0.056		
	EVM Shop Pond	MSP031	0.0079	0.0095	UJ	0.0040	0.0050	U	NS			0.040			NS			NS			NS			NS			NS			NS			0.0041		
Henry Mine	HM Henry Pond	MSP014	0.0023	0.0095	UJ	0.0010	0.0050	U	NS			0.0029	0.0050	U	NS			NS			NS			NS			NS			NS			0.0028		
	HM Smith Pond	MSP015	0.0069	0.0095	UJ	0.0020	0.0050	U	NS			0.0078			NS			NS			NS			NS			NS			NS			0.0026		
	HM Center Henry Pond	MSP016-Avg	0.0043	0.0095	UJ	0.0020	0.0050	U	NS			0.019			NS			NS			NS			NS			NS			NS			0.0045		
		MSP016	0.0041	0.0095	UJ	0.0020	0.0050	U	NS			NA			NS			NS			NS			NS			NS			NS			NA		
		MSP016-D	0.0045	0.0095	UJ	NA			NS			NA			NS			NS			NS			NS			NS			NS			NA		
		MSP016-R1	NA			NA			NS			0.020			NS			NS			NS			NS			NS			NS			0.0045		
		MSP016-R2	NA			NA			NS			0.018			NS			NS			NS			NS			NS			NS			0.0044		
		MSP016-R3	NA			NA			NS			0.019			NS			NS			NS			NS			NS			NS			0.0046		
	HM South Pit Pond	MSP055	0.038		J	0.029			0.040			NS			NS			NS			0.041			0.043			0.033			0.031			0.038		
Ballard Mine	BM Dredge Pond	MSP010-Avg	0.012		J	0.013			0.025			0.023			NS			NS			0.016			0.015			0.039			0.029			0.016		
		MSP010	0.012		J	NA			NA			0.023			NS			NS			NA			NA			0.039			0.029			0.016		
		MSP010-R1	NA			0.012			0.024			NA			NA			NA			0.016			0.015			NA			NA			NA		
		MSP010-R2	NA			0.014			0.026			NA			NA			NA			0.016			0.015			NA			NA			NA		
		MSP010-R3	NA			0.013			0.026			NA			NA			NA			0.016			0.015			NA			NA			NA		
	BM Upper Elk Pond	MSP011-Avg	0.048		J	0.024			NS			NS			NS			NS			NS			NS			NS			NS			0.013		
		MSP011	0.048		J	0.024			NS			NS			NS			NS			NS			NS			NS			NS			NA		
		MSP011-R1	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			0.012		
		MSP011-R2	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			0.013		
		MSP011-R3	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			0.013		
	BM Lower Elk Pond	MSP012	0.040		J	0.039			NS			NS			NS			NS			NS			NS			NS			NS			0.027		
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	0.0078	0.0095	UJ	0.0040	0.0050	U	NS			NS			NS			NS			NS			NS			NS			NS			0.012		
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			0.0062		

Table 14 continued
Ponds - Filtered Results - COPC (mg/L)‡

Station			Zinc																														
			2001			2002												2003														2004		
Mine	Name	ID	May	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag	Jan.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	0.019		J	0.015			NS			0.016	0.075	U	NS			NS			NS			NS			NS			NS			0.012		
		MSP017	0.019		J	0.015			NS			0.016	0.075	U	NS			NS			NS			NS			NS			NS			NA		
		MSP017-R1	NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			0.012		
		MSP017-R2	NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			0.012		
		MSP017-R3	NA			NA			NA			NA			NA			NA			NA			NA			NA			NA			0.012		
	EVM Keyhole Pond	MSP018	6.6		J	6.6			2.6			0.92			4.0		J	3.8			5.7			6.5			4.3			1.9			7.2		
	EVM Bat Cave Pond	MSP019	0.0071	0.010	UJ	0.0030	0.015	U	NS			0.0080	0.075	U	NS			NS			NS			NS			NS			NS			0.0060		
	EVM West Pond	MSP020	0.0059	0.010	UJ	0.0040	0.015	U	NS			0.032	0.075	U	NS			NS			NS			NS			NS			NS			0.032		
	EVM Stock Pond	MSP021-Avg	0.16		J	0.88			NS			0.014	0.075	U	NS			NS			NS			NS			NS			NS			0.40		
		MSP021	0.16		J	NA			NS			0.014	0.075	U	NS			NS			NS			NS			NS			NS			0.40		
		MSP021-R1	NA			0.88			NA			NA			NS			NS			NS			NS			NS			NS			NA		
		MSP021-R2	NA			0.86			NA			NA			NS			NS			NS			NS			NS			NS			NA		
		MSP021-R3	NA			0.89			NA			NA			NS			NS			NS			NS			NS			NS			NA		
	EVM Tipple Pond	MSP022	0.0098	0.010	UJ	0.0040	0.015	U	NS			0.017	0.075	U	NS			NS			NS			NS			NS			NS			0.0011	0.0020	U
	EVM Haul Road Pond	MSP023	0.0074	0.010	UJ	0.0015	0.0020	U	500.0000			0.022	0.075	U	NS			NS			NS			NS			NS			NS			0.0060		
	EVM Shop Pond	MSP031-Avg	0.024		J	0.022			NS			0.079			NS			NS			NS			NS			NS			NS			0.0015	0.0020	U
		MSP031	0.025		J	0.022			NS			0.079			NS			NS			NS			NS			NS			NS			0.0015	0.0020	U
		MSP031-D	0.023		J	NA			NA			NA			NS			NS			NS			NS			NS			NS			NA		
Henry Mine	HM Henry Pond	MSP014	0.0084	0.010	UJ	0.0030	0.015	U	NS			0.012	0.075	U	NS			NS			NS			NS			NS			NS			0.0040		
	HM Smith Pond	MSP015	0.012		J	0.0070	0.015	U	NS			0.011	0.075	U	NS			NS			NS			NS			NS			NS			0.0020	0.0040	U
	HM Center Henry Pond	MSP016-Avg	0.0099	0.010	UJ	0.0016	0.015	U	NS			0.016	0.075	U	NS			NS			NS			NS			NS			NS			0.0015	0.0020	U
		MSP016	0.0099	0.010	UJ	0.0016	0.015	U	NS			NA			NS			NS			NS			NS			NS			NS			NA		
		MSP016-R1	NA			NA			NS			0.016	0.075	U	NS			NS			NS			NS			NS			NS			0.0014	0.0020	U
		MSP016-R2	NA			NA			NS			0.015	0.075	U	NS			NS			NS			NS			NS			NS			0.0016	0.0020	U
		MSP016-R3	NA			NA			NS			0.018	0.075	U	NS			NS			NS			NS			NS			NS			0.0014	0.0020	U
	HM South Pit Pond	MSP055	4.0		J	0.33			0.59			NS			NS			NS			1.7			1.6			1.7			0.65			1.9		

Table 14 continued
Ponds - Filtered Results - COPC (mg/L)‡

Station			Zinc																																
			2001			2002												2003															2004		
Mine	Name	ID	May	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag	Jan.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag
Ballard Mine	BM Dredge Pond	MSP010-Avg	0.025		J	0.013	0.015	U	0.017	0.070	U	0.023	0.075	U	NS			NS			0.021	0.045	U	0.021	0.070	U	0.027	0.080	U	0.017	0.075	U	0.0090		
		MSP010	0.025		J	NA			NA			0.023	0.075	U	NS			NS			NA			NA			0.027	0.080	U	0.017	0.075	U	0.0090		
		MSP010-R1	NA			0.014	0.015	U	0.020	0.070	U	NA			NS			NS			0.021	0.045	U	0.021			NA			NA			NA		
		MSP010-R2	NA			0.014	0.015	U	0.010	0.070	U	NA			NS			NS			0.020	0.045	U	0.019			NA			NA			NA		
		MSP010-R3	NA			0.012	0.015	U	0.020	0.070	U	NA			NS			NS			0.021	0.045	U	0.022			NA			NA			NA		
	BM Upper Elk Pond	MSP011-Avg	0.0078	0.010	UJ	0.0050	0.015	U	NS			NS			NS			NS			NS			NS			NS			NS			0.011		
		MSP011	0.0070	0.010	UJ	0.0050	0.015	U	NS			NS			NS			NS			NS			NS			NS			NS			NA		
		MSP011-D	0.0086	0.010	UJ	NA			NS			NS			NS			NS			NS			NS			NS			NS			NA		
		MSP011-R1	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			0.010		
		MSP011-R2	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			0.011		
		MSP011-R3	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			0.011		
	BM Lower Elk Pond	MSP012	0.010		J	0.0060	0.015	U	NS			NS			NS			NS			NS			NS			NS			NS			0.010		
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	0.0091	0.010	UJ	0.012	0.015	U	NS			NS			NS			NS			NS			NS			NS			NS			0.0070		
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			0.020		

Notes:

‡ All data has been reported uncensored.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004). Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

Data qualifier definitions are:

(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.

(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

COPC - Constituent of Potential Concern

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Table 15
Ponds - Filtered Results - Screening Analytes (mg/L)‡

Station			Aluminum			Antimony			Arseinc			Barium			Beryllium			Chloride												Copper					
			2001			2001			2001			2001			2001			2001			2002						2004			2001			2002		
Mine	Name	ID	May	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	Sept.	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	0.0035	0.034	UJ	0.00052	0.0025	U	0.0010			0.020	0.065	UJ	-0.0035	0.0050	U	49			14		J	90			18			0.0024			0.0020	0.0045	U
		MSP017	0.0035	0.034	UJ	0.00052	0.0025	U	0.0010			0.020	0.065	UJ	-0.0035	0.0050	U	49			14		J	90			NA			0.0024			0.0020	0.0045	U
		MSP017-R1	NA			NA			NA			NA			NA			NA			NA			NA			18			NA			NA		
		MSP017-R2	NA			NA			NA			NA			NA			NA			NA			NA			18			NA			NA		
		MSP017-R3	NA			NA			NA			NA			NA			NA			NA			NA			18			NA			NA		
	EVM Keyhole Pond	MSP018	0.074		J	0.0015	0.0025	U	0.00082			0.0061	0.065	UJ	-0.0035	0.0050	U	3.8	12	U	0.55		J	4.0			3.3			0.0030			0.0030	0.0045	U
	EVM Bat Cave Pond	MSP019	0.0062	0.034	UJ	0.00086	0.0025	U	0.0033			0.011	0.065	UJ	-0.0034	0.0050	U	3.6	12	U	3.2		J	12			3.0			0.0021			0.00090	0.0045	U
	EVM West Pond	MSP020	0.0070	0.034	UJ	0.00050	0.0025	U	0.0015			0.015	0.065	UJ	-0.0033	0.0050	U	3.5	12	U	5.7		J	11			17			0.0012			0.0011	0.0045	U
	EVM Stock Pond	MSP021-Avg	0.0024	0.034	UJ	0.00057	0.0025	U	0.0016			0.011	0.065	UJ	-0.0035	0.0050	U	29			15		J	NS			34			0.0016			0.0014	0.0045	U
		MSP021	0.0024	0.034	UJ	0.00057	0.0025	U	0.0016			0.011	0.065	UJ	-0.0035	0.0050	U	29			NA			NS			34			0.0016			NA		
		MSP021-R1	NA			NA			NA			NA			NA			NA			15		J	NA			NA			NA			0.0013	0.0045	U
		MSP021-R2	NA			NA			NA			NA			NA			NA			15		J	NA			NA			NA			0.0013	0.0045	U
		MSP021-R2	NA			NA			NA			NA			NA			NA			15		J	NA			NA			NA			0.0015	0.0045	U
	EVM Tipple Pond	MSP022	0.0041	0.034	UJ	0.00028	0.0025	U	0.0018			0.068		J	-0.0035	0.0050	U	140			160		J	600			180			0.0013			0.0011	0.0045	U
	EVM Haul Road Pond	MSP023	0.0057	0.034	UJ	0.00062	0.0025	U	500			0.032	0.065	UJ	-0.0034	0.0050	U	210			130		J	1200			57			0.0020			0.0012	0.0045	U
	EVM Shop Pond	MSP031-Avg	0.016	0.034	UJ	0.0019	0.0025	U	0.0027			0.028	0.065	UJ	-0.0035	0.0050	U	210			120		J	240			98			0.0021			0.0018	0.0045	U
		MSP031	0.016	0.034	UJ	0.0019	0.0025	U	0.0027			0.028	0.065	UJ	-0.0033	0.0050	U	210			120		J	240			98			NA			NA		
		MSP031-D	NA			NA			NA			0.027	0.065	UJ	-0.0037	0.0050	U	200			NA			NA			NA			NA			NA		
Henry Mine	HM Henry Pond	MSP014	0.0017	0.034	UJ	0.00034	0.0025	U	0.0016			0.030	0.065	UJ	0.00040	0.0050	U	5.1	12	U	3.5		J	11			3.2			0.0013			0.0039	0.0045	U
	HM Smith Pond	MSP015	0.0010	0.034	UJ	0.00046	0.0025	U	0.0021			0.030	0.065	UJ	0	0.0050	U	4.9	12	U	4.0		J	6.0			4.1			0.0020			0.0013	0.0045	U
	HM Center Henry Pond	MSP016-Avg	0.0072	0.034	UJ	0.00049	0.0025	U	0.0013			0.036	0.065	UJ	0.00020	0.0050	U	6.5	12	U	4.6		J	18			4.3			0.0011	0.0012	U	0.0012	0.0045	U
		MSP016	0.0073	0.034	UJ	0.00048	0.0025	U	0.0013			0.036	0.065	UJ	0.00020	0.0050	U	6.5	12	U	4.6			NA			NA			0.0011	0.0012	U	NA		
		MSP016-D	0.0071	0.034	UJ	0.00049	0.0025	U	0.0012			NA			NA			NA			NA			NA			NA			0.0011	0.0012	U	NA		
		MSP016-R1	NA			NA			NA			NA			NA			NA			NA			19			4.3			NA			NA		
		MSP016-R2	NA			NA			NA			NA			NA			NA			NA			18			4.3			NA			NA		
		MSP016-R3	NA			NA			NA			NA			NA			NA			NA			16			4.2			NA			NA		
	HM South Pit Pond	MSP055	0.0023	0.034	UJ	0.00070	0.0025	U	0.00080			0.018	0.065	UJ	-0.0036	0.0050	U	1.7	12	U	0.90		J	NS			1.5			0.0017			0.00043	0.0045	U
Ballard Mine	BM Dredge Pond	MSP010-Avg	0.0013	0.034	UJ	0.0014	0.0025	U	0.0033			0.034	0.065	UJ	0.00030	0.0050	U	3.1	12	U	1.7		J	30			2.3			0.0043			0.0026	0.0045	U
		MSP010	0.0013	0.034	UJ	0.0014	0.0025	U	0.0033			0.034	0.065	UJ	0.00030	0.0050	U	3.1	12	U	NA			30			2.3			0.0043			NA		
		MSP010-R1	NA			NA			NA			NA			NA			NA			1.7		J	NA			NA			NA			0.0028	0.0045	U
		MSP010-R2	NA			NA			NA			NA			NA			NA			1.8		J	NA			NA			NA			0.0027	0.0045	U
		MSP010-R3	NA			NA			NA			NA			NA			NA			1.7		J	NA			NA			NA			0.0024	0.0045	U
	BM Upper Elk Pond	MSP011-Avg	0.011	0.034	UJ	0.00086	0.0025	U	0.0061			0.0075	0.065	UJ	0.00015	0.0050	U	1.0	12	U	1.2		J	NS			1.2			0.0041			0.0026	0.0045	U
		MSP011	0.011	0.034	UJ	0.00086	0.0025	U	0.0061			0.0080	0.065	UJ	0.00010	0.0050	U	1.0	12	U	1.2		J	NS			NA			NA			NA		
		MSP011-D	NA			NA			NA			0.0070	0.065	UJ	0.00020	0.0050	U	1.0	12	U	NA			NA			NA			NA			NA		
		MSP011-R1	NA			NA			NA			NA			NA			NA			NA			NA			1.1			NA			NA		
		MSP011-R2	NA			NA			NA			NA			NA			NA			NA			NA			1.2			NA			NA		
		MSP011-R3	NA			NA			NA			NA			NA			NA			NA			NA			1.2			NA			NA		
	BM Lower Elk Pond	MSP012	0.0054	0.034	UJ	0.0011	0.0025	U	0.0039			0.0077	0.065	UJ	0.00010	0.0050	U	1.1	12	U	0.80		J	NS			1.2			0.0034			0.0030	0.0045	U
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	0.038		J	0.0010	0.0025	U	0.0030			0.016	0.065	UJ	0.00040	0.0050	U	1.5	12	U	0.60		J	NS			1.7			0.0021			0.0016	0.0045	U
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			NS			NS			NS			NS			4.8			NS			NS		

Table 15 continued
Ponds - Filtered Results - Screening Analytes (mg/L)‡

Station			Calcium																															Cobalt		
			2001			2002												2003														2004			2002		
Mine	Name	ID	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag	Jan.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	May	RL	Flag	May	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	250			220		J	NS			320			NS			NS			NS			NS			NS			NS			200			0.0030	0.010	U
		MSP017	250			220		J	NS			320			NS			NS			NS			NS			NS			NS			NA			0.0030	0.010	U
		MSP017-R1	NA			NA			NS			NA			NS			NS			NS			NS			NS			NS			200			NA		
		MSP017-R2	NA			NA			NS			NA			NS			NS			NS			NS			NS			NS			200			NA		
		MSP017-R3	NA			NA			NS			NA			NS			NS			NS			NS			NS			NS			200			NA		
	EVM Keyhole Pond	MSP018	390			370		J	430			430			320			360			310			350			390			420			280			0.020		
	EVM Bat Cave Pond	MSP019	99			77		J	NS			81			NS			NS			NS			NS			NS			NS			78			0.0010	0.010	U
	EVM West Pond	MSP020	62			88		J	NS			190			NS			NS			NS			NS			NS			NS			88			0.0030	0.010	U
	EVM Stock Pond	MSP021-Avg	180			200		J	NS			230			NS			NS			NS			NS			NS			NS			250			0.00083	0.010	U
		MSP021	180			NA			NS			230			NS			NS			NS			NS			NS			NS			250			NA		
		MSP021-R1	NA			200		J	NS			NA			NS			NS			NS			NS			NS			NS			NA			0.0040	0.010	U
		MSP021-R2	NA			200		J	NS			NA			NS			NS			NS			NS			NS			NS			NA			-0.0010	0.010	U
		MSP021-R3	NA			190		J	NS			NA			NS			NS			NS			NS			NS			NS			NA			-0.00050	0.010	U
	EVM Tipple Pond	MSP022	140			140		J	NS			270			NS			NS			NS			NS			NS			NS			150			-0.0020	0.010	U
	EVM Haul Road Pond	MSP023	120			85		J	500			410			NS			NS			NS			NS			NS			NS			83			0.0010	0.010	U
	EVM Shop Pond	MSP031-Avg	83			47		J	NS			67			NS			NS			NS			NS			NS			NS			49			-0.0010	0.010	U
		MSP031	83			47		J	NS			67			NS			NS			NS			NS			NS			NS			49			NA		
		MSP031-D	82			NA			NA			NA			NS			NS			NS			NS			NS			NS			NA			NA		
Henry Mine	HM Henry Pond	MSP014	90			130		J	NS			230			NS			NS			NS			NS			NS			NS			190			0.0020	0.010	U
	HM Smith Pond	MSP015	120			130		J	NS			86			NS			NS			NS			NS			NS			NS			140			0.0030	0.010	U
	HM Center Henry Pond	MSP016-Avg	91			100		J	NS			68			NS			NS			NS			NS			NS			NS			96			0	0.010	U
		MSP016	91			100		J	NS			NA			NS			NS			NS			NS			NS			NS			NA			NA		
		MSP016-R1	NA			NA			NS			69			NS			NS			NS			NS			NS			NS			96			NA		
		MSP016-R2	NA			NA			NS			68			NS			NS			NS			NS			NS			NS			97			NA		
		MSP016-R3	NA			NA			NS			68			NS			NS			NS			NS			NS			NS			96			NA		
	HM South Pit Pond	MSP055	260			67		J	320			NS			NS			NS			110			140			290			370			180			0.0020	0.010	U
Ballard Mine	BM Dredge Pond	MSP010-Avg	240			150		J	200			380			NS			NS			170			160			240			270			200			0.00050	0.010	U
		MSP010	240			NA			NA			380			NS			NS			NA			NA			240			270			200			NA		
		MSP010-R1	NA			150		J	180			NA			NA			NA			170			170			NA			NA			NA			0	0.010	U
		MSP010-R2	NA			150		J	210			NA			NA			NA			170			160			NA			NA			NA			0.0020	0.010	U
		MSP010-R3	NA			150		J	210			NA			NA			NA			170			160			NA			NA			NA			-0.00050	0.010	U
	BM Upper Elk Pond	MSP011-Avg	28	46	U	28		J	NS			NS			NS			NS			NS			NS			NS			NS			32			0.0020	0.010	U
		MSP011	28	46	U	28		J	NS			NS			NS			NS			NS			NS			NS			NS			NA			NA		
		MSP011-D	28	46	U	NA			NS			NS			NS			NS			NS			NS			NS			NS			NA			NA		
		MSP011-R1	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			32			NA		
		MSP011-R2	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			33			NA		
		MSP011-R3	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			32			NA		
	BM Lower Elk Pond	MSP012	NS			34		J	NS			NS			NS			NS			NS			NS			NS			NS			34			-0.0010	0.010	U
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	18	46	U	12		J	NS			NS			NS			NS			NS			NS			NS			NS			22			-0.00050	0.010	U
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			46			NS		

Table 15 continued
Ponds - Filtered Results - Screening Analytes (mg/L)‡

Station			Iron			Lead			Manganese			Mercury			Molybdenum			Nitrate/Nitrite			Potassium											
			2001			2001			2001			2001			2001			2001			2001			2002						2004		
Mine	Name	ID	Spring	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	Spring	RL	Flag	May	RL	Flag	Sept.	RL	Flag	May	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	-0.0045	0.010	U	0.0000015	0.0027	U	0.42			0.000010	0.00050	U	0.0040		J	0.14	2.1	UJ	3.4	9.5	U	3.7			2.2	4.5	U	3.7		
		MSP017	-0.0045	0.010	U	0.0000015	0.0027	U	0.42			0.000010	0.00050	U	0.0040		J	0.14	2.1	UJ	3.4	9.5	U	3.7			2.2	4.5	U	NA		
		MSP017-R1	NA			NA			NA			NA			NA			NA			NA			NA			NA			3.6		
		MSP017-R2	NA			NA			NA			NA			NA			NA			NA			NA			NA			3.6		
		MSP017-R3	NA			NA			NA			NA			NA			NA			NA			NA			NA			3.8		
	EVM Keyhole Pond	MSP018	-0.0031	0.010	U	-0.000042	0.0027	U	3.4			0.0000090	0.00050	U	0.022		J	0.073	2.1	U	2.8	9.5	U	2.6			2.3	4.5	U	2.8		
	EVM Bat Cave Pond	MSP019	-0.0028	0.010	U	0.000026	0.0027	U	-0.00090	0.0020	U	0.000020	0.00050	U	0.0086		J	0.050	2.1	U	3.9	9.5	U	3.9			4.3	4.5	U	4.5		
	EVM West Pond	MSP020	-0.0027	0.010	U	-0.000053	0.0027	U	0.0085			0.0000030	0.00050	U	0.0047		J	0.0014	2.1	U	0.34	9.5	U	2.1			5.3			2.4		
	EVM Stock Pond	MSP021-Avg	-0.0094	0.010	U	-0.000046	0.0027	U	0.00080	0.0020	U	0.0000040	0.00050	U	0.015		J	0.0020	2.1	U	1.6	9.5	U	1.6			1.4	4.5	U	1.7		
		MSP021	-0.0094	0.010	U	-0.000046	0.0027	U	0.00080	0.0020	U	0.0000040	0.00050	U	0.015		J	0.0020	2.1	U	1.6	9.5	U	NA			1.4	4.5	U	1.7		
		MSP021-R1	NA			NA			NA			NA			NA			NA			NA			1.5			NA			NA		
		MSP021-R2	NA			NA			NA			NA			NA			NA			NA			1.6			NA			NA		
		MSP021-R2	NA			NA			NA			NA			NA			NA			NA			1.7			NA			NA		
	EVM Tipple Pond	MSP022	-0.0072	0.010	U	-0.000060	0.0027	U	-0.0019	0.0020	U	0.0000060	0.00050	U	0.0086		J	0.013	2.1	U	2.4	9.5	U	2.8			10			2.6		
	EVM Haul Road Pond	MSP023	-0.0079	0.010	U	-0.000042	0.0027	U	500	0.0020	U	0.0000050	0.00050	U	0.024		J	-0.00017	2.1	U	3.5	9.5	U	2.4			8.3			1.4		
	EVM Shop Pond	MSP031-Avg	0.080			0.000091	0.0027	U	0.036			0.0000070	0.00050	U	0.0093		J	0.0044	2.1	U	6.9	9.5	U	5.5			9.3			5.7		
		MSP031	0.079			NA			0.036			0.0000070	0.00050	U	NA			NA			6.9	9.5	U	5.5			9.3			5.7		
		MSP031-D	0.081			NA			0.036			NA			NA			NA			6.8	9.5	U	NA			NA			NA		
Henry Mine	HM Henry Pond	MSP014	-0.012	0.010	U	-0.000060	0.0027	U	0.017			0	0.00050	U	0.0040		J	-0.0029	2.1	U	6.6	9.5	U	6.9			20			9.3		
	HM Smith Pond	MSP015	-0.0033	0.010	U	-0.000048	0.0027	U	0.18			0.0000020	0.00050	U	0.0072		J	0.030	2.1	U	3.1	9.5	U	2.5			13			1.7		
	HM Center Henry Pond	MSP016-Avg	-0.010	0.010	U	-0.000060	0.0027	U	0.0077			#########	0.00050	U	0.0020	0.0025	UJ	0.052	2.1	U	1.8	9.5	U	2.5			22			2.5		
		MSP016	-0.010	0.010	U	-0.000061	0.0027	U	NA			0.0000010	0.00050	U	0.0020			0.053	2.1	U	1.8	9.5	U	2.5			NA			NA		
		MSP016-D	NA			-0.000059	0.0027	U	NA			0	0.00050	U	0.0019			0.051	2.1	U	NA			NA			NA			NA		
		MSP016-R1	NA			NA			NA			NA			NA			NA			NA			NA			23			2.4		
		MSP016-R2	NA			NA			NA			NA			NA			NA			NA			NA			22			2.6		
		MSP016-R3	NA			NA			NA			NA			NA			NA			NA			NA			22			2.4		
	HM South Pit Pond	MSP055	-0.0084	0.010	U	-0.000077	0.0027	U	-0.0033	0.0020	U	0.0000030	0.00050	U	0.036		J	0.0094	2.1	U	1.0	9.5	U	0.40			NS			1.0		
Ballard Mine	BM Dredge Pond	MSP010-Avg	-0.010	0.010	U	-0.000046	0.0027	U	0.024			0.000012	0.00050	U	0.046		J	-0.0071	2.1	U	9.8			4.7			120			5.9		
		MSP010	-0.010	0.010	U	-0.000046	0.0027	U	0.024			0.000012	0.00050	U	0.046		J	-0.0071	2.1	U	9.8			NA			120			5.9		
		MSP010-R1	NA			NA			NA			NA			NA			NA			NA			4.8			NA			NA		
		MSP010-R2	NA			NA			NA			NA			NA			NA			NA			4.5			NA			NA		
		MSP010-R3	NA			NA			NA			NA			NA			NA			NA			4.7			NA			NA		
	BM Upper Elk Pond	MSP011-Avg	0.0018	0.010	U	-0.000042	0.0027	U	0.0036			0.0000090	0.00050	U	0.019		J	0.30	2.1	UJ	3.6	9.5	U	3.2			NS			3.8		
		MSP011	0.0010	0.010	U	NA			0.0036			0.0000090	0.00050	U	NA			NA			3.6	9.5	U	3.2			NS			NA		
		MSP011-D	0.0025	0.010	U	NA			0.0036			NA			NA			NA			3.5	9.5	U	NA			NA			NA		
		MSP011-R1	NA			NA			NA			NA			NA			NA			NA			NA			NA			3.7		
		MSP011-R2	NA			NA			NA			NA			NA			NA			NA			NA			NA			3.9		
		MSP011-R3	NA			NA			NA			NA			NA			NA			NA			NA			NA			3.8		
	BM Lower Elk Pond	MSP012	-0.0023	0.010	U	-0.000068	0.0027	U	0.0021			0.0000080	0.00050	U	0.025		J	0.12	2.1	UJ	2.3	9.5	U	2.4			NS			3.0		
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	-0.014	0.010	U	-0.000046	0.0027	U	0.0045			0.00026	0.00050	U	0.0090		J	0.077	2.1	U	2.9	9.5	U	2.0			NS			3.7		
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			NS			NS			NS			NS			NS			10		

Table 15 continued
Ponds - Filtered Results - Screening Analytes (mg/L)‡

Station			Magnesium																																	
			2001			2002												2003															2004		
Mine	Name	ID	Spring	RL	Flag	May	RL	Flag	July	RL	Flag	Sept.	RL	Flag	Nov.	RL	Flag	Jan.	RL	Flag	April	RL	Flag	May	RL	Flag	June	RL	Flag	July	RL	Flag	Spring	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017	78			69			NS			120			NS			NS			NS			NS			NS			NS			71		
	EVM Keyhole Pond	MSP018	140			120			150			130			100			100			94			120			130			140			120		
	EVM Bat Cave Pond	MSP019	29			25			NS			26	61	U	NS			NS			NS			NS			NS			NS			27		
	EVM West Pond	MSP020	12	21	U	22			NS			38	61	U	NS			NS			NS			NS			NS			NS			26		
	EVM Stock Pond	MSP021-Avg	51			56			NS			66			NS			NS			NS			NS			NS			NS			64		
		MSP021	51			NA			NS			66			NS			NS			NS			NS			NS			NS			64		
		MSP021-R1	NA			57			NS			NA			NS			NS			NS			NS			NS			NS			NA		
		MSP021-R2	NA			56			NS			NA			NS			NS			NS			NS			NS			NS			NA		
		MSP021-R3	NA			55			NS			NA			NS			NS			NS			NS			NS			NS			NA		
	EVM Tipple Pond	MSP022	26			28			NS			120			NS			NS			NS			NS			NS			NS			28		
	EVM Haul Road Pond	MSP023	47			25			NS			218			NS			NS			NS			NS			NS			NS			19		
	EVM Shop Pond	MSP031-Avg	18	21	U	11			NS			20	61	U	NS			NS			NS			NS			NS			NS			9.4		
		MSP031	18	21	U	11			NS			20	61	U	NS			NS			NS			NS			NS			NS			9.4		
		MSP031-D	18	21	U	NA			NS			NA			NS			NS			NS			NS			NS			NS			NA		
Henry Mine	HM Henry Pond	MSP014	56			45			500			110			NS			NS			NS			NS			NS			NS			52		
	HM Smith Pond	MSP015	35			37			NS			23	61	U	NS			NS			NS			NS			NS			NS			38		
	HM Center Henry Pond	MSP016-Avg	17	21	U	30			NS			47	61	U	NS			NS			NS			NS			NS			NS			30		
		MSP016	17	21	U	30			NS			NA			NS			NS			NS			NS			NS			NS			NA		
		MSP016-R1	NA			NA			NS			48	61	U	NS			NS			NS			NS			NS			NS			30		
		MSP016-R2	NA			NA			NS			47	61	U	NS			NS			NS			NS			NS			NS			31		
		MSP016-R3	NA			NA			NS			47	61	U	NS			NS			NS			NS			NS			NS			30		
	HM South Pit Pond	MSP055	63			15			83			NS			NS			NS			25			32			72			95			45		
Ballard Mine	BM Dredge Pond	MSP010-Avg	57			34			60			82			NS			NS			41			38			76			120			47		
		MSP010	57			NA			NA			82			NS			NS			NA			NA			76			120			47		
		MSP010-R1	NA			34			57			NA			NS			NS			41			39			NA			NA			NA		
		MSP010-R2	NA			34			61			NA			NS			NS			41			38			NA			NA			NA		
		MSP010-R3	NA			34			62			NA			NS			NS			41			38			NA			NA			NA		
	BM Upper Elk Pond	MSP011-Avg	6.0	21	U	5.9			NS			NS			NS			NS			NS			NS			NS			NS			6.5		
		MSP011	6.0	21	U	5.9			NS			NS			NS			NS			NS			NS			NS			NS			NA		
		MSP011-D	5.9	21	U	NA			NS			NS			NS			NS			NS			NS			NS			NS			NA		
		MSP011-R1	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			6.4		
		MSP011-R2	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			6.5		
		MSP011-R3	NA			NA			NS			NS			NS			NS			NS			NS			NS			NS			6.5		
	BM Lower Elk Pond	MSP012	8.2	21	U	8.1			NS			NS			NS			NS			NS			NS			NS			NS			7.3		
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	5.3	21	U	3.5			NS			NS			NS			NS			NS			NS			NS			NS			6.7		
	BM Pit #6 Pond	MSP062	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			15		

Table 15 continued
Ponds - Filtered Results - Screening Analytes (mg/L)‡

Station			Sulfate												Sodium												Silver			Thallium			Uranium		
			2001			2002						2004			2001			2002						2004			2001			2001			2001		
Mine	Name	ID	May	RL	Flag	May	RL	Flag	Sept.	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	Sept.	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag
Enoch Valley Mine	EVM South Pond	MSP017-Avg	700		J	720		J	1100		J	610			9.7	22	UJ	8.1			13	17	UJ	8.1			-0.000018	0.0021	U	0.00011	0.0025	U	0.011		
		MSP017	700		J	720		J	1100		J	NA			9.7	22	UJ	8.1			13	17	UJ	NA			-0.000018	0.0021	U	0.00011	0.0025	U	0.011		
		MSP017-R1	NA			NA			NA			610			NA			NA			NA			7.9			NA			NA			NA		
		MSP017-R2	NA			NA			NA			610			NA			NA			NA			8.0			NA			NA			NA		
		MSP017-R3	NA			NA			NA			610			NA			NA			NA			8.4			NA			NA			NA		
	EVM Keyhole Pond	MSP018	1500		J	1300		J	1500		J	1400			15	22	UJ	13			17		J	14			0.0000024	0.0021	U	0.0010	0.0025	U	0.010		
	EVM Bat Cave Pond	MSP019	220		J	190		J	230		J	240			4.7	22	UJ	4.9			6.7	17	UJ	4.5			-0.000004	0.0021	U	0.00014	0.0025	U	0.0041	0.0080	U
	EVM West Pond	MSP020	280		J	250		J	500		J	230			3.4	22	UJ	4.1			8.2	17	UJ	4.3			-0.000019	0.0021	U	0.000020	0.0025	U	0.0018	0.0080	U
	EVM Stock Pond	MSP021-Avg	480		J	470		J	NS			700			7.9	22	UJ	8.4			11	17	UJ	9.9			-0.000021	0.0021	U	0.00015	0.0025	U	0.0084		
		MSP021	480		J	NA			NS			700			7.9	22	UJ	NA			11	17	UJ	9.9			-0.000021	0.0021	U	0.00015	0.0025	U	0.0084		
		MSP021-R1	NA			490		J	NA			NA			NA			8.7			NA			NA			NA			NA			NA		
		MSP021-R2	NA			450		J	NA			NA			NA			8.4			NA			NA			NA			NA			NA		
		MSP021-R3	NA			470		J	NA			NA			NA			8.2			NA			NA			NA			NA			NA		
	EVM Tipple Pond	MSP022	320		J	140		J	340		J	170			9.4	22	UJ	9.5			18		J	9.7			-0.000016	0.0021	U	0.000051	0.0025	U	0.0067	0.0080	U
	EVM Haul Road Pond	MSP023	160		J	93		J	500			140			5.3	22	UJ	5.3			17		J	4.3			-0.000015	0.0021	U	0.000062	0.0025	U	0.011		
	EVM Shop Pond	MSP031-Avg	120		J	39		J	85		J	24			90		J	58			140			47			-0.000016	0.0021	U	0.00011	0.0025	U	0.0021	0.0080	U
		MSP031	120		J	39		J	85		J	24			90			58			140			47			-0.000016	0.0021	U	NA			0.0021	0.0080	U
		MSP031-D	120		J	NA			NA			NA			90			NA			NA			NA			NA			NA			NA		
Henry Mine	HM Henry Pond	MSP014	430		J	390		J	940		J	560			14	22	UJ	8.4			23		J	11			-0.000024	0.0021	U	0.000021	0.0025	U	0.0029	0.0080	U
	HM Smith Pond	MSP015	500		J	230		J	300		J	230			9.6	22	UJ	8.3			6.0	17	UJ	8.5			-0.000024	0.0021	U	0.000036	0.0025	U	0.0035	0.0080	U
	HM Center Henry Pond	MSP016-Avg	230		J	180		J	260		J	170			9.6	22	UJ	7.9			17		J	7.8			-0.000025	0.0021	U	0.000034	0.0025	U	0.0028	0.0080	U
		MSP016	230		J	180		J	NA			NA			9.6	22	UJ	7.9			17		J	7.8			-0.000024	0.0021	U	0.000031	0.0025	U	0.0029	0.0080	U
		MSP016-D	NA			NA			NA			NA			NA			NA			NA			NA			-0.000025	0.0021	U	0.000037	0.0025	U	0.0027	0.0080	U
		MSP016-R1	NA			NA			260		J	170			NA			NA			17		J	7.7			NA			NA			NA		
		MSP016-R2	NA			NA			260		J	170			NA			NA			17		J	7.9			NA			NA			NA		
		MSP016-R3	NA			NA			250		J	160			NA			NA			17		J	7.7			NA			NA			NA		
	HM South Pit Pond	MSP055	700		J	230		J	NS			510			5.6	22	UJ	58			NS			2.9			-0.0000083	0.0021	U	0.00044	0.0025	U	0.0030	0.0080	U

Table 15 continued
Ponds - Filtered Results - Screening Analytes (mg/L)‡

Station			Sulfate												Sodium												Silver			Thallium			Uranium		
			2001			2002						2004			2001			2002						2004			2001			2001			2001		
Mine	Name	ID	May	RL	Flag	May	RL	Flag	Sept.	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	Sept.	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag	May	RL	Flag
Ballard Mine	BM Dredge Pond	MSP010-Avg	630		J	150		J	1400		J	420			12	22	UJ	7.2			28		J	9.4			-0.0000081	0.0021	U	0.00017	0.0025	U	0.059		
		MSP010	630		J	NA			1400		J	420			12	22	UJ	NA			28		J	9.4			-0.0000081	0.0021	U	0.00017	0.0025	U	0.059		
		MSP010-R1	NA			150		J	NA			NA			NA			7.3			NA			NA			NA			NA			NA		
		MSP010-R2	NA			150		J	NA			NA			NA			7.0			NA			NA			NA			NA			NA		
		MSP010-R3	NA			150		J	NA			NA			NA			7.2			NA			NA			NA			NA			NA		
	BM Upper Elk Pond	MSP011-Avg	13		J	12		J	NS			9.0			2.0	22	UJ	1.8			NS			1.8			0.000069	0.0021	U	0.00023	0.0025	U	0.0011	0.0080	U
		MSP011	13		J	12		J	NS			9.0			2.3	22	UJ	1.8			NS			NA			0.000069	0.0021	U	0.00023	0.0025	U	0.0011	0.0080	U
		MSP011-D	13		J	NA			NS			NA			1.7	22	UJ	NA			NS			1.8			NA			NA			NA		
		MSP011-R1	NA			NA			NS			9.1			NA			NA			NS			1.8			NA			NA			NA		
		MSP011-R2	NA			NA			NS			9.1			NA			NA			NS			1.8			NA			NA			NA		
		MSP011-R3	NA			NA			NS			9.0			NA			NA			NS			1.8			NA			NA			NA		
	BM Lower Elk Pond	MSP012	42		J	29		J	NS			23			1.2	22	UJ	1.6			NS			1.7			0.000065	0.0021	U	0.00023	0.0025	U	0.0017	0.0080	U
	BM Northeast Pond	MSP013	NS			NS			NS			NS			NS			NS			NS			NS			NS			NS			NS		
	BM Pit #4 Stock Pond	MSP059	13		J	2.0		J	NS			8.8			1.6	22	UJ	1.2			NS			2.4			0.0000039	0.0021	U	0.000062	0.0025	U	0.00028	0.0080	U
	BM Pit #6 Pond	MSP062	NS			NS			NS			0.6			NS			NS			NS			2.7			NS			NS			NS		

Notes:

‡ All data has been reported uncensored.

Laboratory and field replicates are shown as unaveraged as well as averaged where appropriate. Data validation was performed in accordance with MWH SOP-NW-18.1 and USEPA Laboratory Data Validation Functional Guidelines for Evaluating Inorganic Analyses (EPA, 2004).

Flag refers to the USEPA data qualifier (flag) assigned to the data resulting from the data validation procedure. More than one flag may be assigned during the data validation process.

Data qualifier definitions are:

(U) - The material was analyzed for, but was not detected above the level of the associated value. The associated value is the sample reporting limit.

(J) - The result is an estimated quantity.

(R) - The data are unusable.

(UJ) - The material was analyzed for, but was not detected above the level of the associated value. The result is an estimate and may be inaccurate or imprecise.

RL - Reporting Limit. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues.

NS - Not Sampled

NA - Not Analyzed

Appendix E
Major Ion Plots

MEMORANDUM

MWH
2353 130th Avenue N.E., Suite 200
Bellevue, Washington 98005
Phone: (425) 602-4000
Fax: (425) 867-1970

To: P4 Production Project File 1010076
From: C. Duffy and W. Wright, MWH
Subject: Ion Balance Request

Date: 2/07/07
Reference: 1010076.011602

This memorandum serves to provide supplemental guidance and additional data needs to support the major ion Piper Diagram plots (Attachment A) as requested in the comments to Version 4 of the Monitoring Well Installation Technical Memorandum (M. Rowe, IDEQ [Letter to R. Geddes, Monsanto], December 2006). The major ion balance results for groundwater monitoring locations from May 2004 to June 2005 are shown in Tables 1 and Table 2.

Ion concentrations were converted to equivalent weights and relative errors were calculated from the difference between cation and anions. A 10% error threshold was used to determine quality of the balance. Of the 71 events shown, 92% of them were found to have a relative error below 10%. However, the nine events must be ignored at this time because the field parameters were not available for the necessary carbonate and bicarbonate adjustment. Of the remaining 62 events, 92% of them were found to have a relative error below 10%. The average relative error for all 71 events is 3.0%.

Table 1
Ion Charge Balances with Percent Error - Wells

Mine	Station Name	Station ID	Sampling Date	Cations (mg/L)				Anions (mg/L)				Charge Balance Error (%)
				Magnesium	Calcium	Sodium	Potassium	Chloride	Sulfate	Carbonate	Bicarbonate	
Domestic Wells												
	(b) (6) House Well	MDW001	May-04	13	67	5.9	0.50	13	11	0.098	230	4.4
	(b) (6) House Well	MDW002	May-04	19	54	21	2.4	32	44	0.037	180	5.1
	(b) (6) House Well	MDW003	May-04	6.5	74	6.0	0.50	7.8	6.4	0.088	230	4.5
	(b) (6) House Well	MDW004	May-04	20	73	15	2.2	7.8	15	0.063	310	4.2
	Cedar Bay RV Park Well	MDW005	May-04	38	150	16	2.4	17	44	0.12	550	4.8
	(b) (6) House Well	MDW006	May-04	27	66	45	2.8	58	100	0.029	180	7.2
Agricultural Wells												
	School Bus Well	MAW001[a]	May-04	12	66	5.9	0.57	11	11	0.32	210	6.9
	(b) (6) Field Well	MAW002	May-04	22	62	22	2.0	3.2	0.091	0.15	310	6.7
	(b) (6) Field Well	MAW003	May-04	8.6	34	9.0	0.40	4.8	6.4	0.026	140	4.7
	(b) (6) Field Well	MAW004	May-04	61	180	10	4.8	7.5	7.7	0.12	860	0.71
	(b) (6) Windmill Field Well	MAW005	May-04	38	110	100	5.7	140	270	0.32	180	2.6
	(b) (6) Field Well W	MAW006	Sep-04	10	38	8.7	1.6	9.2	10	0.011	150	3.7
	(b) (6) Field Well N	MAW007	Oct-04	20	58	13	2.8	12	24	0.067	300	-4.7
Production Wells												
Henry Mine	Henry S Pit Well	MPW022	May-04	13	57	6.8	1.4	4.4	2.9	0.23	230	4.6
	Henry S Pit Well	MPW022	Oct-04	12	52	6.4	1.1	5.8	4.0	0.089	240	-3.2
	Henry S Pit Well	MPW022	Jun-05	13	57	7.4	1.2	5.4	2.8	0.061	220	7.6
	Henry Center Pit Well	MPW023	Oct-04	24	63	9.3	0.80	6.6	70	0.091	230	1.9
	Henry Center Pit Well	MPW023	Jun-05	23	61	9.5	0.80	6.8	63	0.041	220	2.8
Enoch Valley Mine	Agrium Production Well	MPW006	May-04	28	72	18	1.3	3.9	120	0.13	200	6.6
	Agrium Production Well	MPW006	Sep-04	30	71	17	1.1	4.0	170	0.064	210	-1.6
	EVM Shop Well	MPW019	May-04	9.9	72	6.9	0.80	6.1	8.3	0.10	270	-0.16
	EVM Shop Well	MPW019	Sep-04	9.5	69	6.8	0.60	6.7	10	0.012	270	-2.3
	EVM Shop Well	MPW019	Jun-05	9.7	71	7.3	0.60	8.0	8.3	0.047	230	6.5
	Degerstrom Well at EVM	MPW020	Oct-04	17	51	5.3	0.60	6.2	98	0.032	120	0.70
Monitoring Wells												
Henry Mine	Henry N Pit Well S	MMW003	May-04	21	54	21	2.2	34	81	0.019	140	5.1
	Henry N Pit Well S	MMW003	Sep-04	28	67	35	2.7	55	120	0.011	200	-0.027
	Henry N Pit Well S	MMW003	Jun-05	25	62	36	2.6	41	99	0.027	190	3.7
	Henry N Pit Well N	MMW004[a]	May-04	26	76	46	3.6	67	130	0.062	170	4.5
	Henry N Pit Well N	MMW004	Oct-04	37	70	8.6	1.6	64	140	0.023	160	-2.3
	Henry N Pit Well N	MMW004[a]	Jun-05	26	71	45	3.5	57	120	0.026	190	4.5
Ballard Mine	Ballard Pit E Well	MMW001	May-04	22	120	10	0.90	5.8	100	0.070	320	5.0
	Ballard Pit E Well	MMW001[a]	Oct-04	21	110	8.9	0.8	6.6	99	0.077	330	0.36
	Ballard Pit E Well	MMW001	Jun-05	23	110	9.7	0.90	6.6	120	0.070	300	1.6
	Ballard Pit W Well	MMW002	May-04	45	78	9.7	1.9	12	54	0.53	370	4.0
	Ballard Pit W Well	MMW002[a]	Oct-04	36	69	8.5	1.4	12	49	0.38	380	-4.7
	Ballard Pit W Well	MMW002	Jun-05	40	74	13	1.7	15	50	0.047	340	4.0

Notes:
[a] Results averaged from laboratory replicates.
N/A Not applicable

Table 2
Ion Charge Balances with Percent Error - Springs and Seeps

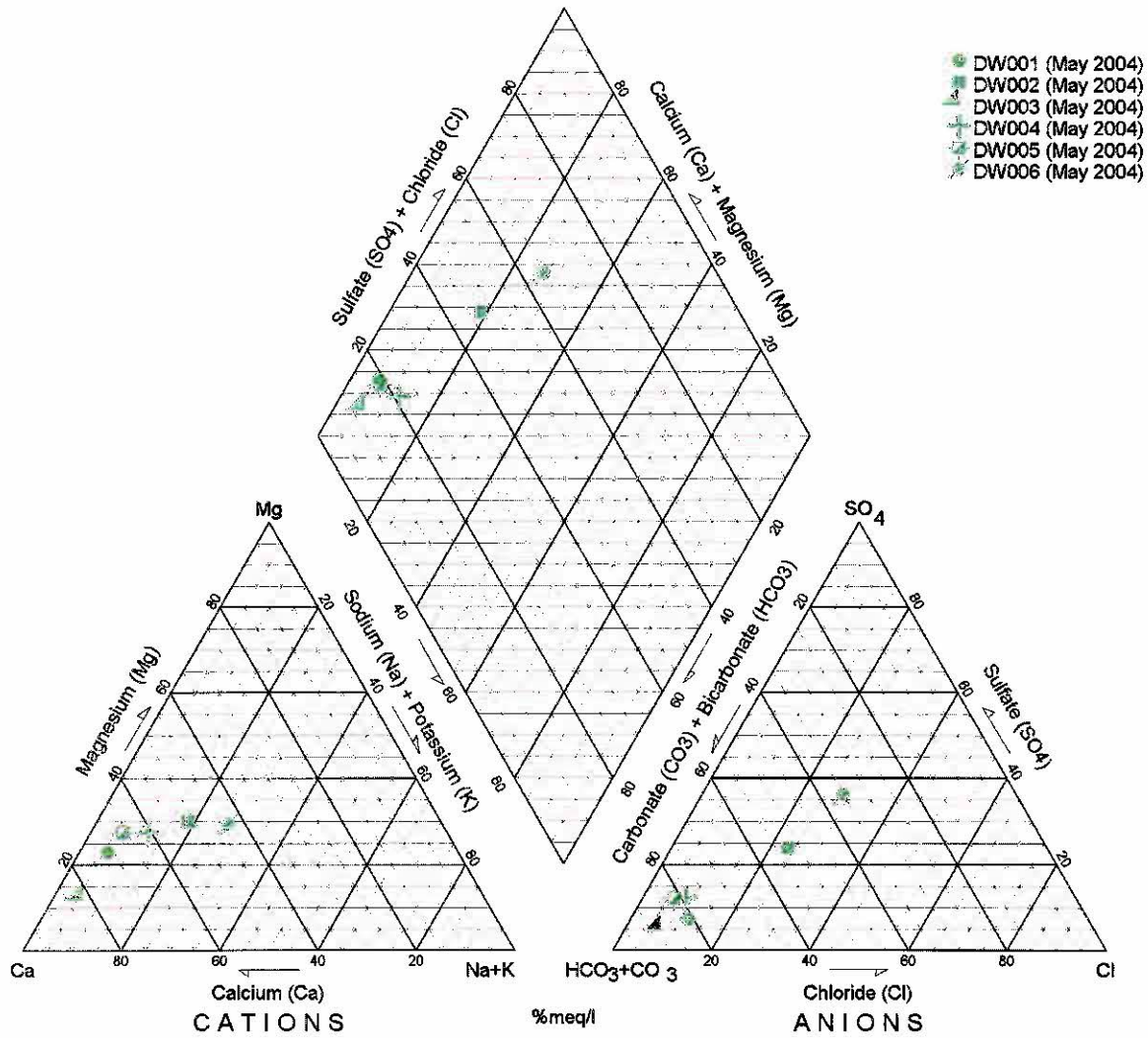
Mine	Station Name	Station ID	Sampling Date	Cations (mg/L)				Anions (mg/L)				Charge Balance Error (%)
				Magnesium	Calcium	Sodium	Potassium	Chloride	Sulfate	Carbonate	Bicarbonate	
Springs												
Henry Mine	Above W Fork Lone Pine Creek	MST058	May-04	13	76	6.8	1.2	3.3	19	0.36	270	3.1
	Above W Fork Lone Pine Creek	MST058	Sep-04	18	98	9.2	3.4	5.2	34	0.21	380	-1.4
	Above W Fork Lone Pine Creek	MST064	May-04	17	76	9.4	0.60	4.1	40	0.41	270	2.2
	Above W Fork Lone Pine Creek	MST064[ab]	Sep-04	17	76	9.5	0.73	4.1	39	0	310	-3.3
	Above W Fork Lone Pine Creek	MST276	May-04	11	76	7.0	0.50	2.4	40	0.68	230	4.2
	Above W Fork Lone Pine Creek	MST276	Sep-04	13	80	7.9	0.70	4.5	47	0.25	280	-2.2
Enoch Valley Mine	Above Rasmussen Creek	MST274	May-04	9.3	67	4.9	0.60	23	37	0.48	180	0.25
	Above Rasmussen Creek	MST274	Sep-04	9.9	70	4.7	7.8	23	16	0.034	220	1.6
	Above E Fork Lone Pine Creek	MST275	May-04	4.1	16	4.6	20	5.6	8.6	0.30	71	**10**
	Above E Fork Lone Pine Creek	MST275	Sep-04	22	75	17	100	37	2.2	1.0	770	**-21**
	Hedin Spring	MSG001	May-04	10	70	5.6	0.70	11	10	0.20	240	1.5
	Hedin Spring	MSG001[ab]	Sep-04	10	69	5.7	0.63	11	11	0	240	1.4
Ballard Mine	Below Ballard Mine	MST069	May-04	87	440	25	2.7	12	1200	0.22	270	1.2
	Below Ballard Mine	MST069[b]	Sep-04	86	430	24	3.9	17	760	0	370	15
	Below Ballard Mine	MST096	May-04	17	94	5.4	1.2	3.4	100	0.25	230	3.4
	Below Ballard Mine	MST096[b]	Sep-04	19	100	5.7	1.6	4.0	59	0	280	7.5
	Garden Hose Spring	MSG003	May-04	15	140	9.5	0.80	4.5	120	0.26	340	3.1
	Garden Hose Spring	MSG003[b]	Sep-04	15	140	9.2	0.90	10	110	0	330	4.5
	Holmgren Spring	MSG004	May-04	24	66	4.7	1.5	2.9	34	0.88	280	1.2
	Holmgren Spring	MSG004[b]	Sep-04	26	78	4.8	1.9	3.5	46	0	310	1.8
	Cattle Spring	MSG005	May-04	22	85	4.2	0.50	3.3	34	0.51	320	1.9
	Cattle Spring	MSG005[ab]	Sep-04	22	84	4.8	0.63	2.8	30	0	330	1.0
	SE Spring	MSG006	May-04	41	220	9.0	0.70	4.8	390	0.29	280	7.1
	SE Spring	MSG006[b]	Sep-04	42	210	9.9	1.4	4.8	440	0	310	2.0
Dump Seeps												
Henry Mine	S Pit Overburden Dump Seep	MDS016	May-04	52	280	9.3	1.1	1.3	350	0.39	320	**20**
	S Pit Overburden Limestone Drain	MDS022	May-04	47	120	14	1.4	3.6	60	1.2	490	5.7
	S Pit Overburden Limestone Drain	MDS022[b]	Sep-04	56	140	17	1.9	5.5	49	0	700	-0.60
Enoch Valley Mine	Enoch Valley Mine W Dump Seep	MDS025	May-04	62	240	12	3.4	5.0	590	0.0066	220	5.3
	Enoch Valley Mine S Dump Seep	MDS026	May-04	83	360	17	5.3	0.80	810	0.069	400	4.0
Ballard Mine	Pit #2 Upper Dump Seep	MDS030	May-04	17	160	11	1.0	3.9	140	0.17	390	2.5
	Pit #2 Lower Dump Seep S	MDS031	May-04	18	140	11	1.5	2.9	160	0.15	290	5.0
	Pit #2 Lower Dump Seep S	MDS031	Sep-04	20	140	12	1.7	3.2	200	0.17	280	2.3
	Pit #2 Lower Dump Seep N	MDS032	May-04	69	230	37	2.6	6.6	570	0.24	220	**11**
	Pit #2 Lower Dump Seep N	MDS032	Sep-04	75	230	38	9.0	7.4	440	0.64	390	**12**
	Goat Seep	MDS033	May-04	64	280	28	3.0	4.1	720	0.31	350	-0.66

Notes:
[a] Results averaged from laboratory replicates.
[b] Events have not been adjusted with field data so cannot be used at this time

Attachment A

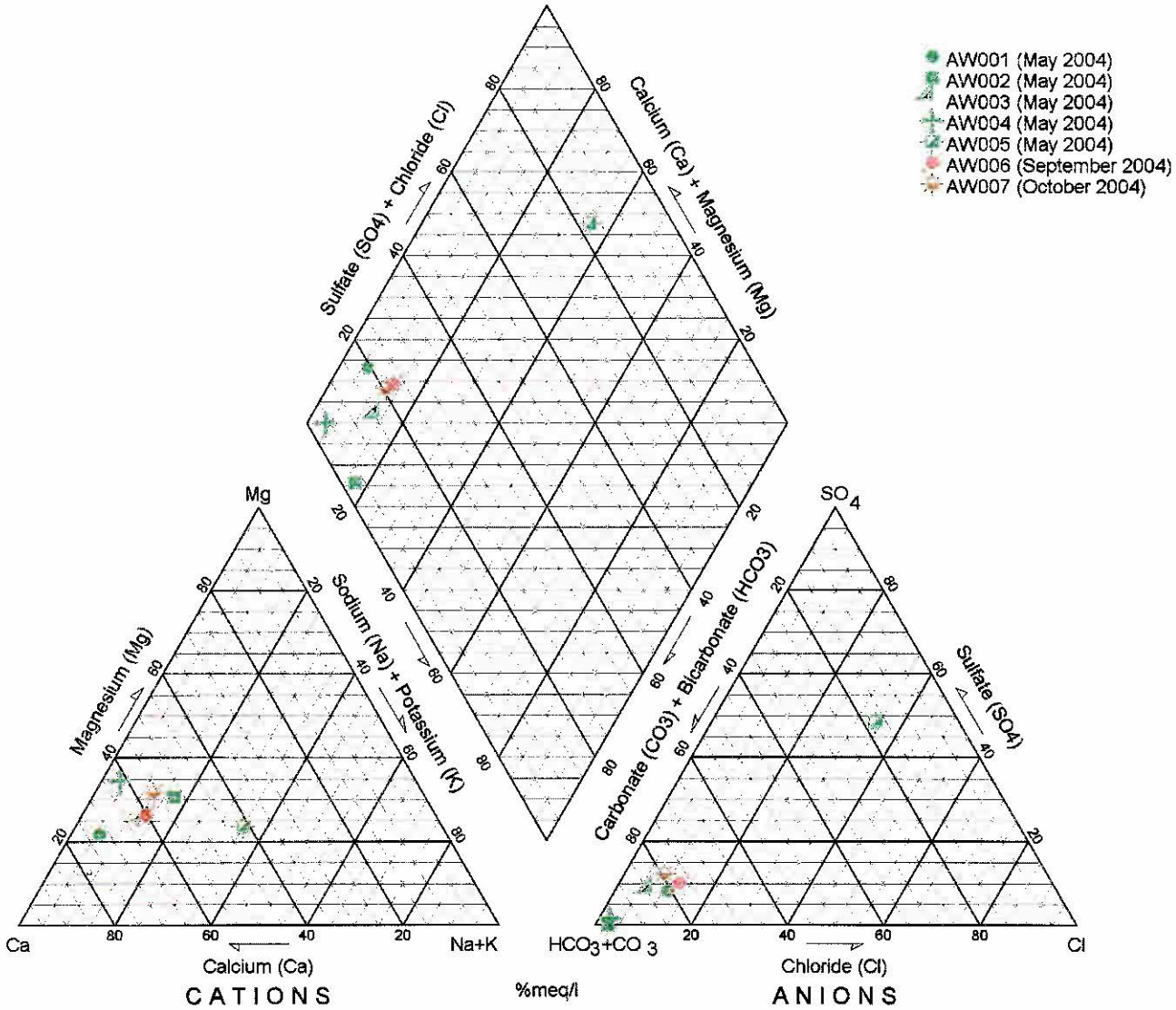
Piper Diagram

Domestic Wells



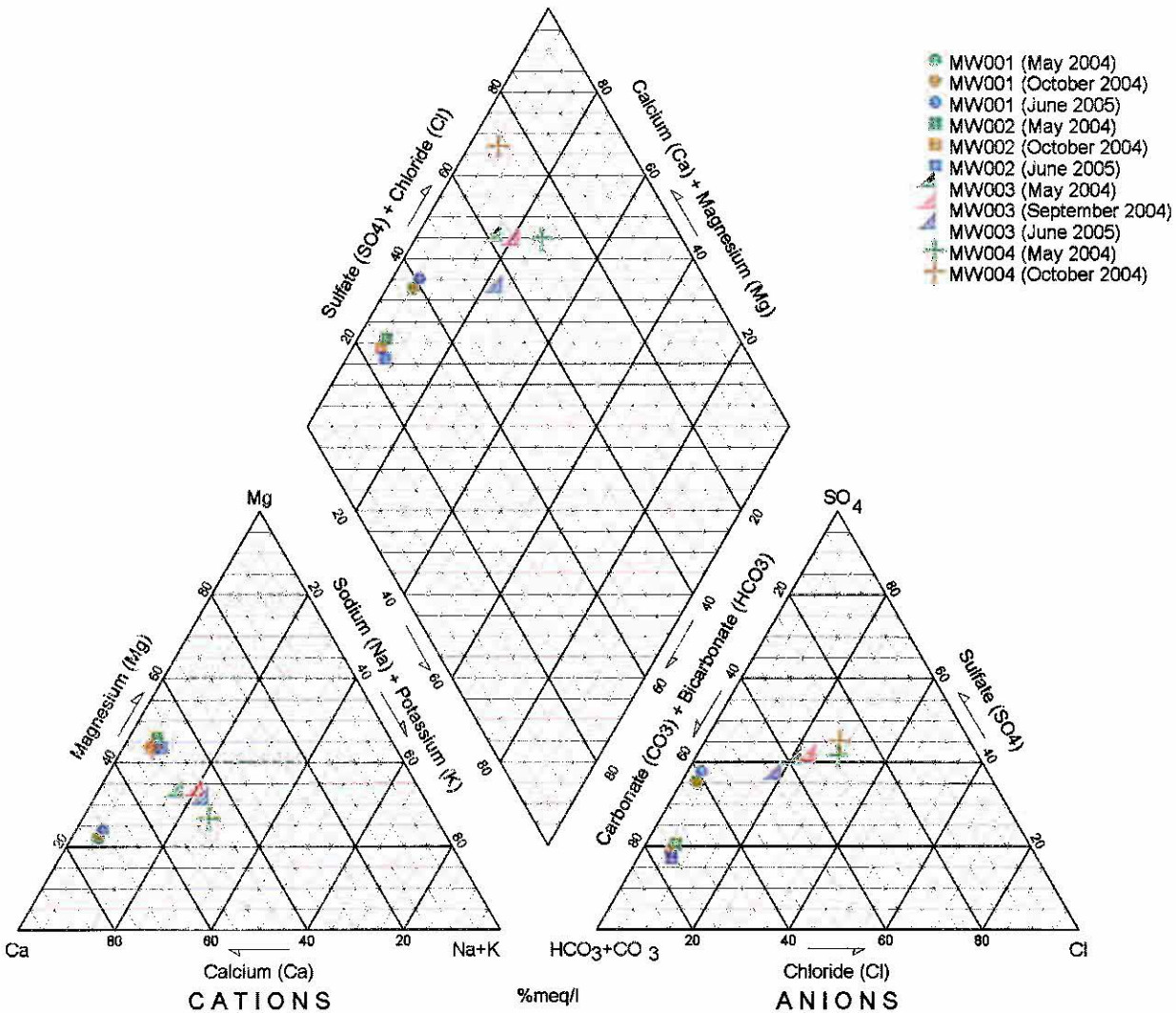
Piper Diagram

Agricultural Wells



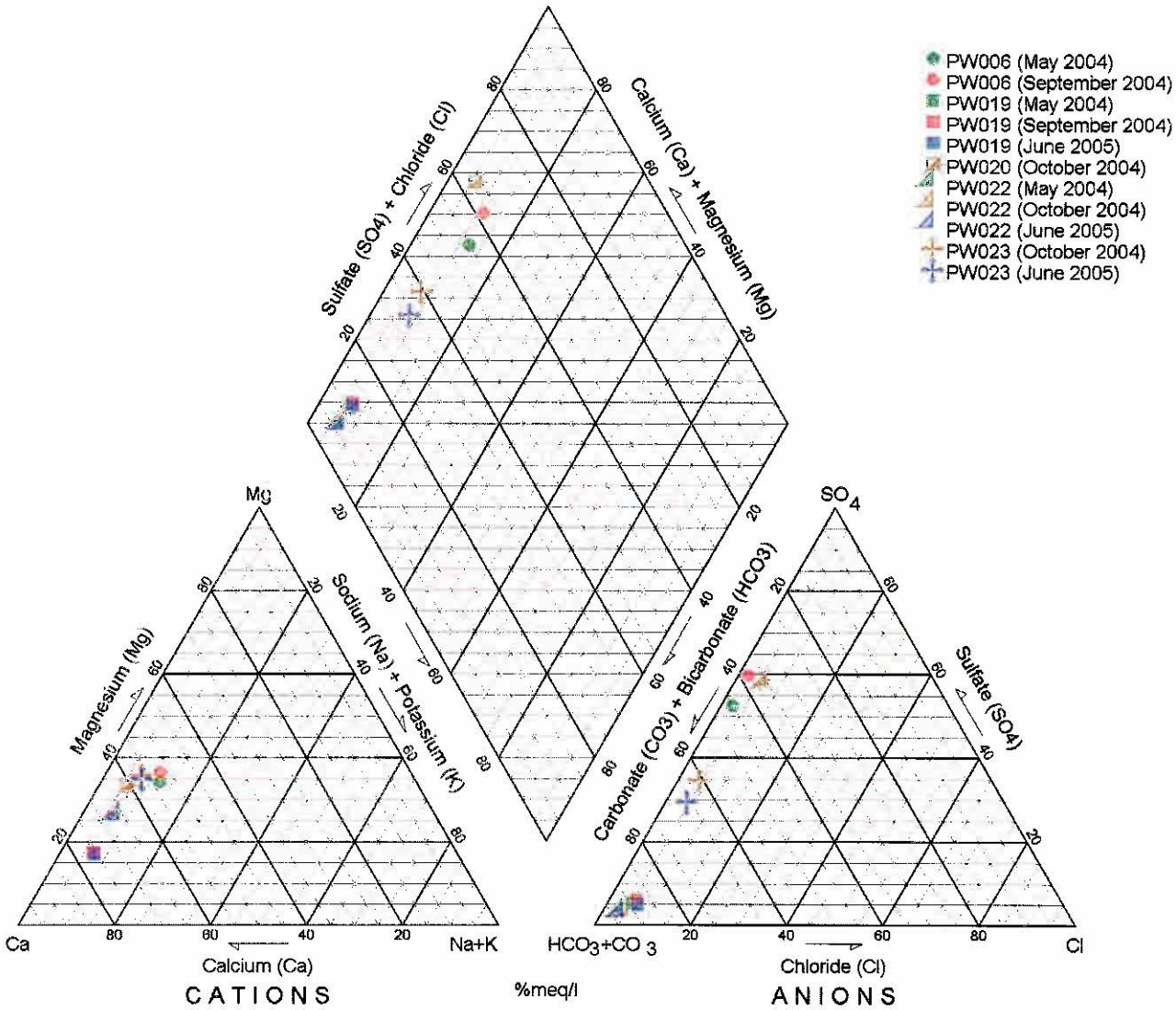
Piper Diagram

Monitoring Wells



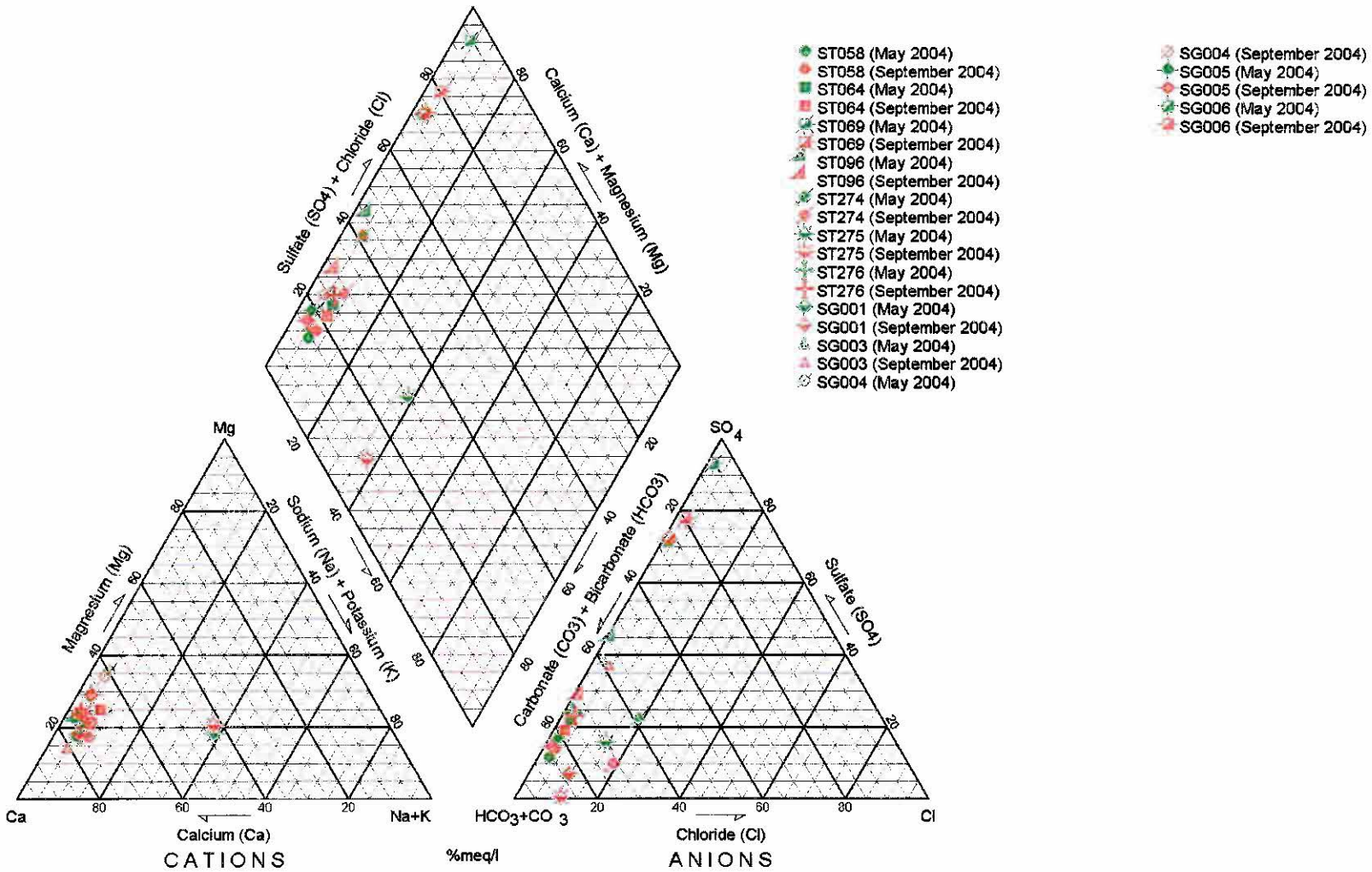
Piper Diagram

Production Wells



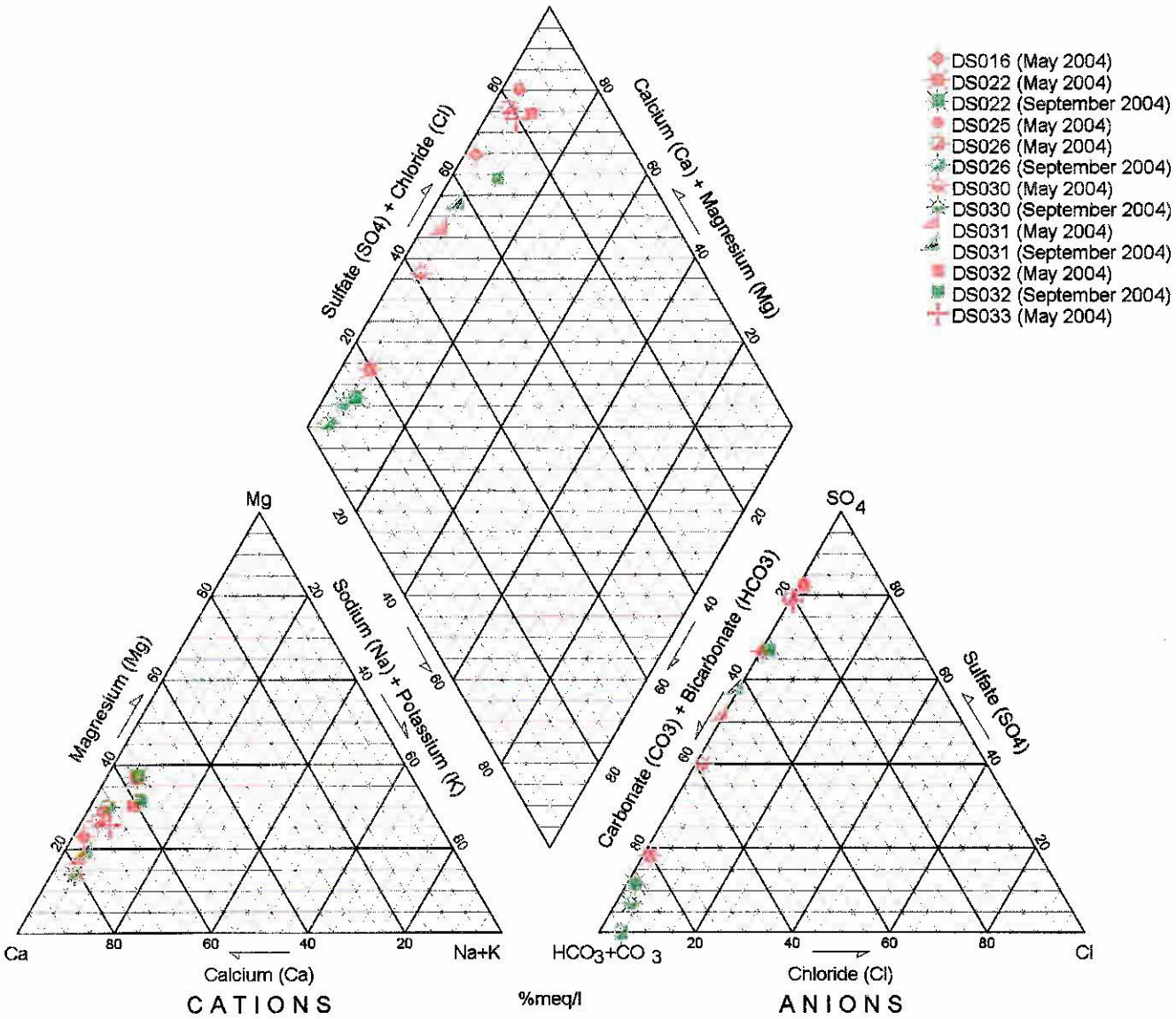
Piper Diagram

Springs

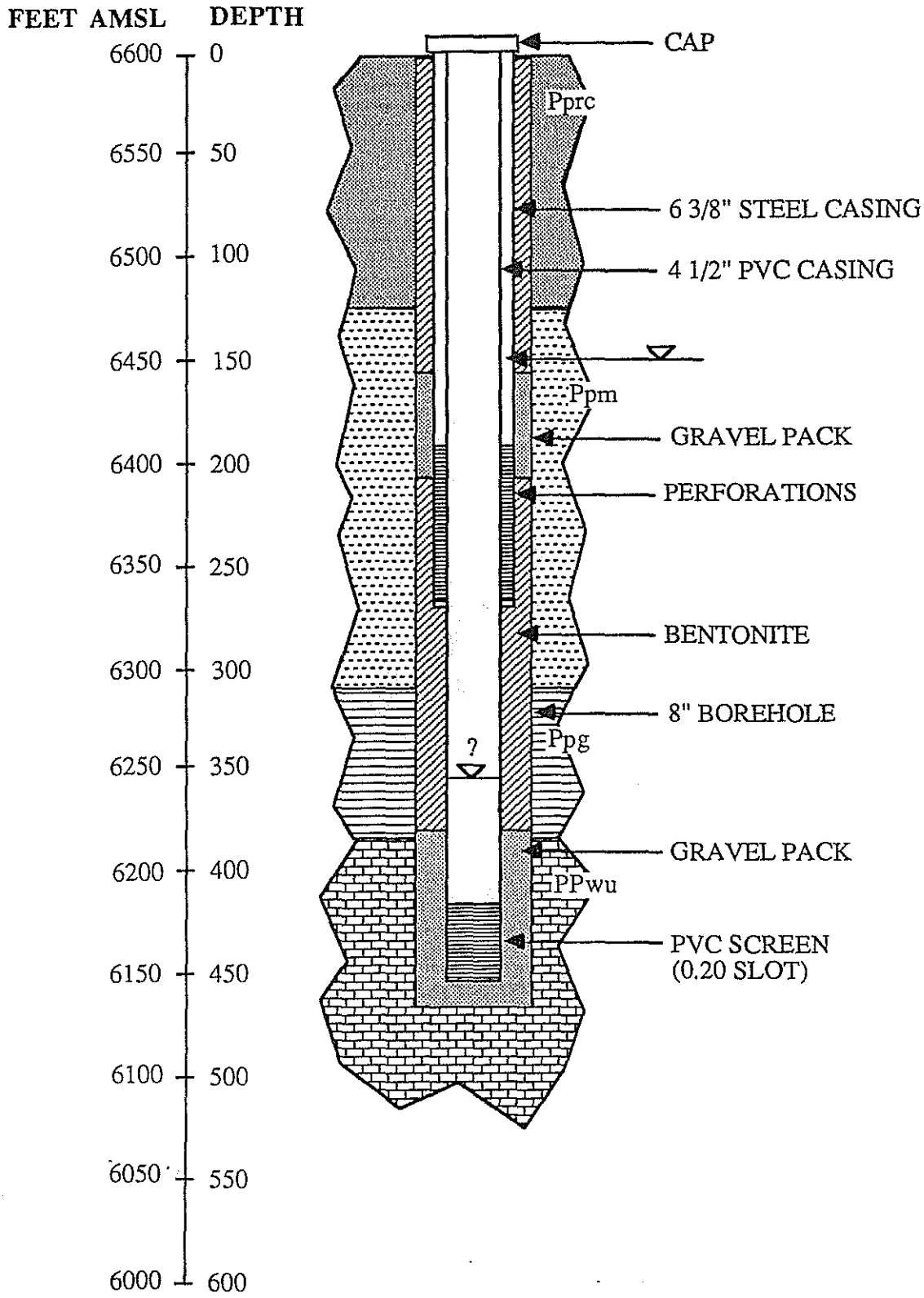


Piper Diagram

Dump Seeps



Appendix F
Well Logs

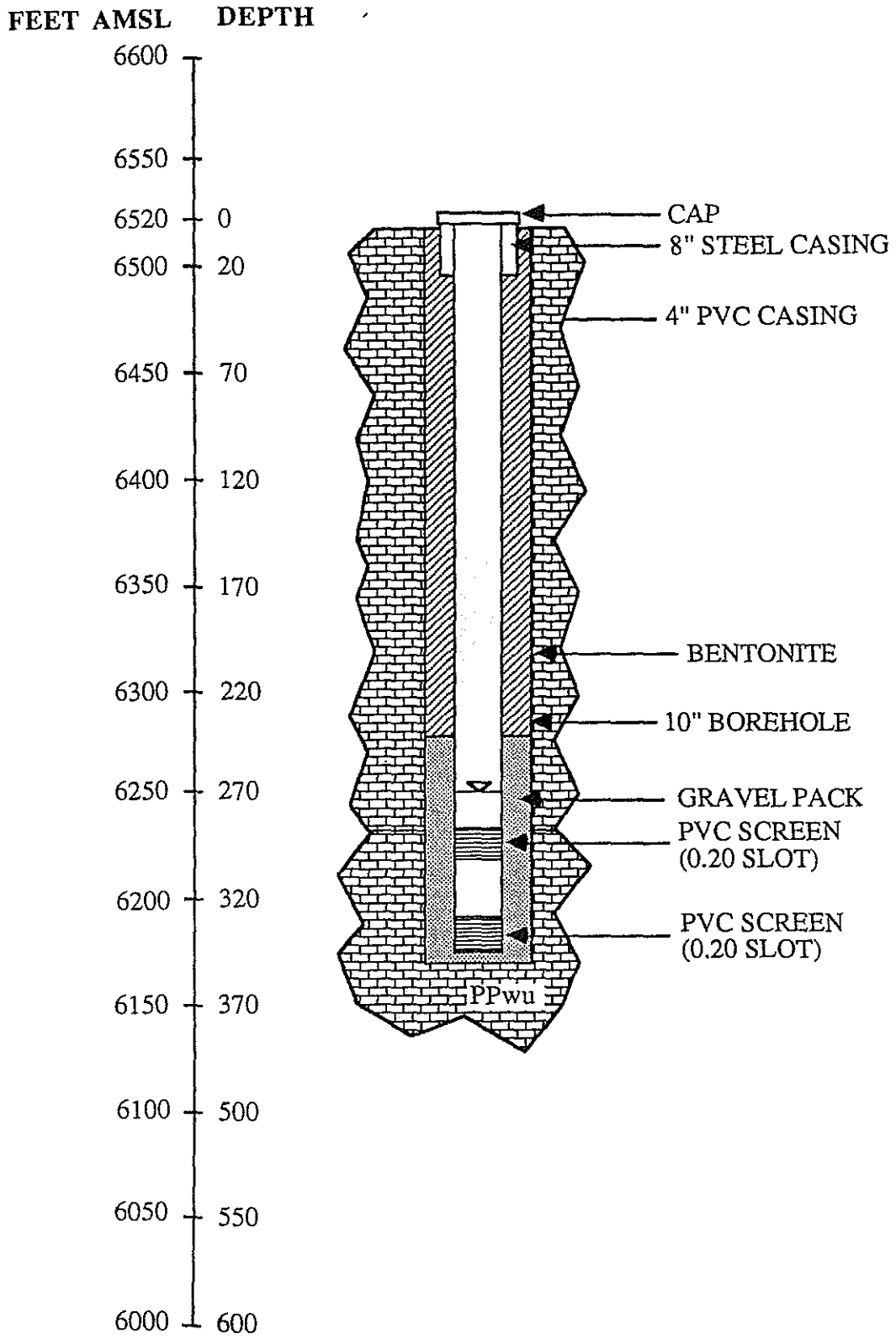


MW001

Geologic Log of Monitor Well #1

HOWARD CONSULTANTS, INC.
CONSULTING GEOTECHNICAL ENGINEERS

DATE ____ BY ____ FILE ____ CHECKED BY ____



Geologic Log of Monitor Well #2

MW002

HOWARD CONSULTANTS, INC.
CONSULTING GEOTECHNICAL ENGINEERS

PLATE 3

DATE
BY
FILE
CHECKED BY

Form 238-7
8/90

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

USE TYPEWRITER [redacted]
BALLPOINT [redacted]

MW-1

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name MONSANTO Co. #1 E.
Address BOX 816 Soda Springs, Id. 83276
Drilling Permit No. 27-92E-060-001
Water Right Permit No. _____

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement
☐ Well diameter increase
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☒ Test ☐ Municipal
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☒ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☒ Other PVC F.J.

Thickness	Diameter	From	To
.250 inches	6 5/8 inches +	2 feet	271 feet
.250 inches	4½ PVC inches	+ 2 feet	452 feet
inches	inches	feet	feet
inches	inches	feet	feet

Was casing drive shoe used? ☐ Yes ☒ No
Was a packer or seal used? ☒ Yes ☐ No
Perforated? ☒ Yes ☐ No
How perforated? ☒ Factory ☐ Knife ☐ Torch ☐ Gun
Size of perforation .020 inches by 2 inches

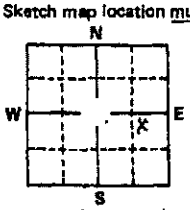
		From	To
PVC Size .020	perforations	420 feet	450 feet
	perforations	feet	feet
Steel 80	perforations	191 feet	271 feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ___ Slot size ___ Set from ___ feet to ___ feet
Diameter ___ Slot size ___ Set from ___ feet to ___ feet
Gravel packed? ☒ Yes ☐ No ☐ Size of gravel 3/8 -
Placed from 380 feet to 450 feet
Surface seal depth ___ Material used in seal: ☐ Cement grout
☒ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☒ ~~Temp.~~ perm. surface casing
☒ Overbore to seal depth
Method of joining casing: ☒ Threaded PVC ☒ Welded Steel ☐ Solvent Weld
☐ Cemented between strata
Describe access port LOCKING CAP

6. LOCATION OF WELL

Sketch map location must agree with written [redacted]

N
W E
X
S



~~Subdivision Name~~ _____
Collar Elev. AUG 09 1993
Lot No. _____ Block No. _____

County Caribou
NE ¼ SE ¼ Sec. 12, T. 7 N ☐ S ☒ R. 42 E ☒ W ☐

7. WATER LEVEL

Static water level 190 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature 49 °F. Quality Good
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
15	210	4

9. LITHOLOGIC LOG 103888

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
12"	0	10	cherty overburden		X
	10	100	Med. Cht. Shale		
	100	130	" Blk. "		
	130	150	" Chert		
	150	170	" Blk. Shale		
	170	190	Phosphate - 15 GPM	X	
	190	212	Med. blk. shales		X
7 7/8	212	265	" " "	X	
"	265	290	hard ls.		X
6"	270	345	Med. to hard shales		
	345	385	Phosphate		
	385	395	foot wall silts		
	395	410	Hard ls.		
	410	420	Broken ls.		
	420	460	Hard ls.		

RECEIVED
JAN 01 1993
Department of Water Resources
Eastern District Office

RECEIVED
FEB 22 1993
Department of Water Resources

10. Work started 11-11-92 finished 12-29-92

11. DRILLERS CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Nelson Firm No. 215
Address Soda Springs Date 12-30-92
Signed by (Firm Official) R. Nelson
and
(Operator) [signature]

USE ADDITIONAL SHEETS IF NECESSARY — FORWARD THE WHITE COPY TO THE DEPARTMENT

Form 238-7
9/90

MW002

USE TYPEWRITER OR BALLPOINT

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name MONSANTO Co. #2 W.

Address Box 816 Soda Springs, Id. 83276

Drilling Permit No. 27-92E-060-002

Water Right Permit No. _____

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement
☐ Well diameter increase
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☒ Test ☐ Municipal
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☒ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☒ Other PVC F.J.

	Thickness	Diameter	From	To
Steel	.250 inches	8" ID inches	+ 2 feet	20 feet
PVC	.250 inches	4" ID inches	+ 2 feet	348 feet
	inches	inches	feet	feet
	inches	inches	feet	feet

Was casing drive shoe used? ☐ Yes ☒ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☒ Yes ☐ No
How perforated? ☒ Factory ☐ Knife ☐ Torch ☐ Gun
Size of perforation .020 inches by 2 inches

Number		From	To
.020	perforations	328 feet	348 feet
.020	perforations	288 feet	308 feet
	perforations	feet	feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Gravel packed? ☒ Yes ☐ No ☐ Size of gravel 3/8 -
Placed from 250 feet to 350 feet
Surface seal depth 20 Material used in seal: ☐ Cement grout ☒ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☒ ~~Temp.~~ Perm. surface casing ☒ Overbore to seal depth
Method of joining casing: ☒ Threaded PVC ☒ Welded Steel ☐ Solvent Weld
☐ Cemented between strata

7. WATER LEVEL

Static water level 223 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature 49 °F. Quality Good
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☐ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
25	330	4

9. LITHOLOGIC LOG

103889

Bore Diam.	Depth From	Depth To	Material	Water Yes
12¼	0	12	overburden	
"	12	19	Med. Sandstone	
7⅞	19	42	" "	
	42	54	Hard limestone	
	54	60	Med. Sandstone	
	60	73	Hard "	
	73	169	Med. "	
	169	178	Hard "	
	178	220	Med "	
	220	259	Med. limestone	
	259	270	Med. Sandstone	
	270	282	Med. limestone 15GPM	X
	282	286	Hard "	
	286	330	Med. " 10GPM	X
	330	400	Hard "	

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Form 238-7
4/92

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

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USE TYPEWRITER OR BALLPOINT PEN

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

PW006 (2 wells)

0-7539
0-7540
C-0252

1. WELL OWNER

Name Rhone Poulenc
Address P.O. Box 160 Montpelier, ID 83254
Drilling Permit No. 27-92E-~~054~~0080-000 D.W. See Remarks 3-27-95
Water Right Permit No. 27-07540

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement
☐ Well diameter increase ☐ Modification
☐ Abandoned (describe abandonment or modification procedures such as liners, screen, materials, plug depths, etc. in lithologic log, section 9.)

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Monitor
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☒ Other Road Watering (specify type)

4. METHOD DRILLED

☒ Rotary ☒ Air ☐ Auger ☐ Reverse rotary
☐ Cable ☐ Mud ☐ Other _____ (backhoe, hydraulic, etc.)

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.375 inches	10 inches	+ 1 feet	280 feet
.250 inches	8 inches	+ 18" feet	601 feet
inches	inches	feet	feet

Was casing drive shoe used? ☒ Yes ☐ No
Was a packer or seal used? ☐ Yes ☐ No
Perforated? ☒ Yes ☐ No
How perforated? ☐ Factory ☒ Knife ☐ Torch ☐ Gun
Size of perforation? ¼ inches by 2½ inches

Number		From	To
800	perforations	380 feet	280 feet
480	perforations	580 feet	520 feet
	perforations	feet	feet

Well screen installed? ☐ Yes ☒ No
Manufacturer _____ Type _____
Top Packer or Headpipe _____
Bottom of Tailpipe _____

Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Gravel packed? ☐ Yes ☐ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet

Surface seal depth 280 Material used in seal: ☐ Cement grout
☒ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit
☒ Temp. surface casing ☐ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded
☐ Solvent Weld ☐ Cemented between strata

Describe access port 1¼" Nipple w/cap

6. LOCATION OF WELL

Sketch map location must agree with written location.

N W E S

Subdivision Name _____
Lot No. _____ Block No. _____
County Caribou
Address of Well Site Rassmuesen Valley (give at least name of road)
T. 6 N ☐ or S ☒
NW ¼ SW ¼ Sec. 26, R. 43 E ☒ or W ☐

7. WATER LEVEL

Static water level 267 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature _____ °F. Quality _____
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
40	Unknown	8

9. LITHOLOGIC LOG 074862

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
10 3/4	0	5	Top Soil		
10 3/4	5	20	Gravel		x
10 3/4	20	40	Gravel & Clay		x
10 3/4	40	60	Gravel & Clay		x
10 3/4	60	80	Gravel & Clay		x
10 3/4	80	100	Gravel & Clay		x
10 3/4	100	120	Gravel & Clay		x
10 3/4	120	140	Gravel & Clay		x
10 3/4	140	160	Gravel, Clay & Mudstone		x
10 3/4	160	180	Gravel, Clay & Mudstone		x
10 3/4	180	200	Gravel, Clay & Mudstone		x
10 3/4	200	220	Gravel, Clay & Mudstone		x
10 3/4	220	240	Gravel, Clay & Mudstone		x
10 3/4	240	260	Gravel, Clay & Mudstone		x
10 3/4	260	280	Gravel, Clay & Phosphate		x
8 5/8	280	300	Gravel		x
8 5/8	300	320	Gravel		x
8 5/8	320	340	Gravel		x
8 5/8	340	360	Gravel		x
8 5/8	360	380	Gravel		x
8 5/8	380	400	Gravel		x
8 5/8	400	420	Gravel		x
8 5/8	420	440	Gravel	x	
8 5/8	440	460	Gravel	x	
8 5/8	460	480	Sandstone		x
8 5/8	480	500	Sand & Sandstone		x
8 5/8	500	520	Sand Stone & Sand		x
8 5/8	520	540	Sand & SAndstone	x	
8 5/8	540	560	Sand & Sandstone	x	
8 5/8	560	580	SAnd & Sandstone		x
8 5/8	580	590	Limestone		x
8 5/8	590	600	Limestone		x
8 5/8	600	630	Pink Sandstone		x
8 5/8	630	650	Sandstone, & Gravel		x

Wells

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10.

Work started 2-11-93 finished 8-9-93

11. DRILLER'S CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Thomas Drilling, Inc. Firm No. 390
Address Rt. 1 Afton, WY 83110 Date 1-27-94
Signed by Drilling Supervisor _____
and
(Operator) _____ (If different than the Drilling Supervisor)

MAY 08 1995

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Form 238-7
4/92

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

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USE TYPEWRITER OR BALLPOINT PEN

PW006 (2 wells)

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name: Rhone Poulenc

Address: P.O. Box 160 Montpelier, ID 83254

Drilling Permit No. 27-92E-054-000 Correct #

Water Right Permit No. 27-07540

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement
☐ Well diameter increase ☐ Modification
☐ Abandoned (describe abandonment or modification procedures such as liners, screen, materials, plug depths, etc. in lithologic log, section 9.)

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Monitor
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☒ Other Road Watering (specify type)

4. METHOD DRILLED

☒ Rotary ☒ Air ☐ Auger ☐ Reverse rotary
☐ Cable ☐ Mud ☐ Other _____ (backhoe, hydraulic, etc.)

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.375 inches	10 inches	+ 1 feet	150 feet
.250 inches	6 inches	+ 18" feet	390 feet
_____ inches	_____ inches	_____ feet	_____ feet

Was casing drive shoe used? ☒ Yes ☐ No
Was a packer or seal used? ☐ Yes ☐ No
Perforated? ☒ Yes ☐ No
How perforated? ☐ Factory ☒ Knife ☐ Torch ☐ Gun
Size of perforation? ¼ inches by 2½ inches

Number		From	To
80	perforations	90 feet	80 feet
320	perforations	385 feet	350 feet
_____	perforations	_____ feet	_____ feet

Well screen installed? ☐ Yes ☒ No
Manufacturer _____ Type _____
Top Packer or Headpipe _____
Bottom of Tailpipe N/A

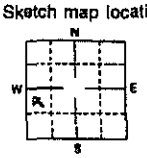
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Gravel packed? ☐ Yes ☐ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet

Surface seal depth 150 Material used in seal: ☐ Cement grout ☒ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☒ Temp. surface casing ☐ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld ☐ Cemented between strata

Describe access port 1¼" Coupling w/ plug

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____
Lot No. _____ Block No. _____
County Caribou
Address of Well Site Rasmuessen Valley (give at least name of road)
T. 6 N ☐ or S ☒
NW ¼ SW ¼ Sec. 26, R. 43 E ☒ or W ☐

7. WATER LEVEL

Static water level 32 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature _____ °F. Quality _____
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
40	Couldn't tell	7

9. LITHOLOGIC LOG 074861

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
10	0	3	Top soil		x
10	3	35	RedClay		x
10	35	45	Tan Clay & Gravel		x
10	45	48	Gravel	x	
10	48	70	Tan Clay & Gravel		x
10	70	80	Tan Clay		x
10	80	90	Gravel	x	
10	90	100	Gravel	x	
83/4	100	130	Gravel & TanClay		x
8 3/4	130	150	Tan Clay, Mud Stone		x
8 3/4	150	230	Tan Clay, Mud Stone		x
8 3/4	230	240	Tan Shale, Mud Stone		x
8 3/4	240	250	Tan Shale, Mud Stone		x
8 3/4	250	260	Tan Shale, Mud Stone		x
8 3/4	260	270	Tan Shale, Mud Stone		x
8 3/4	270	280	Black Shale		x
8 3/4	280	300	Black Shale		x
8 3/4	300	350	Black Shale		x
8 3/4	350	360	Black Shale, Interbed Lime Stone	x	
8 3/4	360	370	Black Shale, Interbed Lime Stone	x	
8 3/4	370	380	~~Black Shale, Interbed Lime Stone~~	x	
8 3/4	380	390	~~Black Shale, Interbed Lime Stone~~	x	

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10. Work started 9-26-92 finished 6-17-93

11. DRILLER'S CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Thomas Drilling, Inc. Firm No. 390
Address Rt. 1 Afton, WY 83110 Date 1-27-94
Signed by Drilling Supervisor _____
and
(Operator) _____ *(if different than the Drilling Supervisor)*

MAY 08 1995

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STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

USE TYPEWRITER OR BALLPOINT PEN

PW 19

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name Diamond Soda Springs, Monsanto

Address Box 975 Soda Springs, Id, 83276

Owner's Permit No. _____

2. NATURE OF WORK Drill Permit # 27-90-E-023

☒ New well ☐ Deepened ☐ Replacement
☐ Well diameter increase
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)

3. PROPOSED USE

☒ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☒ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☐ Steel ☒ Concrete ☐ Other _____

Thickness	Diameter	From	To
.250 inches	16 inches +	1 feet	20 feet
.250 inches	10 inches +	2 feet	225 feet
inches	inches	feet	feet
inches	inches	feet	feet

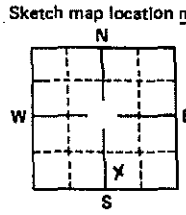
Was casing drive shoe used? ☐ Yes ☒ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☒ Yes ☐ No
How perforated? ☐ Factory ☐ Knife ☒ Torch ☐ Gun
Size of perforation 74 inches by 12 inches

Number	From	To
120 perforations	175 feet	235 feet
perforations	feet	feet
perforations	feet	feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Gravel packed? ☒ Yes ☐ No ☐ Size of gravel 3/8" -
Placed from 235 feet to 35 (loyd) feet
Surface seal depth 20 Material used in seal: ☐ Cement grout ☒ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☒ ~~Temp.~~ perm. surface casing ☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld
☐ Cemented between strata
Describe access port PLUG IN CAP

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____

Lot No. _____ Block No. _____

County _____

SW ¼ SE ¼ Sec. 21, T. 6 N ☐ S ☒ R. 43 E ☒ W ☐

7. WATER LEVEL

Static water level 137 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature 50 °F. Quality Good
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
300	235	8

9. LITHOLOGIC LOG 072583

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
20"	0	11	Fill		X
"	11	20	Clay		X
15"	20	96	"		X
"	96	108	" + Rock		X
"	108	189	"		
"	189	217	Broken Rock - May be BASALT	X	
"	217	230	Hard Rock	X	
"	230	234	" Broken Rock	X	
9 7/8	234	255	Hard Rock	X	

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Eastern District Office

10. Work started 5-21-90 finished 6-1-90

11. DRILLERS CERTIFICATION DL

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Nelson Drilling Firm No. 215

Address Soda Springs Date 6-16-90

Signed by (Firm Official) R. Nelson

and

(Operator) R. Nelson

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STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

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Eastern District Office

PW 20

1. WELL OWNER Monsanto

Name Diamo Soda Springs
Box 975
Address Soda Springs, Id, 83276

Owner's Permit No. 27-07452

2. NATURE OF WORK Drill Permit # 27-90-E-001

☒ New well ☐ Deepened ☐ Replacement
☐ Well diameter increase
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☒ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.250 inches	16 inches	+ 1 feet	22 feet
.250 inches	12 inches	+ 2 feet	461 feet
inches	inches	feet	feet
inches	inches	feet	feet

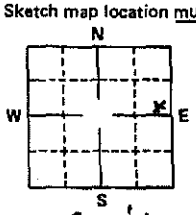
Was casing drive shoe used? ☐ Yes ☒ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☒ Yes ☐ No
How perforated? ☐ Factory ☐ Knife ☒ Torch ☐ Gun
Size of perforation 1/4 inches by 12" inches

Number	From	To
120 perforations	401 feet	461 feet
perforations	feet	feet
perforations	feet	feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ___ Slot size ___ Set from ___ feet to ___ feet
Diameter ___ Slot size ___ Set from ___ feet to ___ feet
Gravel packed? ☐ Yes ☒ No ☐ Size of gravel _____
Placed from ___ feet to ___ feet
Surface seal depth 22 Material used in seal: ☒ Cement grout
☒ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☒ ~~Temp~~ Perm surface casing
☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld
☐ Cemented between strata
Describe access port plug in cap

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____
Lot No. _____ Block _____

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County Caribou
SE ¼ NE ¼ Sec. 21, T. 6 S N ☐ R. 43 E ☒ W ☐

7. WATER LEVEL

Static water level 260' feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature 49 °F. Quality Good
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
100 - 150	460	4

9. LITHOLOGIC LOG 072584

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
20"	0	10	Clay		X
"	10	22	Clay + overburden		X
15"	22	50	" "		X
"	50	100	Gymwoody		X
"	100	160	" + Clay		X
"	160	320	"		X
"	320	440	Cherty Shales		X
"	440	510	Hard porous chert	X	
12"	510	720	Shales + Phosphate		X
"	720	722	Void	X	
"	722	726	Broken limestone	X	
"	726	800	Hard limestone		X
"	800	810	Sandy lse - losing H2O		X

10. Work started 4-4-90 finished 5-16-90

11. DRILLERS CERTIFICATION DL

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Nelson Drilling Firm No. 215
Address Soda Springs, Id, Date 5-21-90
Signed by (Firm Official) R. Nelson
and
(Operator) Ray Nelson

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Form 238-7

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

USE TYPEWRITER OR BALLPOINT PEN

~~PW 023~~ ?
PW 022 ?

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name Monsanto Hole #504

Address Soda Springs, Idaho

Owner's Permit No. _____

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement
☐ Abandoned (describe method of abandoning) _____

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☒ Test ☐ Municipal
☐ Industrial ☐ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.250 inches	6 inches +	1 feet	151 feet
.250 inches	8 inches	1 feet	19 feet
inches	inches	feet	feet
inches	inches	feet	feet

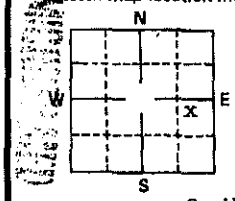
Was casing drive shoe used? ☒ Yes ☐ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☐ Yes ☒ No
How perforated? ☐ Factory ☐ Knife ☐ Torch
Size of perforation _____ inches by _____ inches

Number	From	To
perforations	feet	feet
perforations	feet	feet
perforations	feet	feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Gravel packed? ☐ Yes ☒ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 18' Material used in seal: ☐ Cement grout
Bentonite ☒ Puddling clay ☐ Well cuttings
Sealing procedure used: ☐ Slurry pit ☐ Temp. surface casing
☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld
☐ Cemented between strata
Describe access port _____

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name So. Henry Mine

Lot No. _____ Block No. _____

County Caribou

NE ¼ SE ¼ Sec. 30, T. 6 N/S, R. 43 E/W.

7. WATER LEVEL

Static water level 63' feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature ____ °F. Quality Good

8. WELL TEST DATA

☐ Pump ☐ Bailer ☐ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped

9. LITHOLOGIC LOG

Hole Diam.	Depth From	Depth To	Material	Water Yes	Water No
8	0	5	Soil		x
8	5	122	Gummy Clay and Gravel		x
8	122	125	Soft Shale-Greenish Gray	x	
8	125	150	Soft Shale " "		x

RECEIVED JAN 23 1981 Department of Water Resources Eastern Region

10.

Work started 3-20-80 finished 3-26-80

11. DRILLERS CERTIFICATION

CbdL

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Andrew Well Drilling Contr. Firm No. 5
Address 1269 East 17th Street Date 5-8-80
Idaho Falls, Idaho 83401
Signed by (Firm Official) [signature]
and
(Operator) [signature]

USE ADDITIONAL SHEETS IF NECESSARY — FORWARD THE WHITE COPY TO THE DEPARTMENT

Form 238-7
9/82

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

USE TYPEWRITER OR BALL POINT PEN

DW 001 or ~~AW 003~~

DEC 16 1988

RECEIVED DEC 22 1988 Department of Water Resources

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

Department of Water Resources
Eastern District Office

1. WELL OWNER

Name [redacted] (b) (6)

Address (b) (6) [redacted], (b) (6) [redacted]

Owner's Permit No. 27-88-G-040

2. NATURE OF WORK

☐ New well ☒ Deepened ☐ Replacement
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log).

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☒ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☒ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☐ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
_____ inches	_____ inches +	_____ feet	_____ feet
.250 inches	16" I.D. inches +	1 feet	109 feet
.258 inches	5" I.D. inches	92 feet	160 feet
_____ inches	_____ inches	_____ feet	_____ feet

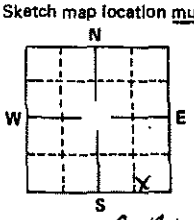
Was casing drive shoe used? ☐ Yes ☒ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☒ Yes ☐ No
How perforated? ☐ Factory ☐ Knife ☒ Torch
Size of perforation 3/16 inches by 12 inches

Number	From	To
60 perforations	70 feet	110 feet
33 perforations	139 feet	160 feet
_____ perforations	_____ feet	_____ feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Gravel packed? ☒ Yes ☐ No ☐ Size of gravel 1/4"
Placed from 110 feet to 20 feet
Surface seal depth 20 Material used in seal: ☐ Cement grout ☒ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☐ Temp. surface casing ☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld
☐ Cemented between strata
Describe access port plug on cap

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____
Lot No. _____ Block No. _____

County CARIBOU
SE ¼ SE ¼ Sec. 18, T. 6 S, R. 43 E

7. WATER LEVEL

Static water level 13 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature 48 °F. Quality Good
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☐ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
30	160	3

9. LITHOLOGIC LOG

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
			This well was drilled over 30 years ago. was just going to install a pump - but well pumped dry.		
9 7/8	90	110	Brn. Clay & gravel		X
6 3/4	110	138	" " " "		X
"	138	142	hard lava		X
"	142	150	broken limestone	X	
"	150	160	hard "	X	

10. Work started 10-28-88 finished 11-4-88

11. DRILLERS CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Nelson Firm No. 215
Address Soda Springs Date 11-9-88
Signed by (Firm Official) R. Nelson
and
(Operator) Ray Nelson

USE ADDITIONAL SHEETS IF NECESSARY — FORWARD THE WHITE COPY TO THE DEPARTMENT

Form 238-7
9/82

NELSON SAYS this Location is Correct. HWJ

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

DW002 USE TYPEWRITER OR BALLPOINT PEN

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name (b) (6) [redacted] (b) (6) [redacted]
HENRY - ENOCH Valley
Address [redacted] (b) (6) [redacted] (b) (6) [redacted]

Owner's Permit No. 27-87-E-017

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement
☐ Abandoned (describe abandonment procedures such as materials, plug depths; etc. in lithologic log)

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☒ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.250 inches	8" I.D. inches +	1 feet	19 feet
.280 inches	6" I.D. inches +	1 feet	159 feet
inches	inches	feet	feet
inches	inches	feet	feet

Was casing drive shoe used? ☐ Yes ☒ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☒ Yes ☐ No
How perforated? ☐ Factory ☐ Knife ☒ Torch
Size of perforation 1/4" inches by 12" inches

Number	From	To
15 perforations	20 feet	30 feet
30 perforations	160 feet	180 feet
perforations	feet	feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Gravel packed? ☐ Yes ☒ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 19 Material used in seal: ☒ Cement grout
☐ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☒ ~~Temp.~~ Perm. surface casing
☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☐ Welded ☐ Solvent Weld

7. WATER LEVEL

Static water level 10 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature 48 °F. Quality Good
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
40		6

9. LITHOLOGIC LOG

Bore Diam.	Depth From	Depth To	Material	Water Yes
12 1/4	0	5	overburden	
"	5	19	clay	
8 1/2"	19	25	clay	
	25	40	gravel + clay	X
	40	140	" "	
	140	150	Sandstone	
	150	155	gravel	X
	155	159	hard rock	
4 3/4"	159	180	hard rock	

RECEIVED
DEC
Department of Water Resources
Eastern District Office

USE TYPEWRITER OR BALL POINT PEN

State Idaho
Department of Reclamation

WELL DRILLER'S REPORT

State law requires that this report be filed with the State Reclamation Engineer within 30 days after completion or abandonment of the well.

K-4 7-23-6 mw

DW005

1. WELL OWNER

Name (b) (6) [redacted]

Address (b) (6) [redacted]

Owner's Permit No. _____

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement

☐ Abandoned (describe method of abandoning)

3. PROPOSED USE

☒ Domestic ☐ Irrigation ☐ Test

☐ Municipal ☐ Industrial ☐ Stock

4. METHOD DRILLED

☒ Cable ☐ Rotory ☐ Dug ☐ Other

5. WELL CONSTRUCTION

Diameter of hole 6 inches Total depth 46 feet

Casing schedule: ☒ Steel ☐ Concrete

Thickness	Diameter	From	To
.250 inches	6 5/8 inches	top feet	46-6 feet
inches	inches	feet	feet
inches	inches	feet	feet
inches	inches	feet	feet
inches	inches	feet	feet

Was a packer or seal used? ☐ Yes ☐ No

Perforated? ☒ Yes ☐ No

How perforated? ☐ Factory ☐ Knife ☒ Torch

Size of perforation 5 inches by ¼ inches

Number	From	To
24 perforations	~~35~~ 40 feet	45 feet
perforations	feet	feet
perforations	feet	feet

Well screen installed? ☐ Yes ☐ No

Manufacturer's name _____

Type _____ Model No. _____

Diameter ___ Slot size ___ Set from ___ feet to ___ feet

Diameter ___ Slot size ___ Set from ___ feet to ___ feet

Gravel packed? ☐ Yes ☐ No Size of gravel _____

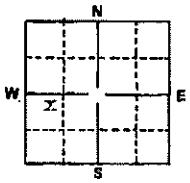
Placed from _____ feet to _____ feet

Surface seal? ☒ Yes ☐ No To what depth 19 feet

Material used in seal ☒ Cement grout ☐ Puddling clay

6. LOCATION OF WELL

Sketch map location must agree with written location.



County Caribou

NW ¼ SW ¼ Sec. 10, T. 6 N/S, R. 42 E/W

27 mw

7. WATER LEVEL

Static water level 6 feet below land surface

Flowing? ☐ Yes ☒ No G.P.M. flow _____

Temperature _____ ° F. Quality _____

Artesian closed-in pressure _____ p.s.i.

Controlled by ☐ Valve ☐ Cap ☐ Plug

8. WELL TEST DATA

☐ Pump ☒ Bailer ☐ Other

Discharge G.P.M.	Draw Down	Hours Pumped
~~XX~~ 20	8 ft.	30 min.

9. LITHOLOGIC LOG 29712

Hole Diam.	Depth From	Depth To	Material	Water Yes	Water No
6 in	0	4	Clay		
	4	8	Gravel and sand		
	8	14	White loose rock	X	
	14	29	White crevised rock		
	29	38	White broken rock		
	38	46	White loose rock	X	

10.

Work started May 5, 1969 finished May 10, 1969

11. DRILLER'S CERTIFICATION

This well was drilled under my supervision and this report is true to the best of my knowledge.

Westlake Drilling mw 114

Driller's or Firm's Name Number

P.O.Box 40 Bannington, Idaho 83219

Address

Signed By Bert Westlake Date 7-10-69

USE ADDITIONAL SHEETS IF NECESSARY

USE TYPEWRITER OR BALL POINT PEN

State of Idaho
Department of Reclamation

WELL DRILLER'S REPORT

RECEIVED
NOV 20 1969
Department of Reclamation

AW002

State law requires that this report be filed with the State Reclamation Engineer within 30 days after completion or abandonment of the well.

1. WELL OWNER Enoch Valley Grazing Assn. Inc

Name D. (b) (6) [redacted]

Address (b) (6) [redacted]

Owner's Permit No.

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement

☐ Abandoned (describe method of abandoning)

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Test

☐ Municipal ☐ Industrial ☒ Stock

4. METHOD DRILLED

☒ Cable ☐ Rotory ☐ Dug ☐ Other

5. WELL CONSTRUCTION

Diameter of hole 6 inches Total depth 153 feet

Casing schedule: ☒ Steel ☐ Concrete

Thickness	Diameter	From	To
.250 inches	6 5/8 inches	+ 1.50 feet	152 feet
inches	inches	feet	feet
inches	inches	feet	feet
inches	inches	feet	feet
inches	inches	feet	feet

Was a packer or seal used? ☐ Yes ☐ No

Perforated? ☒ Yes ☐ No

How perforated? ☐ Factory ☐ Knife ☒ Torch

Size of perforation 6 inches by 1/4 inches

Number	From	To
18 perforations	142 feet	146 feet
perforations	feet	feet
perforations	feet	feet

Well screen installed? ☐ Yes ☐ No

Manufacturer's name

Type Model No.

Diameter Slot size Set from feet to feet

Diameter Slot size Set from feet to feet

Gravel packed? ☐ Yes ☐ No Size of gravel

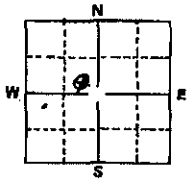
Placed from feet to feet

Surface seal? ☒ Yes ☐ No To what depth 34 feet

Material used in seal ☐ Cement grout ☒ Puddling clay

6. LOCATION OF WELL

Sketch map location must agree with written location.



County Caribou

S.E. ¼ NW ¼ Sec. 17, T. 6 S, R. 43 E

7. WATER LEVEL

Static water level 17'-7" feet below land surface

Flowing? ☐ Yes ☐ No G.P.M. flow

Temperature ° F. Quality

Artesian closed-in pressure p.s.i.

Controlled by ☐ Valve ☐ Cap ☐ Plug

8. WELL TEST DATA

☐ Pump ☒ Bailer ☐ Other

Discharge G.P.M.	Draw Down	Hours Pumped
15	4 FT	30 MIN

9. LITHOLOGIC LOG 29709

Hole Diam.	Depth From	Depth To	Material	Water Yes	Water No
6	0	8	CLAY TAN		
	8	14	" SOFT + SANDY		
	14	34	" "		
	34	63	" MEDIUM SOFT TAN		
	63	67	BLUE CLAY + GRAVEL		
	67	81	" "		
	81	86	" " + COURSE SAND		
	86	105	" "		
	105	114	" " + COURSE SAND		
	114	138	" " SHELLS		
	138	142	BLACK CINDERS + SILT		
	142	151	" "	✓	
	151	154	BLUE CLAY		

10. Work started Aug 28 1969 finished Aug 29 1969

11. DRILLER'S CERTIFICATION

This well was drilled under my supervision and this report is true to the best of my knowledge.

Bert Westlake Drilling 114
Driller's or Firm's Name Number

Bennington Idaho 83219
Address

Bert Westlake Sept 6 1969
Signed By Date

USE ADDITIONAL SHEETS IF NECESSARY

Form 238-7
9/82

NELSON SAYS
His Location
Correct. HWJ

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

USE TYPEWRITER OR BALLPOINT PEN

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

~~DW001 or~~
AW003

1. WELL OWNER

Name (b) (6) [redacted]
Henry - Enloch Valley
Address (b) [redacted]
(6)
Owner's Permit No. 27-87-E-017

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☒ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☐ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.250 inches	8" I.D. inches +	1 feet	19 feet
.280 inches	6" I.D. inches +	1 feet	159 feet
inches	inches	feet	feet
inches	inches	feet	feet

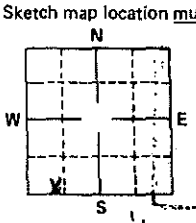
Was casing drive shoe used? ☐ Yes ☒ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☒ Yes ☐ No
How perforated? ☐ Factory ☐ Knife ☒ Torch
Size of perforation 1/4" inches by 12" inches

Number	From	To
15 perforations	20 feet	30 feet
30 perforations	160 feet	180 feet
perforations	feet	feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ___ Slot size ___ Set from ___ feet to ___ feet
Diameter ___ Slot size ___ Set from ___ feet to ___ feet
Gravel packed? ☐ Yes ☒ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 19 Material used in seal: ☒ Cement grout
☐ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☒ ~~Temp.~~ Perm. surface casing
☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☐ Welded ☐ Solvent Weld
☐ Cemented between strata
Describe access port plug in cap

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____
OCT 17 1988
Lot No. _____ Block No. _____
County Caribou SE 1/4
SW 1/4 SW 1/4 Sec. 8, T. 6 N/S, R. 43 E/W.

7. WATER LEVEL

Static water level 10 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature 48 °F. Quality Good
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
40		6

9. LITHOLOGIC LOG

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
12 1/4	0	5	overburden		X
"	5	19	clay		X
8 1/2"	19	25	clay		X
	25	40	gravel + clay	X	
	40	140	" "		X
	140	150	Sandstone		X
	150	155	gravel	X	
	155	159	hard rock		X
4 3/4"	159	180	hard rock		X

RECEIVED
DEC
Department of Water Resources
Eastern District Office

10.

Work started 10-20-87 finished 11-5-87

11. DRILLERS CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Nelson Drilling Firm No. 215
Address Soda Springs, Id. Date 12-8-87
Signed by (Firm Official) R. Nelson
and
(Operator) Ray Nelson

USE ADDITIONAL SHEETS IF NECESSARY — FORWARD THE WHITE COPY TO THE DEPARTMENT

rm 238-7
/82

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

USE TYPEWRITER OR BALLPOINT PEN

AW005

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

1. WELL OWNER

Name (b) (6) [redacted]

Address 3235 Round Hill Dr. (b) (6) [redacted]

Owner's Permit No. _____

2. NATURE OF WORK Drill Permit 27-90-E047

☒ New well ☐ Deepened ☐ Replacement
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☒ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☒ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.250 inches	8" I.D. inches +	1 feet	20 feet
.250 inches	6" I.D. inches +	1.5 feet	239 feet
inches	inches	feet	feet
inches	inches	feet	feet

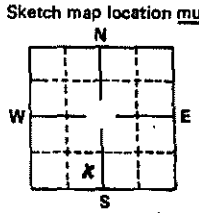
Was casing drive shoe used? ☐ Yes ☒ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☒ Yes ☐ No
How perforated? ☐ Factory ☐ Knife ☒ Torch
Size of perforation 3/16 inches by 12 inches

Number	From	To
60 perforations	199 feet	239 feet
28 perforations	159 feet	199 feet
perforations	feet	feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ___ Slot size ___ Set from ___ feet to ___ feet
Diameter ___ Slot size ___ Set from ___ feet to ___ feet
Gravel packed? ☐ Yes ☒ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 20 Material used in seal: ☒ Cement grout
☐ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☒ Perm. surface casing
☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld
☐ Cemented between strata
Describe access port None - CAP Welded ON

6. LOCATION OF WELL

Sketch map location must agree with written location.



N
W E
S
X

Subdivision Name _____

JUN 21 1991

Lot No. _____ Block No. _____

County CARIBOU

SE ¼ SW ¼ Sec. 26, T. 6 N/S, R. 43 E/W

7. WATER LEVEL

Static water level 220 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature 49 °F. Quality Good
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
10	260	3

9. LITHOLOGIC LOG 072585

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
12¼	0	20	Blue Clay		X
7⅞	20	40	" "		
	40	90	Red "		
	90	168	Brown "		
	168	210	Red Clay		
	210	220	Hard limestone		
	220	235	Broken " 1 GPM	X	
	235	245	Hard "		X
6"	245	260	Broken " 3 GPM	X	
	260	271	Hard "		X
	271	280	Broken " 6 GPM	X	

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DEC 1 7 1990
Department of Water Resources
Eastern District Office

10. Work started 11-19-90 finished 11-28-90

11. DRILLERS CERTIFICATION DL

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Nelson Firm No. 215

Address Soda Springs, Id. Date 12-1-90

Signed by (Firm Official) Ray Nelson

and

(Operator) [signature]

USE ADDITIONAL SHEETS IF NECESSARY — FORWARD THE WHITE COPY TO THE DEPARTMENT

Form 238-7
9/82

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

USE TYPEWRITER OR BALLPOINT PEN

AWOD6

Department of Water Resources
OCT 18 1988

1. WELL OWNER

Name (b) (6) [redacted]

Address (b) (6) [redacted]

Owner's Permit No. 27-88-E 028

2. NATURE OF WORK

☒ New well ☐ Deepened ☐ Replacement
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log).

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☒ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☒ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.250 inches	8" ID inches +	1 feet	19 feet
.250 inches	6" ID inches +	1 feet	109 feet
inches	inches	feet	feet
inches	inches	feet	feet

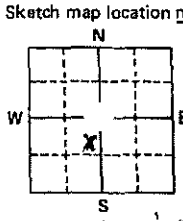
Was casing drive shoe used? ☐ Yes ☒ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☒ Yes ☐ No
How perforated? ☐ Factory ☐ Knife ☒ Torch
Size of perforation 3/16" inches by 12 inches

Number	From	To
30 perforations	89 feet	109 feet
perforations	feet	feet
perforations	feet	feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Gravel packed? ☐ Yes ☒ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 19 Material used in seal: ☒ Cement grout
☒ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☒ Pump. surface casing
☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld
☐ Cemented between strata
Describe access port plug in cap

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____

Lot No. _____ Block No. _____

County Caribou

NW ¼ SW ¼ Sec. 35, T. 6 S/S, R. 42 E/W

7. WATER LEVEL

Static water level 27 feet below land surface.
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature 48 °F. Quality Good
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
40	110	3

9. LITHOLOGIC LOG

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
12¼	0	4	overburden		X
"	4	17	Clay		X
"	17	19	Hard lava		X
7⅞	19	27	" "		X
	27	33	" porous lava w/cinder	X	
	33	58	" lava		X
	58	59	Clay seam		X
	59	63	Hard lava		X
	63	69	Hard broken lava	X	
	69	81	" lava		X
	81	87	Brown Clay		X
	87	102	Cinders	X	
	102	110	Hard lava		X
5"	110	120	" "		

OCT 4 1989
Department of Water Resources
Eastern District Office

10. Work started 9-1-88 finished 9-1-88

11. DRILLERS CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Nelson Firm No. 215

Address Soda Springs, Id. Date 9-17-88

Signed by (Firm Official) R. Nelson

and

(Operator) Ray Nelson

USE ADDITIONAL SHEETS IF NECESSARY — FORWARD THE WHITE COPY TO THE DEPARTMENT

Form 238-7
9/82

STATE OF IDAHO
DEPARTMENT OF WATER RESOURCES

WELL DRILLER'S REPORT

State law requires that this report be filed with the Director, Department of Water Resources within 30 days after the completion or abandonment of the well.

USE TYPEWRITER OR BALLPOINT PEN

RECEIVED JUL 18 1988 Department of Water Resources

AW007?

1. WELL OWNER

Name (b) (6) [redacted] (b) (6) [redacted]
321 Court
Address [redacted] (b) (6) (b [redacted]
Owner's Permit No. 27-88-E-015

2. NATURE OF WORK

☐ New well ☒ Deepened ☐ Replacement
☐ Abandoned (describe abandonment procedures such as materials, plug depths, etc. in lithologic log)

3. PROPOSED USE

☐ Domestic ☐ Irrigation ☐ Test ☐ Municipal
☐ Industrial ☒ Stock ☐ Waste Disposal or Injection
☐ Other _____ (specify type)

4. METHOD DRILLED

☒ Rotary ☒ Air ☐ Hydraulic ☐ Reverse rotary
☐ Cable ☐ Dug ☐ Other _____

5. WELL CONSTRUCTION

Casing schedule: ☒ Steel ☐ Concrete ☐ Other _____

Thickness	Diameter	From	To
.250 inches	6" Id inches +	1 feet	119 feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet
_____ inches	_____ inches	_____ feet	_____ feet

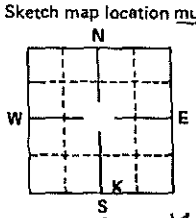
Was casing drive shoe used? ☐ Yes ☒ No
Was a packer or seal used? ☐ Yes ☒ No
Perforated? ☒ Yes ☐ No
How perforated? ☐ Factory ☐ Knife ☒ Torch
Size of perforation 3/16 inches by 12 inches

Number	From	To
45 perforations	59 feet	119 feet
_____ perforations	_____ feet	_____ feet
_____ perforations	_____ feet	_____ feet

Well screen installed? ☐ Yes ☒ No
Manufacturer's name _____
Type _____ Model No. _____
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Diameter ____ Slot size ____ Set from ____ feet to ____ feet
Gravel packed? ☐ Yes ☒ No ☐ Size of gravel _____
Placed from _____ feet to _____ feet
Surface seal depth 20 Material used in seal: ☐ Cement grout ☒ Bentonite ☐ Puddling clay ☐ _____
Sealing procedure used: ☐ Slurry pit ☒ Temp. surface casing ☒ Overbore to seal depth
Method of joining casing: ☐ Threaded ☒ Welded ☐ Solvent Weld ☐ Cemented between strata
Describe access port plug in Cap

6. LOCATION OF WELL

Sketch map location must agree with written location.



Subdivision Name _____
Lot No. _____ Block No. _____
County Caribou
SW ¼ SE ¼ Sec. 23, T. 6 ☒S, R. 42 E/☒.

7. WATER LEVEL

Static water level 80 feet below land surface
Flowing? ☐ Yes ☒ No G.P.M. flow _____
Artesian closed-in pressure _____ p.s.i.
Controlled by: ☐ Valve ☐ Cap ☐ Plug
Temperature 57 °F. Quality Good
Describe artesian or temperature zones below.

8. WELL TEST DATA

☐ Pump ☐ Bailer ☒ Air ☐ Other _____

Discharge G.P.M.	Pumping Level	Hours Pumped
40	120	2

9. LITHOLOGIC LOG

Bore Diam.	Depth From	Depth To	Material	Water Yes	Water No
10"	0	4	overburden		X
10	4	10	Gray Clay		
10"	10	19	" "		
6¾	19	53			
"	53	57	Sand Stone	X	
"	57	93	Blue Clay		X
"	93	120	Hard Rock (Chert?)	X	

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10.

Work started 6-24-88 finished 6-26-88

11. DRILLERS CERTIFICATION

I/We certify that all minimum well construction standards were complied with at the time the rig was removed.

Firm Name Nelson Drilling Firm No. 215
Address Soda Springs Id. Date 82
Signed by (Firm Official) R. Nelson
and
(Operator) Ray Nelson

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Appendix G
Standard Operating Procedures
Borehole Drilling and Logging
Monitoring Well Installation

Borehole Drilling and Logging
Monitoring Well Installation
Aquifer Testing

Standard Operating Procedures

June 2004

Prepared by:

MWH
100 S. Broad Street
Globe, Arizona 85501

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B	Unified Soil Classification System
C	Criteria for Describing Plasticity
D	Criteria for Describing Density and Consistency
E	Criteria for Describing Structure
F	Soil Boring Log Form
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N	Time Intervals for Manual and Electronic Measurements of Drawdown
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1.0 INTRODUCTION

The purpose of this document is to define the standard procedures for drilling, logging, testing, documentation, and installation of boreholes and monitoring wells. This SOP provides descriptions of equipment, field procedures, and technical procedures necessary to perform the proposed drilling and sampling activity. The procedures described herein are intended to be used with other applicable SOPs, as appropriate.

This SOP describes procedures for conducting the tasks listed below.

- Drilling boreholes
- Sampling soil and bedrock for lithologic description
- Borehole logging
- Equipment decontamination
- Well design and construction
- Well development
- Topographic surveying
- Aquifer testing (sieve, packer and pumping tests)

Many terms included in this SOP may be unfamiliar to the reader. A glossary of terms is included in Attachment A.

2.0 DRILLING OPERATIONS

Drilling methods can be separated into two general types - techniques that do not use circulating fluids and techniques that use circulating fluids. The following sections discuss the drilling methods that fall into each of these two general categories that are most likely to be used for this project.

This section provides a description of the principles of operation and the applicability and implementability of the drilling methods that are proposed for this investigation. It focuses on methods and equipment that are readily available and typically applied. It is not intended to provide an all-inclusive discussion of drilling methods. Drilling will be conducted using air rotary drilling rigs, hollow stem auger (HSA) drilling rigs, and direct push Cone Penetrometer (CPT) rigs. Other alternatives that will be available are dual-tube percussion hammer and Rotary-sonic drilling. These methods are discussed below. All drillers and drilling personnel working onsite will be 40 hour OSHA (CFR 1910) certified and 24 hour MSHA certified. Drillers will also be available to provide additional services for minor repair or servicing of existing wells.

2.1 DRILLING METHODS WITHOUT CIRCULATING FLUIDS

2.1.1 HOLLOW-STEM AUGER DRILLING

Drilling is accomplished by rotating a pipe or rod that has a cutting bit. The common auger drilling method expected to be used is discussed in section.

Hollow-stem augers (H.S.A.) are commonly used in unconsolidated materials up to 150 feet in depth. A key advantage of H.S.A. drilling is that undisturbed soil samples can be collected through the auger, which acts as a temporary outer casing during drilling. The auger also acts as a temporary outer casing during monitoring well installation.

Hollow-stem augers consist of two parts: a tube with flights attached to the outside and connected the lead auger, and an inner pilot or center rod and bit which is removable from the center of the auger. The removable inner plug is the primary advantage of this drilling method. Withdrawing the plug while leaving the auger in place provides an open, cased hole into which soil samplers, down-hole drive hammers, instruments, casing, wire, pipe, or numerous other items can be inserted. Replacing the center bit and plug allows for continuation of the borehole.

Hollow-stem augers are specified by the inside diameter of the hollow stem, not by the hole size it drills. Hollow-stem augers are available in a variety of diameters, such as 2.5, 3.25, 3.375, 4.0, 4.25, 6.25, 6.625, 8.25, and 10.25 inches. The most commonly used sizes are 3.25 inches and 4.25 inches for soil borings that may be completed as 2-inch monitoring wells, and 6.625 inches for soil borings that may be completed as 4-inch monitoring wells.

The rotation of the augers causes the cuttings to move upward and be "smeared" along the borehole walls. This smearing may effectively seal off the upper zones thereby reducing the possibility of cross contamination of the upper zones to the deeper zones but increases the possibility of deep to shallow contamination. Conversely, smearing of clays on the borehole walls may seal off aquifers to be monitored.

Applications

- Suitable for all types of soil investigations.
- Allows good soil sampling with split-spoon samplers or Shelby tubes.
- Monitoring well installation in all unconsolidated formations.
- Can serve as temporary casing.
- Can be used in stable formations to set surface casing.

Limitations

- Difficulty in preserving sample integrity in heaving formations.
- Formation invasion by water or drilling mud if used to control heaving.
- Possible cross contamination of aquifers where annular space not positively controlled by water or drilling mud or surface casing.
- Limited diameter of augers limits casing size.
- Smearing of clays may seal off aquifer to be monitored.

2.1.2 ROTARY-SONIC DRILLING

Rotasonic drilling is a dual-cased drilling system that uses high frequency vibration to take continuous core samples and advance casing into the ground. The hydraulically powered drill head applies vibration to the drill string. This energy is directed down the drill string to the face of the core bit. No mud pump or air compressor is used to force cutting away from the borehole. The inner core barrel is advanced in increments into the formation, and then the outer casing is advanced down over the core barrel. The core barrel is then removed and the sample extruded into a plastic sleeve.

Applications

- Suitable for all types of soil investigations.
- Allows undisturbed soil sampling and recovery with continuous coring.
- Monitoring well installation in all unconsolidated formations.
- Waste minimization.
- Prevents cross contamination and formation mixing.

Limitations

- Slower through hard dense formations.
- Large rig and requires a support vehicle.
- Technique can create high heat, which is a concern if sampling for hydrocarbons.
- Technique is not appropriate for dense, consolidated material (rock).

2.2 DRILLING METHODS WITH CIRCULATING FLUIDS

Many drilling techniques use a circulating fluid, such as water, drilling mud, air, a combination of air and water, or even a surfactant to create foam. Circulation fluids flow from the surface either through the drill pipe, out through the bit, and up the annulus between the borehole wall and the drill pipe (direct rotary) or down the borehole annulus, into the bit, and up the drill pipe (reverse rotary). Generally the up-hole velocity needed to transport cuttings to the surface is between 100 to 150 feet per minute for plain water with no additives, 80 to 120 feet per minute for high-grade bentonite drill muds, 50 to 1,000 feet per minute for foam drilling, and up to 3,000 feet per minute for air with no additives. Additives decrease the required minimum velocity. Excessive velocities can cause erosion of the borehole wall. For this project, air is the expected fluid.

The use of circulating fluids may involve the addition of chemicals to the borehole. Drilling mud utilizes bentonite clay or polymers. Additives to air drilling may include surfactants (detergents) and water mist to generate foam. Compressed air may also contain various amounts of hydrocarbon lubricants. Therefore, attention should be given to the circulating fluids and any possible additives that are used when using drilling methods utilizing circulation fluids.

2.2.1 DUAL-TUBE PERCUSSION DRILLING

Dual-tube percussion drilling is very similar to dual-tube rotary with the exception that the two drive pipes do not rotate during drilling. The two concentric drive pipes are driven into the ground with a

hammer. The hammer is similar to the mechanisms mounted on pile drivers. The typical outside diameter of the outer drive pipe is 7 to 12 inches. The typical inside diameter of the inner pipe, where well materials are normally inserted, is 4.25 to 8 inches. This drilling system is also a center stem recovery system and is used primarily in hazardous waste investigations. It is rapid and effective to depths of about 250 feet.

The outer pipe effectively seals off the formation while drilling, reducing the chance of cross contamination. Air is pumped between the annulus of the two pipes to the bit where it is deflected upward into the inner pipe. Cuttings are transported to the surface through the inner pipe.

In general, three systems are available: 7-inch OD/4.25-inch ID, 9-inch OD/6-inch ID, and 12-inch OD/8-inch ID. A 2-inch diameter monitoring well can be constructed in the 7-inch system, a 4-inch diameter monitoring well can be constructed in the 9-inch system, and a 5- or 6-inch diameter monitoring well can be constructed in the 12-inch system.

Applications

- Very rapid drilling through consolidated formations, especially sands and gravels.
- Allows continuous sampling for lithologic logging in all types of formations.
- Representative samples can be obtained with minimal risk of contamination of sample and/or water bearing zone.
- In stable formations, wells with diameters as large as 6 inches can be installed in open hole completions.
- Soil samples can be easily obtained for chemical analysis.
- Capable of advancing third surface casing.
- Capable of driving 3-inch North American Large Penetration split-spoon sampler, potentially driven with a down hole 300 lb hammer with a wire line winch.

Limitations

- In unstable formations wells are limited to approximately 4 inches.
- Air may modify chemical or biological conditions; recovery time is uncertain.
- Not appropriate for drilling consolidated rock.

2.2.2 AIR ROTARY DOWN-THE-HOLE HAMMER

This method combines percussion and air rotary drilling methods to drill. The borehole is drilled using the air rotary drilling method. A pneumatic drill, "down-the-hole", at the end of the drill pipe strikes the rock while the drill pipe is gradually rotated. Rotation helps to insure even penetration. The air used to run the drill is used to remove cuttings. Casing or drive pipe follows closely behind the rotary bit to prevent the erosion of the borehole wall.

Applications & Advantages

- Rapid drilling of unconsolidated sands, silts, and clays.
- Drilling in alluvial materials (including boulder formations).
- Casing supports borehole thereby maintaining borehole integrity and minimizing inter-aquifer cross contamination.
- Eliminates circulation problems common with direct mud rotary method.
- Good formation samples for stratigraphic evaluation.
- Minimal formation damage as casing is pulled back.

Limitations

- Thin, low pressure water bearing zones easily overlooked if drilling is not stopped at appropriate places to observe whether or not water levels are recovering.
- Samples pulverized as in all rotary drilling.
- Air may modify chemical or biological conditions.
- Difficult to obtain soil samples for chemical analysis.

2.3 PERMITTING

All monitoring wells and piezometers proposed to be installed will be installed and constructed in accordance with all applicable Idaho Department of Water Quality (IDWR) rules and regulations. For each monitoring well a permit to drill, deepen, replace, or modify a Monitoring Well must be filed with IDWR prior to the start of drilling.

A licensed drilling subcontractor registered with IDWR will conduct all drilling and well installation activities.

2.4 SAMPLING METHODS

2.4.1 SPOON SAMPLERS

Split-spoon samplers are the most commonly used samplers for monitoring and geotechnical work and can be applied to a variety of drilling methods. Split-spoon samplers are usually steel or stainless steel, are tubular in shape, and are split longitudinally into two semi-cylindrical halves. They may be lined or unlined. Liners are made of brass, aluminum, stainless steel, or various synthetic materials. Split-spoon samplers are generally available in 2-, 2.5-, 3-, 3.5-, and 4-inch outside diameters (OD). Lengths range between 12 and 60 inches. The 18-inch long sampler is the most commonly used. Three 6-inch liners are generally used with this sampler. Sixty-inch samplers are used when continuous coring is necessary.

Driving (hammering) is the usual method of obtaining split-spoon samples up to 2.5 feet in length. Samples are collected from the split-spoon sampler by driving the sampler into undisturbed material beneath the bottom of the casing or borehole with a weighted hammer. For most sampling, a 140-pound hammer is used. The hammer may either be at the ground surface or in-hole. The number of blow counts per 6-inch increment of total drive is recorded. An estimate of the density and consistency of the subsurface soils can be made from the relationships among the hammer weight, drop, and number of blows required to advance the split spoon in 6-inch increments. The split spoon associated with the North American Large Penetration Test is 3.0 iin outside diameter and is driven by a 300 pound hammer.

If the sampler cannot be advanced 6 inches with a reasonable number of blows (usually about 50), sampler refusal occurs and the sampling effort at that particular interval is terminated. If "auger refusal" has not occurred, the hole is advanced to the next sampling interval where another attempt at sample retrieval is made.

After the split spoon is removed, it is opened for visual inspection and classification. If an adequate volume of sample has not been retrieved, additional sample shall be collected from a second sampler from the interval immediately below the preceding interval.

If VOCs are to be analyzed, the sample is immediately transferred into the appropriate sampling jars upon retrieval of the split spoon from the borehole. Following sample description, sample material for non-VOC analyses may be composited, homogenized, or collected from discrete intervals as provided in the project work plan. Care shall be taken to ensure that the sample collected is

representative of the sample interval of interest, and not slough material. All slough material shall be discarded. If a representative sample is to be retained for future reference, the sample must be stored in a container that is compatible with potential contaminants in the sample and minimizes the potential for accidental spillage.

2.4.2 THIN-WALLED TUBE SAMPLERS

The thin-walled tube (Shelby tube) sampler is a 18-, 30-, or 36-inch long, thin-walled steel, aluminum, brass, or stainless steel tube equipped with a connector head. It is primarily used in soft or clayey formations where it will provide more sample recovery than a split-spoon sampler and when relatively undisturbed samples are desired. The most commonly used sampler has a 3-inch OD and a 2.81-inch cutting diameter, and is 30 inches long.

Pressing or pushing without rotation is the normal mode of advance for the thin-walled sampler. If pressing cannot advance the tube, it may become necessary to drive the sample with drill rods and hammers without rotation. The tubes are generally allowed to stay in the hole 10 to 15 minutes to allow the buildup of skin friction prior to removal. The tube is then rotated to separate it from the soil beneath it, prior to being brought to the surface.

After removal, the sample is inspected to ensure an adequate sample volume has been collected. If an inadequate volume has been collected, the above sampling procedure is repeated.

Upon retrieval, a description of the soil core is recorded in the logbook and any disturbed soil removed from the end of the tube. VOC samples are removed and placed in the appropriate sample containers immediately upon sample retrieval. Thin-walled tubes are capped with non-reactive material for transport.

2.4.3 CONTINUOUS CORING

Continuous coring is usually performed with a 60-inch split-spoon sampler that is advanced by pressing without rotating while the drill bit is rotating. The sampling tube is lowered into and retrieved from the auger or drill stem using wireline or drill rods.

The sampling tube is locked into place so the sampler protrudes slightly ahead of the drill bit. As the bit is advanced, the auger is pressed into the formation. After the hole has been advanced the length of the sampling tube, the full sampler is retrieved and an empty sampler is put down the hole. Sampling procedures will follow those described in Section 4.2.2.

2.5 BOREHOLE OR WELL ABANDONMENT

Any borehole that will not be converted into a well (e.g., soil borings, bedrock boreholes) will be abandoned according to all applicable IDWR rules and regulations. The borehole will be abandoned by pumping cement-bentonite grout to the bottom of the borehole through a tremie pipe until the borehole is filled to the ground surface with undiluted grout. Dry holes less than 15 feet deep can be filled with grout poured from the surface. After 24 hours, the abandoned borehole will be checked for grout settlement. Any settlement will be filled in with grout, using a tremie pipe if it is deeper than 15 feet. This process will be continued until firm grout remains at the ground surface. Under no circumstances, will the borehole be backfilled with the soil removed during drilling and sampling operations.

There are currently no monitoring wells slated for abandonment during this SCP. However, if circumstances develop where a monitoring well needs to be abandoned, the well will be abandoned according to IDWR regulations, and the proper forms will need to be filed with IDWR prior to commencement of abandonment procedures.

2.6 DRILLING EQUIPMENT DECONTAMINATION

The purpose of decontamination and cleaning procedures during excavation, drilling and sampling is to prevent contamination of the samples and cross-contamination between sites. A decontamination area and clean zone will be established for the preparation and breakdown of equipment prior to each sampling task. The decontamination area will be large enough to accommodate equipment to be used for invasive work and that will allow decontamination rinsate to be pumped off for temporary storage and subsequent disposal. Before use and between each site, all equipment and other non-sampling equipment will be decontaminated with high-pressure steam, or scrubbed with a non-phosphate detergent and rinsed with water from an approved water source. If appropriate, equipment will be covered in plastic to protect it from the elements.

All equipment that may directly contact samples, such as split-spoon samples or core barrels, will be decontaminated on-site. The following sampling-specific decontamination procedures will be utilized.

- Wash and scrub with detergent (laboratory grade, non-phosphate detergent)
- Rinse with potable water
- Rinse with deionized water
- Rinse with another batch of deionized water
- Air dry
- Protect from fugitive dust and vapors

3.0 BOREHOLE LOGGING - SOILS

3.1 GENERAL

The procedures described herein are applicable to logging soils and are based on the Unified Soils Classification System (USCS); ASTM Standard D 2488-93, Standard Practice for Description and Identification of Soils (Visual Manual); and ASTM Standard D 5434-93, Standard Guide for Field Logging of Subsurface Explorations of Soil and Rock (ASTM, 1993).

Much of the information described in this section is summarized on several tables and a USCS field guide, as shown in Attachment B. Other field guidance references also may be used according to personal preference, however, such references must be based on the USCS. Note that many references (for example, AGI Data Sheet grain size scales) base soil classifications on the Wentworth Scale. Such scales may vary significantly from the USCS and will lead to inaccurate or inconsistent soil descriptions.

All soil logging will be documented using the *Soil Boring Log Form* included in Attachment F.

3.2 GEOLOGIST/HYDROGEOLOGIST

One or more geologists or hydrogeologist will accompany each operating drill rig for inspection of drilling and borehole testing work. Each individual will be responsible for only one operating rig. Once assigned to an individual borehole, that person will remain as the geologist or hydrogeologist until that borehole is completed, unless approved for replacement. The geologist or hydrogeologist will be present during the entire time that the drill rig is operating and during casing and screen installation, developing and clean-out operations.

The geologist or hydrogeologist will observe and record the drilling operations along with the characteristics of the subsurface materials. This individual will be responsible for the preparation of a separate log for each boring and will sign each log.

3.3 DEFINITIONS

Use of the USCS requires familiarity with the grain size ranges that define a particular type of soil, as well as several other physical characteristics. The grain size definitions and physical characteristics upon which soil descriptions are based are presented below.

3.3.1 GRAIN SIZES

USCS grain sizes are based on U.S. standard sieve sizes, which are listed below.

- Standard sieves with larger openings are named according to the size of the openings in the sieve mesh. For example, a "3-in." sieve contains openings that are 3 inches square.
- Standard sieves with smaller openings are given numbered designations that indicate the number of openings per inch. For example, a "No. 4" sieve contains 4 openings per inch.

The following grain size definitions are paraphrased from the ASTM Standard D 2488-93. Field personnel should familiarize themselves with the grain size definitions.

Boulders - Particles of rock that will not pass a 12-in. (300-mm) square opening.

Cobbles - Particles of rock that will pass a 12-in. (300-mm) square opening and be retained on a 3-in. (75-mm) sieve.

Gravel - Particles of rock that will pass a 3-in. (75-mm) sieve and be retained on a No. 4 (4.75-mm) sieve with the following subdivisions:

- *Coarse Gravel* - passes a 3-in. (75-mm) sieve and is retained on a 3/4-in. (19-mm) sieve
- *Fine Gravel* - passes a 3/4-in. (19-mm) sieve and is retained on a No. 4 (4.75-mm) sieve

Sand - Particles of rock that will pass a No. 4 (0.19 in. or 4.75-mm) sieve and be retained on a No. 200 (0.003 in. or 75-μm) sieve with the following subdivisions:

- *Coarse Sand* - passes a No. 4 (0.19 in. or 4.75-mm) sieve and is retained on a No. 10 (0.08 in. or 2-mm) sieve
- *Medium Sand* - passes a No. 10 (0.08 in. or 2-mm) sieve and is retained on a No. 40 (0.017 in. or 425-μm) sieve
- *Fine Sand* - passes a No. 40 (0.017 in. or 425-μm) sieve and is retained on a No. 200 (0.003 in. or 75-μm) sieve

Silt - Soil passing a No. 200 (0.003 in. or 75-μm) sieve that is nonplastic or very slightly plastic and that exhibits little or no strength when air-dried. Individual silt particles are not visible to the naked eye.

Clay - Soil passing a No. 200 (0.003 in. or 75-μm) sieve that can be made to exhibit plasticity within a range of water contents and that exhibits considerable strength when air-dried. Individual clay particles are not visible to the naked eye.

3.3.2 PHYSICAL CHARACTERISTICS

The following physical characteristics are used in the USCS classification for fine-grained soils. A brief definition of each physical characteristic is presented below. A determination of the type of fine-grained soil present in the sample can generally be made on the basis of plasticity, as described in Section 3.4.1.2.

Dry Strength - The ease with which a dry lump of soil crushes between the fingers.

Dilatancy Reaction - The speed with which water appears in a moist pat of soil when shaking in the hand and disappears while squeezing.

Toughness - The strength of a soil, moistened near its plastic limit, when rolled into a 1/8-inch diameter thread.

Plasticity - The extent to which a soil may be rolled into a 1/8-inch thread and re-rolled when drier than the plastic limit.

3.4 SOIL LOGGING PROCEDURES

The following aspects of a project must be understood before sampling and soil logging commences.

- Purpose of the soil logging (e.g., initial investigation, subsequent investigation, remediation)
- Known or anticipated hydrogeologic setting including presence of fill material, lithology, physical characteristics of the aquifer, type of aquifer, recharge/discharge conditions, aquifer thickness and ground water/conditions
- Drilling conditions
- Previous soil boring or borehole geophysical logs
- Soil sampling and geotechnical testing program
- Characteristics of potential chemical release(s) (chemistry, density, viscosity, reactivity and concentration)

- Health and Safety protection requirements
- Regulatory requirements

The procedures used to determine the correct soil sample classification are described below. These procedures are presented in Attachment B.

The soils should be described in terms of lithologic units, rather than on a sample-by-sample basis. Thus, a single description may cover several sample intervals, or conversely, several units may occur within a single sample interval. For a specific unit, the primary classification is described and then variations or minor changes are noted below the main description at the depth where they occur.

3.4.1 FIELD CLASSIFICATION OF SOILS

When naming soils, the proper USCS soil group name is given followed by the group symbol. For clarity, it is recommended that the group symbol be placed in parentheses after the written soil group name.

Soil identification using the visual-manual procedures is based on naming the portion of the soil sample that will pass a 3-in. (75-mm) sieve. Therefore, before classifying a soil, any particles larger than 3 inches (cobbles and boulders) should be removed, if possible. Estimate and note the percentage of cobbles and boulders.

Using the remaining soil, the next step of the procedure is to estimate the percentages by dry weight of the gravel, sand and fine fractions (particles passing a No. 200 sieve). The percentages shall be estimated to the closest 5%. In general, the soil is *fine-grained* (e.g., a silt or a clay) if it contains 50% or more fines and *coarse-grained* (e.g., a sand or a gravel) if it contains less than 50% fines. If one of the components is present but estimated to be less than 5%, its presence is indicated by the term *trace*. For example, "trace of fines" would be added as additional information following the formal USCS soil description.

3.4.1.1 Procedure for Identifying Coarse-Grained Soils (contain less than 50% fines)

If it has been determined that the soil contains less than 50% fines, the soil is a *gravel* if the percentage of gravel is estimated to be more than the percentage of sand. The soil is a *sand* if the percentage of gravel is estimated to be equal to or less than the percentage of sand.

If the soil is predominantly sand or gravel but contains an estimated 15% or more of the other coarse-grained constituent, the words "with gravel" or "with sand" shall be added to the group name. For example: "gravel with sand (GP)." If the sample contains any cobbles or boulders, the words "with cobbles" or "with cobbles and boulders" shall be added to group name. For example: "silty gravel with cobbles (GM)."

5% or less fines. The soil is a "clean gravel" or "clean sand" if the percentage of fines is estimated to be 5% or less. "Clean" is not a formal USCS name but rather a general descriptor for implying little to no fines. Clean sands and gravels are given the USCS designation as either *well-graded* or *poorly-graded*, as described below.

Identify the soil as a *well-graded gravel* (GW) or as a *well-graded sand* (SW), if it has a wide range of particle sizes and substantial amounts of the intermediate particle sizes. Identify the soil as a *poorly-graded gravel* (GP) or as a *poorly-graded sand* (SP) if it consists predominantly of one grain size (uniformly graded) or has a wide range of sizes with some intermediate sizes obviously missing (gap- or skip-graded).

Note: When using the USCS, keep in mind the difference between grading and sorting. The term grading is used to indicate the range of particles contained in the sample. For example, a poorly-graded sand containing predominantly one grain size would be considered well-sorted and vice-versa.

One notable exception to this general rule is a skip-graded (bimodally distributed) sample: a sand containing two distinct grain sizes would be considered both poorly-sorted and poorly-graded. The USCS uses only the *GRADING* descriptor in soil naming, not the sorting descriptor.

≥ 15% fines. The soil is a *silty* or *clayey gravel* or a *silty* or *clayey sand* if the percentage of fines is estimated to be 15% or more. For example, identify the soil as *clayey gravel* (GC) or a *clayey sand* (SC) if the fines are clayey. Identify the soil as a *silty gravel* (GM) or a *silty sand* (SM) if the fines are silty. The coarse-grained descriptor "poorly-graded" or "well-graded" is not included in the soil name, but rather, should be included as additional information following the formal USCS soil description.

>5% but <15% fines. If the soil is estimated to contain greater than 5% and less than 15% fines, give the soil a dual identification using two group symbols. The first group symbol shall correspond to a clean gravel or sand (GW, GP, SW, SP) and the second symbol shall correspond to a clayey/silty gravel or sand (GC, GM, SC, SM). The group name shall correspond to the first group symbol and include the words "poorly-graded" or "well-graded", plus the words "with clay" or "with silt" to indicate the character of the fines. For example, "poorly-graded gravel with silt (GP-GM)".

3.4.1.2 Procedure for Identifying Fine-Grained Soils (contain 50% or more fines)

The USCS classifies inorganic fine-grained soils according to their degree of plasticity (no or low plasticity - indicated with an "L", or high plasticity - indicated with an "H"). The field tests used to determine dry strength, dilatancy and toughness are generally too time consuming to be performed on a routine basis. Field personnel should be familiar with the definitions of the physical characteristics and the concepts of the field tests; however, field classifications will generally be based primarily on plasticity, as described in Attachment C.

Lean clay (CL) - soil has medium to high dry strength, no or slow dilatancy and medium toughness and plasticity.

Fat clay (CH) - soil has high to very high dry strength, no dilatancy and high toughness and plasticity.

Silt (ML) - the soil has no to low dry strength, slow to rapid dilatancy and low toughness and plasticity, or is nonplastic.

Elastic silt (MH) - the soil has low to medium dry strength, no to slow dilatancy and low to medium toughness and plasticity; will air dry more quickly than lean clay and have a smooth, silky feel when dry.

Organic soil (OL or OH) - the soil contains enough organic particles to influence the soil properties. Organic soils usually have a dark brown to black color and may have an organic odor. Often, organic soils will change color, for example, from black to brown, when exposed to the air. Organic soils normally will not have a high toughness or plasticity.

Other Modifiers for Use with Fine-Grained Soils:

15% to 25% coarse-grained material. If the soil is estimated to have 15% to 25% sand or gravel, or both, the words "with sand" or "with gravel" (whichever is predominant) shall be added to the group name. For example: "lean clay with sand (CL)" or "silt with gravel (ML)." If the percentage of sand is equal to the percentage of gravel, use "with sand."

≥30% coarse-grained material. If the soil is estimated to have 30% or more sand or gravel, or both, the words "sandy" or "gravelly" shall be added to the group name. Add the word "sandy" if there appears to be the same or more sand than gravel. Add the word "gravelly" if there appears to be more gravel than sand. For example: "sandy silt (ML)", or "gravelly fat clay (CH)."

3.4.1.3 Procedure for Identifying Borderline Soils

To indicate that the soil may fall into one of two possible basic groups, a borderline symbol may be used with the two symbols separated by a slash. For example, a soil containing an estimated 50% silt and 50% fine grained sand may be assigned a borderline symbol "SM/ML." Borderline symbols should not be used indiscriminately. Every effort should be made to first place the soil into a single group and then to estimate percentages following the USCS soil description.

3.4.2 DESCRIPTIVE INFORMATION FOR SOILS

After the soil name and symbol are assigned, the soil color, consistency/density and moisture content shall be described in that order. Other information is presented later in the description, as applicable.

3.4.2.1 Color

Describe the color using the Munsell Soil Color Chart (1992). Color is an important property in identifying organic soils and may also be useful in identifying materials of similar geologic or depositional origin in a given location.

When using the Munsell Soil Color Charts, first attempt to assign the soil a general color, such as brown, gray, red, etc. Then go to the correct area in the charts and assign the applicable color name and Munsell symbol. The ability to detect minor color differences varies among people and the chance of finding a perfect color match in the charts is rare. Keeping this in mind should help field personnel avoid spending unnecessary time and confusion going through the chart pages. In addition, attempting to describe detail beyond the reasonable accuracy of field observations could lead to making poorer soil descriptions than by expressing the dominant colors simply (Munsell Soil Color Chart, 1992).

If the color charts are not being used or are unavailable, again attempt to assign general colors to soils. Comparing a particular soil sample to samples from different locations in the borehole will help keep the eye "calibrated." For example, by holding two soils together, it may become evident that one is obviously greenish-brown, while another is reddish.

3.4.2.2 Consistency & Density

For intact fine-grained soil, describe consistency as very soft, soft, medium stiff, stiff, very stiff, or hard, based on the blows per foot using a 140-pound hammer dropped 30", as described in Attachment D. If blow counts are not available, use the thumb test, as described in Attachment D to determine consistency.

For coarse-grained soils, describe density based on blows per foot as very loose, loose, medium dense, dense and very dense, as described in Attachment D. If blow counts are not available, attempt to estimate the soil density by observation, since a practical field test is not available. Be sure to clearly indicate on the field boring log if blow counts could not be obtained.

3.4.2.3 Moisture

Describe the moisture condition of the soil as dry (absence of moisture, dusty, dry to the touch), moist (damp but no visible water, even in interstices) or wet (visible free water, saturated).

3.4.2.4 Maximum Grain Size

Describe the maximum particle size found in the sample in accordance with the information listed below.

- **Sand Size** - If the maximum particle size is a sand size, describe as fine, medium, or coarse.
- **Gravel Size** - If the maximum particle size is a gravel size, describe the diameter of the maximum particle size in inches.
- **Cobble or Boulder Size** - If the maximum particle size is a cobble or boulder size, describe the maximum dimension of the largest particle.

For gravel and sand components, describe the range of particle sizes within each component. For example, "about 20% fine to coarse gravel, about 40% fine to coarse sand."

3.4.2.5 Odor

Due to health and safety concerns, NEVER intentionally smell the soil. This could result in exposure to volatile contaminants that may be present in the soil. If, however, an odor is incidentally noticed, it should be described if organic or unusual. Soils containing a significant amount of organic material usually have a distinctive odor of decaying vegetation (sometimes a hydrogen sulfide ["rotten egg"] smell). If the odor is unusual (petroleum product, chemical, etc.), it should be described. Organic vapor readings from an OVM or similar instrument should be noted on the field boring log. The project-specific Heath and Safety Plan should then be consulted to determine the appropriate level of protection necessary for the continuation of fieldwork.

3.4.2.6 Cementation

Describe the cementation of intact coarse-grained soils as weak, moderate or strong, in accordance with the criteria listed below.

- **Weak** - Crumbles or breaks with handling or little finger pressure
- **Moderate** - Crumbles or breaks with considerable finger pressure
- **Strong** - Will not crumble or break with finger pressure

The presence of calcium carbonate may be confirmed on the basis of effervescence with dilute hydrochloric acid, HCl, if calcium carbonate or caliche is believed to be present in the soil. Proper health and safety precautions must be followed when mixing, handling, storing, or transporting HCl.

3.4.2.7 Angularity

Describe the angularity of the sand (coarse sizes only), gravel, cobbles and boulders, as angular, subangular, subrounded, or rounded in accordance with the criteria listed below.

- **Angular** - Particles have sharp edges and relatively planar sides with unpolished surfaces
- **Subangular** - Particles are similar to angular description but have rounded edges
- **Subrounded** - Particles have nearly plane sides but have well-rounded corners and edges
- **Rounded** - Particles have smoothly curved sides and no edges

A range of angularity may be stated, such as "subrounded to rounded".

3.4.2.8 Structure

Describe the structure of intact soils in accordance with the criteria in Attachment E.

3.4.2.9 Lithology

Describe the primary lithologies (rock or mineral type) of the sand, gravel, cobbles and boulders, if possible. It may be difficult to determine the lithology of fine and medium-grained sand or particles that have undergone alteration.

3.4.2.10 Additional Comments

Additional comments may include the presence of roots or other vegetation, fossils or organic debris, staining, mottling, or oxidation; difficulty in drilling and caving or sloughing of the borehole walls. Also, when drilling in an area known or suspected to contain imported fill material, every effort should be made to identify the contact between fill and native soils. If a soil is suspected to be fill, this should be clearly indicated on the log following the soil description. Stratigraphic units and their contacts should be noted wherever possible.

3.4.3 ADDITIONAL BORING LOG INFORMATION

In addition to soil descriptions, there are several other items that should be included on all *soil boring log forms*, included in Attachment F. Information in the log heading should be complete and accurate. The information listed below should be included, at a minimum.

- Boring or monitoring well number
- Project name and job number
- Site name
- Name of individual who logged the boring
- Drilling contractor
- Drill rig type and method of drilling (for example, "CME 75, hollow stem auger")
- Name of drilling company
- Name of driller and helper
- Borehole diameter and drill bit type
- Type of soil sampler (for example, Modified California, continuous core, etc.)
- Time and date that drilling started and finished
- Time and date that the well was completed or the soil boring backfilled, as appropriate
- Method of borehole abandonment, if applicable
- Sketch map of boring or well location with estimated distances to major site features such as property lines or buildings and north arrow

Soil sample information should include the depth interval that was sampled, the blow counts per six inches, the amount of soil recovered and the portion submitted for analysis or testing, if any. The sample identification number may also be noted on the log.

The degree to which soil samples are collected during a field effort depends on the overall scope and purpose of the investigation, which should be clearly defined before the field effort commences. Additional soil samples may need to be collected if, for example, soils are very heterogeneous or unexpected conditions such as perched water zones or zones of contamination are encountered.

If groundwater is encountered during drilling, the depth to water and the time and date of the observation should be recorded. If the first water encountered is a perched zone, the depth, time and date that any additional groundwater zones are encountered should also be recorded. Depth to water after drilling, the measuring point and the date and time of the measurement(s) must be noted. Additional measurements of depth to groundwater, including depth and time, may be beneficial.

4.0 BOREHOLE LOGGING - BEDROCK

4.1 GENERAL

This discussion has been prepared to assist geologists in the recovery of geologic and hydrogeologic data from boreholes drilled through bedrock. Drilling is expensive and it is therefore appropriate to obtain as much relevant information from each borehole as possible. Core logging is often a slow process; the program described herein has been designed to utilize simple observations and tests in order to keep the effort required to a minimum.

4.2 BEDROCK LOGGING PROCEDURES

A *Rock Core Log Form* is included in Attachment G. This form contains columns for recording virtually all information of geologic or hydrogeologic significance that is available from rock core.

4.2.1 HEADER INFORMATION

Information required at the top of the sheet includes the following.

Date — Date record prepared

Borehole Location — Brief description of physical location of borehole. May be grid coordinates, chainage and offset, or geographical description. Should not simply say "see plan."

Logged by — First initial and surname of logger

Elevation — Reference elevation below which all down-hole depths are measured. This is not always available at the time of drilling.

Ref. Point — The reference point, below which all down-hole depths are measured; normally below ground surface (bgs). If the reference point is not the ground surface, the height of the reference point above the ground surface should be noted.

Datum — The survey datum to which the reference elevation is referred (e.g., State Plane NAD 83).

Drill Rig — Drill rig manufacturer and model number (e.g., Longyear 44).

Inclination — Surveyed inclination from horizontal of borehole at collar (90 degrees for vertical drill hole).

Azimuth — Surveyed azimuth of inclined borehole at collar (use N/A - not applicable for vertical drill holes). (If the drill hole inclination or azimuth are not surveyed, this should be noted and the method of estimating [e.g., with an inclinometer and compass] should be described.)

Bit Type — Brief description of type of diamond core bit used (e.g., "face discharge, surface set").

Flush — Medium used to cool the drill bit and flush cuttings out of the hole (e.g., water, compressed air).

Feed The method by which pressure/force is applied to advance the bit in the hole (e.g., hydraulic, screw).

4.2.2 DRILLING INFORMATION

The first (left-hand) four columns in the data section of the form record pertinent drilling information regarding hole size, casing and water conditions.

Core dia.: Depth This column records the standard core descriptor (e.g., NQ3) over the applicable depth interval shown graphically.

Casing dia.: Depth This column records the standard casing descriptor (e.g., NW) or nominal diameter of steel drill casing (e.g., 4 in.), if used (if none, insert "uncased") and the cased depth interval shown graphically. Any notes on telescoping or withdrawing casing should also be recorded.

Water Notes Any observations related to groundwater conditions in the hole should be noted (e.g., "hole made water at 19 meters [62 ft]," "lost circulation at 14 meters [47 ft.]"). This column should also include an estimate (usually by visual observation) of the flush return, or rate of return of drilling fluid. It is expressed as a percentage of fluid pumped into the hole (100 equals full return; 0 equals total loss of circulation). The depth interval over which the return rate is applicable should be indicated graphically. The color, particularly changes in color, of the return drill fluid should also be noted.

4.2.3 ROCK TYPE

The next three columns on the form present the lithologic information from the drill hole. This description should be complete, although due to lack of space, reference to additional detail found on the geologic log is often appropriate. The rock type should be described in terms of lithologic units rather than on a run-by-run basis. Thus, a single description may cover several runs, or conversely, several rock types may occur within a single run.

Depth The depth below ground surface of all boundaries between lithologic units (rock types). Boundaries should be plotted at scaled depths and should be extended horizontally across the "Description" column, as described below. Identification/recording of boundaries between lithologic units is one of the **primary responsibilities** of the logger.

Description This section of the log provides a complete description of each lithologic unit encountered by the drill hole. Soil, if included in the rock log, or soil infillings should also be described.

Contacts between rock types are represented as listed below.

- *Sharp* - solid horizontal line at contact location
- *Gradational* - solid slanted line from start of gradational change to end of gradational change
- *Inferred contact* - dashed slanted line extending over depth range of inferred contact
- *Erosional* - solid wavy line at contact location (depth)
- *Fault* - heavy solid horizontal line at contact location (depth)

The description should include the items shown in the list below.

- Rock type (e.g., basalt)
- Formation name, if known

- Modifiers (e.g., shaly, calcareous, siliceous, micaceous, vesicular)
- Bedding characteristics (e.g., laminated, thin bedded, massive)
- Color (based on USGS Rock Color Chart)
- Hardness (soft, very hard)
- Degree at cementation (poorly cemented, well cemented)
- Texture (dense, fine-, medium-,or coarse-grained; glassy; porphyritic; crystalline)
- Solution or void conditions (solid, cavernous, vuggy with partial infilling by clay)
- Primary and secondary permeability

4.2.4 DEPTH SCALE

The vertical scale, generally in feet, to which the drilling information, lithologic description and core data are plotted on the log. Typically, the log is set up to handle 8 meters (27.5 ft.) of hole but any scale can be used as long as it is clearly documented. The units to which the scale is plotted (e.g., feet, meters) should always be marked in the space provided in the column header.

4.2.5 CORE RECOVERY DATA

This portion of the form records pertinent data regarding the condition of the recovered core. This information is recorded on a "per run" basis. Accordingly, for each core run, the "run interval" should be indicated by solid horizontal lines plotted at the start and end depths of the run and extending across all of the "Core Recovery Data" columns. The actual cored interval should be indicated on the log, not the length of recovered core.

Details regarding drilling conditions ("hard drilling," "easy drilling," "machine off pressure," etc.), core blockages or any other factors which could effect or indicate the condition of the core should be noted.

For each run the following information should be recorded within the core interval (or immediately above the interval in the case of very short runs).

Run No. Core runs should be numbered consecutively (from-to) with increasing depth. If the overburden portion of the drill hole was sampled, the core runs should be numbered consecutively with the soil samples. The start and end depths of the core run should also be recorded in this column.

T.C.R. The Total Core Recovery of each run should be recorded as both the actual lengths cored and recovered and as the calculated percentage recovery.

R.Q.D. The Rock Quality Designation should be recorded as both the actual lengths cored and recovered and as the calculated percentage recovery.

$$\text{RQD} = \frac{\text{Sum of 10 cm (4 in) Lengths}}{\text{Total Length of Run}} \text{ (expressed as \%)}$$

Fractures This column is used to record the number of natural (not drilling induced) fractures per foot (or other appropriate interval) in a given length of core. If more than ten naturally occurring fractures are counted in the interval, record ">10" in the "Fractures per ____" column.

4.2.6 DISCONTINUITY DATA

This section of the form records information regarding the orientation and physical characteristics of each significant natural discontinuity in the core. When similar natural fractures occur regularly along pre-existing weakness planes such as bedding or foliation, it is not necessary to record the orientation

and characteristics of each fracture individually. An explanatory note such as "unless otherwise noted fractures to 83.5 meters (274 feet), are along foliation; planar; smooth" should be included to eliminate the need to repeat the description for each fracture. With this convention, only fractures that do not meet the stated criteria need to be described individually, although the location and dip of all fractures should be recorded. The following additional information should also be recorded:

- Dip W.R.T - the dip with respect to the core axis of each significant natural discontinuity should be measured and recorded numerically (i.e., 90 degrees for horizontal).
- Type and surface - the type of discontinuity and the surface description characteristics should be determined and recorded using the abbreviations included in the footer section of the log form.

4.2.7 STRENGTH DATA

Weathering Index Weathering Index is recorded in this column. Changes in the Weathering Index are indicated by a solid, horizontal line at the point of change for an abrupt change, or a solid slanting line covering the range of weathering change. The classification scheme for weathering index is shown in Attachment H, *Weathering and Intact Rock Strength Classification.*

Strength Index: Strength Index is recorded in this column. Any change in the Strength Index should be indicated by a solid horizontal line at the point of change. The classification scheme for strength index is shown in Attachment H.

4.2.8 ADDITIONAL NOTES

The final column on the form is used to record any additional notes for performed on the core or in the hole. This might include data such as drilling equipment malfunction, core blockage or data that did not fit in the other columns.

4.3 DRILL CORE PHOTOGRAPHY

Each box of bedrock core will be photographed as soon as possible. Photographic records will be acquired using 35mm slides and/or digital cameras. A separate bound field logbook shall be assigned to each camera for recording the photographer's name, subject matter, borehole identification number, interval and other pertinent information for each frame or digital image. The photography is a routine process and care must be taken to ensure that sharp focus and proper exposure settings are maintained throughout. A setup which utilizes daylight photo flood lamps or sunlight at an appropriate angle (e.g., directly overhead with no shadows) should be used for the best color. A signboard should be included in each picture, which contains identifying information. This would include the project name, borehole number, box number, depth interval and a scale. An engineer's scale or tape and standard Munsell/Geological Society of America (GSA) soil or rock color reference charts will be included in any photographs taken of rock core or soil. Any wasted frames or images in a roll of film or sequence of digital images shall be so noted in the field logbook. The core can be photographed either wet or dry depending on which condition reveals the most detail.

The core photography provides a permanent record of the core condition as it came out of the ground. It is easier to access for review than the core itself and contains information that is otherwise lost as the core is handled for logging, split for assaying, samples taken for testing, etc. It may turn out that the photographic file is the only record behind the logs for a number of reasons, including core storage facilities have collapsed, core has been discarded after the initial logging because storage is expensive, or due to time pressures some core may not be logged at all. When a project changes hands, the new owner or lessor often receives an incomplete collection for one reason or another. In such cases, the photographic record will prove invaluable.

5.0 MONITORING WELL DESIGN AND INSTALLATION

5.1 GENERAL

This guideline is applicable to the design and installation of permanent monitoring wells at CC. Each monitoring well will be designed to suit the hydrogeologic setting of the site, the type of contaminants to be monitored, the overall purpose of the monitoring program and other site-specific variables. During all phases of well design, attention must be given to clear documentation of the basis for design decisions, the details of well construction and the materials to be used. A *Typical Monitoring Well Installation Diagram* is provided as Attachment I and a *Monitoring Well Construction Form* is provided in Attachment J.

5.2 WELL LOCATIONS

The current scope of work entails installing 6 monitoring wells. The locations and rationale of these wells are discussed in the Work Plan. These wells are located as single wells.

5.3 WELL DESIGN

5.3.1 CASING DIAMETER AND SCREEN LENGTH

Monitoring well casing diameter is dependent on the purpose of the well and the amount and size of downhole equipment that must be accommodated. All of the wells are designed to be multipurpose monitoring wells. Therefore, they will all be constructed with 4-inch or 6-inch diameter PVC well casing.

With the exception of any wells specifically designed for accommodating a pumping test, the screen lengths will be 10 feet. Any wells that will be screened near the water table will be screened across the water table. Consideration should be given to seasonal fluctuations in water levels when locating the well screen across the top of the water table.

5.3.2 CASING AND SCREEN MATERIALS

The two most commonly used materials are PVC and stainless steel. PVC is inexpensive, widely available, lightweight and easy to work with. Many studies have been conducted concerning the effect of PVC on water quality data. Adsorption of some chlorinated species to PVC was found to be too slow to effect data quality. Because a sample is generally taken shortly after the purging of stagnant water in contact with the casing, the contaminants in the water will have minimal time to be influenced by sorption or leaching effects. Therefore, potential sample bias effects due to interactions with PVC are negligible (Reynolds, et al, 1990). Consequently, monitoring well casings and screens will be constructed of polyvinyl chloride (PVC). Wells less than 150 feet deep will be constructed of schedule 40 PVC, while deeper wells will be constructed of schedule 80 PVC.

The hydraulic efficiency of a well screen depends primarily upon the amount of open area available per unit length of screen. The two screen types commonly used for monitoring wells are machine-slotted and continuous-slot wire-wound. The continuous-slot, wire-wound screen has a greater area per opening per length and diameter than is available with any other screen type. The percentage of open area in continuous-slot screen is often more than twice that provided by standard slotted well screen. The triangular shaped wire makes these screens non-clogging. The monitoring wells installed at the site will be constructed with machine-slotted PVC screens, except ones installed for conducting pumping tests, which may be installed with continuous-slot wire-wound PVC screen.

Additional construction specifications are listed below.

- Threaded, flush-joint casing

- Well caps that are vented to prevent the accumulation of gases and to allow water levels in the well to respond to barometric and hydraulic pressure changes
- Threaded end-caps

5.3.3 DECONTAMINATION OF CASING AND SCREEN MATERIALS

During the production of PVC casing, a wax layer can develop on the inner wall of the casing; protective coatings may also be added to enhance casing durability. All of these represent potential sources of chemical interference and must be removed with either a laboratory-grade non-phosphate solution or by steam cleaning prior to installation. Factory cleaning of casing and screen in a controlled environment by standard detergent washing, rinsing and air-drying procedures is superior to any cleaning efforts attempted in the field. Factory cleaned and sealed casing and screen that is certified by the supplier will be used if available.

5.3.4 FILTER PACK AND WELL SCREEN DESIGN

A properly designed monitoring well requires that a well screen be placed opposite the zone to be monitored and be surrounded by materials that are coarser and of greater hydraulic conductivity than the natural formation material. Filter packs are installed to create a permeable envelope around the well screen. The selection of the filter pack grain size should be based on the grain size of the finest layer to be screened.

The typical well construction for a monitoring well in average formation materials includes filter pack on the order of #3 Monterey sand size and 0.020 inch slotted screen. A configuration similar to this will be used, unless the materials encountered are radically different than expected. The design of wells to be used for pumping during a pumping test is described in Section 10.2.4.

If conditions warrant, filter pack grain size and well screen slot size should be determined by the grain size distribution of the formation material. The filter pack should be designed first. It is recommended to use a filter pack grain size that is three to five times the average (D50) size of the formation materials. D50 will be estimated based on the lithologic description made by the site geologist or hydrogeologist. However, this method may be misleading in coarse, well graded formation materials. Another way to determine filter pack grain size is to take the D30 grain size of the formation materials and multiplying it by a factor of between 3 and 6, with 3 used if the formation is fine and uniform and 6 used if the formation is coarse and non-uniform. For both methods, the uniformity coefficient of the filter pack materials should be as close to 1.0 as possible to minimize particle size segregation during filter pack installation.

The filter pack will extend from the bottom of the well screen to approximately 3 to 5 feet above the top of the screen to account for settlement of the pack material during development and to act as a buffer between the well screen and the annular seal. Filter pack thickness must be sufficient to surround the well screen but thin enough to minimize resistance to the flow of fine-grained formation material and water into the well during development. Consequently, a filter pack thickness of approximately 2 inches will be used.

The materials comprising the filter pack should be as chemically inert as possible. It should be comprised of clean quartz sand or glass beads. Filter pack materials usually come in 100-pound bags; these materials are washed, dried and factory packaged.

The size of well intake openings can only be selected after the filter-pack grain size is specified. The slot size should be such that 90 percent to 100 percent of the filter-pack material is held back by the well screen.

The casing string should be installed in the center of the borehole. This will allow the filter-pack materials to evenly fill the annular space around the screen and ensure that annular seal materials fill

the annular space evenly around the casing. Where a dual-tube rig is used, the inner tube of the dual tube will adequately centralize the casing string. For other types of drilling, centralizers will be used to ensure the casing string is positioned in the center of the borehole. Centralizers are typically expandable metal or plastic that attach to the outside of the casing and are adjustable along the length of the casing. Centralizers will be attached immediately above the well screen and at 20-foot intervals along the casing to the surface.

Methods for filter pack emplacement normally used for monitoring wells include: 1) gravity (free-fall); and 2) tremie pipe. Gravity emplacement is only possible in relatively shallow wells (less than ~50 feet) with an annular space of more than 2 inches where the potential occurrence of bridging is minimized. Bridging can result in the occurrence of large unfilled voids in the filter pack or the failure of filter pack materials to reach their intended depth. Gravity emplacement may also cause filter pack gradation. Additionally, formation materials from the borehole wall can become incorporated into the filter pack, potentially contaminating it.

With the tremie emplacement method, the filter pack is poured or slurried into the annular space adjacent to the well screen through a rigid pipe, usually 1.5 inches in diameter. Initially the pipe is positioned so that its end is at the bottom of the annulus. If the filter pack is being installed in a temporarily cased borehole (e.g., dual-tube percussion) the temporary casing is pulled to expose the screen as the filter-pack material builds up around the well screen. In unconsolidated formations the temporary casing should only be pulled out 1 to 2 feet at a time to prevent caving. In consolidated or well-cemented formations or in cohesive unconsolidated formations, the temporary casing may be raised well above the bottom of the borehole prior to filter pack emplacement. For deep wells and/or nonuniform filter pack materials, the filter pack may be pressure fed through a tremie pipe with a pump. Emplacement will be continuously monitored with a weighted measuring tape accurate to the nearest 0.1 foot to determine when the filter pack has reached the desired height.

5.3.5 ANNULAR SEAL

Proper annular seal formulation and placement results in the complete filling of the annular space and envelopes the entire length of the well casing to ensure that no vertical migration can occur within the borehole.

Annular seal materials will include bentonite chips or a high solids (approximately 10%) bentonite grout with a weight in the range of eleven to thirteen pounds per gallon of sealant. The grout will be mixed using the manufacturer's directions. A bentonite seal at least 2 feet thick will be emplaced immediately above the filter pack using a side-discharge tremie pipe. The use of bentonite as a sealing material depends on its efficient hydration following emplacement. Expansion of bentonite in water can be on the order of 8 to 10 times the volume of dry bentonite. This expansion causes the bentonite to provide a tight seal between the casing and the adjacent formation. Bentonite pellets, granules, or chip will be used for this seal. Bentonite pellets expand in water at relatively slow rates, thus reducing the potential for bridging compared to chips, chunks, or granules. If the bentonite seal will be above the saturated zone, several gallons of clean distilled water will be poured down the annulus to begin the hydration process. A minimum of 30 minutes should pass to allow for hydration before additional annular seal materials are placed above the bentonite.

The high solids grout will be mechanically blended in an aboveground rigid container and pumped through a tremie pipe to within a few inches of the bottom of the space to be sealed. This allows the grout to displace groundwater and loose formation materials up the hole. The end of the tremie pipe should always remain in the grout without allowing air spaces. After emplacement, the tremie pipe should be removed immediately. The grout should be emplaced in one continuous mass before initial setting of the cement or before the mixture loses its fluidity.

Cement is a highly alkaline substance (pH from 10 to 12) and introduces the possibility of altering the chemistry of the water it contacts. Thinner slurries may infiltrate an unprotected filter pack. After a

borehole annulus is filled with grout a sample of water may be obtained and the pH determined in the field. A pH reading of 12 or higher may indicate an invasion of cement grout into the well.

5.3.6 SURFACE COMPLETIONS

Two types of surface completions will be used: aboveground and flush-mounted. Aboveground completions will be used wherever practical. Flush mounted completions will be used anywhere there may be vehicle traffic or where low visibility is preferred. The primary purpose of either type of completion is to prevent surface runoff from entering and infiltrating down the annulus of the well and to protect the well from accidental damage or vandalism. The surface seal may be an extension of the annular seal installed above the filter pack, or a separate seal emplaced atop the annular seal.

For aboveground completions, a protective steel casing fitted with a locking cover will be set into the uncured cement surface seal. Four guard posts (bollards) will be spaced around each well with above ground completions to afford additional protection.

In a flush-mount surface completion, a water-tight monitoring well Christy box or its equivalent will be set into the cement surface seal before it has cured. This type of completion is used in high-traffic areas. A low, gently sloping mound of cement will discourage surface runoff. A locking well cap will be used to secure the inner well casing.

5.3.7 SUMMARY OF WELL DESIGN

In summary, the filter pack and well design criteria for the investigations are listed below.

- PVC screen and casing
- Schedule 40 casing for wells less than 150 feet deep
- Schedule 80 casing for wells greater than 150 feet deep
- 0.020-inch machine slotted screen
- 4-inch diameter casing
- Threaded flush joint casing and end-caps
- Centralizers in uncased holes
- #3 Monterey sand or equivalent for filter packs up to 3 to 5 feet above the top of the screened interval
- Bentonite plug at least 2 feet thick on top of filter pack
- Annular seal to the surface to consist of neat cement
- Both filter pack and annular seal are to be emplaced using a tremie pipe
- Surface completions will be aboveground stand-pipes with bollards unless in a vehicle traffic right-of-way of area where low visibility is preferred

6.0 PIEZOMETER INSTALLATION

Piezometers are typically installed at investigation sites where permanent groundwater monitoring wells are not required or are not feasible. Piezometers are primarily used for groundwater elevation studies. Piezometers differ from permanent monitoring wells mainly in construction and development standards. However, like permanent monitoring wells, piezometers will be designed to suit the hydrogeologic setting, the types of contaminants to be monitored, the overall purpose of the monitoring program, and other site-specific variables. Clear documentation of design parameters, construction details, and materials used will be maintained. During installation of piezometers, care will be taken to ensure that they do not serve as conduits for surface contaminants to the subsurface. Therefore, surface completions will follow essentially the same standards as outlined for monitoring wells.

6.1 BASIC INSTALLATION AND OPERATION OF PIEZOMETERS

A piezometer is essentially a device used for the measurement of hydraulic head. A piezometer must be sealed along its length, must be open to groundwater flow at the bottom, and be open to the atmosphere at the top. The intake is usually a section of slotted pipe or a commercially available well point. In either case, the intake is designed to allow the inflow of water but not of the sand grains or clay particles that make up the formation. A simple standpipe piezometer may be replaced in some applications by more complex designs utilizing pressure transducers, pneumatic devices, and electronic components.

Piezometers are installed using either direct-push methods or installed through a soil boring. With the use of direct-push methods, the piezometer pipe is attached to the push rods and driven to depth using a hydraulic ram. With use of a drill rig, the pipe is attached to standard soil sampling drill rods and driven to depth using either a standard 140-pound hammer, or hydraulically advanced into the water-bearing zone. Blow counts during advancement of the sampler should not exceed 30 per 6 inches. Piezometers can also be constructed in auger strings within a boring.

Unless otherwise specified in project-specific work plans, piezometers will be completed as naturally developed wells with the formation materials allowed to collapse around the screen. As previously described for monitoring wells, screen slot sizes will be based on grain-size distribution. Surface completions will be constructed in a similar manner as for monitoring wells. However, the protective outer PVC casing will not be installed. The piezometer will instead be fitted with a PVC end cap.

Piezometers will be constructed using one of three common methods:

1. Using the pull-back method
2. Driving the well point beyond the end of the casing into the formation below
3. Construction within drill pipes or augers

Pull-Back Method: In the pull-back method for piezometer installation, the casing is first set to the desired depth. A packer is then threaded to the top of the well point or riser pipe and lowered through the casing. After the well point has been lowered through the casing, the casing is pulled back to expose the screen to the water-bearing sediment. Drill tools (drill stem or driving bar) may be placed on the well point to hold it down as the casing is pulled back. Alternatively, some well points are manufactured with a drive plate mounted just above the point. The driving force is directed at the point, and the screen is pulled into place. However, care should be taken when using this technique

as inside driving may cause severe damage to the bottom of the screen. All points to be driven from the inside should be identified as such when ordered from the manufacturer. Two-inch well points can be set in 4-inch diameter wells using the pull-back method.

Driven Well Point: Occasionally the pull-back method cannot be used because the friction on the pipe is so great that the force required to move the pipe might break it. In this case, a well point can be driven beyond the end of the casing into the sand formation below. All the sediment in the casing is removed to prevent the well point from becoming sand-locked inside the pipe. If the sediment tends to heave, the casing is kept full of water while the screen is set (any water used should be from an approved source and complete records of quantities used should be maintained). -A self-sealing packer is attached to the well point, and the well point is dropped through the casing. A driving bar, drill stem, or other similar tool is lowered to the top of the packer and alternately raised and dropped to drive the well point out the bottom of the casing. Careful measurements must be made so the driller knows when the screen has been driven to the correct depth. A riser pipe may be used for this purpose.

Construction within Drill Pipe or Auger: Two-inch well points can be easily set through drill pipes or hollow stem augers once the pipes/auger-flight assembly has reached the desired depth. The screen is attached directly to the casing, and the string is lowered inside the pipes/augers to the bottom of the borehole. The pipes/auger flights are then pulled back to expose the screen and casing. This method is particularly suitable in shallow, caving formations.

7.0 WELL DEVELOPMENT

The goal of monitoring well development is to remove fines and drilling fluid residue from the gravel pack and the natural formation in the vicinity of the screened interval, this will assure good communication between the aquifer and the well. The result of well development is assurance that a sample collected will be a true representative of the quality of water moving through the formation.

The well development process is composed of: (1) the application of sufficient energy in a monitoring well to create groundwater flow reversals (surging) in and out of the well and the gravel pack to release and draw fines into the well; and (2) pumping or bailing to draw drilling fluids out of the borehole and adjacent natural formation along with fines that have been surged into the well.

7.1 GENERAL

The following general guidelines are applicable to well development regardless of method.

7.1.1 DECONTAMINATION

It is essential that every effort be made to avoid outside contamination and the cross-contamination of monitoring wells. This can accomplished by ensuring that all equipment is clean prior to being introduced into a well. Before use and between each site, all equipment and other non-sampling equipment will be decontaminated with high-pressure steam or scrubbed with a non-phosphate detergent and rinsed with water from an approved water source. If appropriate, equipment will be covered in plastic to protect it from the elements.

7.1.2 DOCUMENTATION

A critical part of monitoring well development is recording of significant details and events; a *Well Development Record* is provided in Attachment K. Listed are some important details to document.

- Well identification number
- Installation date
- Date and time of development
- Quantity of drilling fluid lost during well installation
- Measured well depth (pre-development and post-development)
- Water level
- Height of water column
- Pumping rate and water level draw down (if applicable)
- Recharge rate (poor, good, excellent)
- Periodic parameter readings
- Sample observations
- Type of equipment used
- Total amount of water removed
- Completion time

7.1.3 WELL PURGING

The total volume of water purged during the development process will be based on two factors: (1) indicator parameters and (2) minimum purge volume.

7.1.3.1 Indicator Parameters

During the development process, the indicator parameters pH, temperature, electrical conductivity and turbidity will be measured. The parameters pH, temperature and electrical conductivity will be measured with a field meter while turbidity will be described qualitatively. Other observations of the

water, such as color and odor, will also be recorded. Measurement of the indicator parameters will be taken at the beginning and end of the development process and at least once every ½-casing-volume with a minimum of 4 measurements. Once the minimum required volume is reached, as described in Section 6.1.3.2, purging will continue until three consecutive measurements of the stabilization parameters meet the stabilization requirements shown below.

pH	± 0.2 units	
Conductivity	± 3% of span	(i.e., ± 0.03 for span of 0 to 1 mS/cm)
Temperature	± 1° C	
Turbidity	± 10%	

However, if the indicator parameters have stabilized, but there are still significant changes in color or some other qualitative characteristic, purging will continue until it has stabilized, if practical.

7.1.3.2 Purge Volume

Before the development process begins, the minimum number of gallons to be removed will be calculated. The minimum number of gallons to purge will be equal to three casing volumes or one purge volume (described below), whichever is larger.

Information needed to calculate purge volume is listed below.

1. Total depth of well (TD)
2. Measured static water level (WL)
3. Screen length (SL)
4. Well casing inner diameter (ID)
5. Borehole Diameter (BD)
6. Number of gallons of water used during well drilling/construction
7. If the standing water column (SC) is longer then the screen length, you will need to note how many feet of filter pack was installed above the screen.

Calculating one well volume:

- To calculate standing water column (SC), TD - WL = SC
- Use a well volume chart to find a multiplier in the "gallons per foot" column that coincides with the wells ID. This volume chart is located in Attachment K.
- SC x ID multiplier = gallons of water in one well volume

Calculating one annulus volume (2 Options):

Option 1, if SC is shorter then the screen length

- Portion of saturated annulus = SC
- Use a volume chart to find a multiplier in the "Gallons per foot" column that coincides with the wells BD
- BD multiplier - ID multiplier = annulus multiplier
- Feet of saturated annulus x annulus multiplier x 30% (assumed porosity) = gallons of water in one annulus volume

Option 2, if SC is longer then the screen length

- Portion of saturated annulus is = to the screen length + the number of feet of sand above the top of the screen
- Use a volume chart to find a multiplier in the "Gallons per foot" column that coincides with the wells BD

- BD multiplier - ID multiplier = annulus multiplier
- Feet of saturated annulus x annulus multiplier x 30% (assumed porosity) = gallons of water in one annulus volume

Calculating the minimum gallons to be removed: well volume + annulus volume + number of gallons lost during well drilling/construction = one purge volume

Example:

You are to develop a 4-inch well. From the Well Construction Diagram you note_the borehole diameter was 11 inches, the screen is 15 feet long and the driller used 75 gallons of water during well construction. With a water level indicator you measure the static water level at 59.45 feet and with a well tagger you measure the well depth at 71.21 feet.

Record in log book: TD = 71.25'
WL = 59.45'

TD -WL = SC
Log book: SC = 11.8'

From a Volume chart, the "gallons per foot" multiplier for a 4-inch well is 0.653 and 11.8 x 0.653 = 7.71 (gallons of water in one well volume).

Log book, One well vol. = 7.71 gallons

From a Volume chart, the "gallons per foot" for an 11-inch borehole is 4.937. Therefore, 4.937(BD multiplier) - 0.653(ID multiplier) = 4.284(annulus multiplier). And, 11.8 x 4.284 x 30% = 15.17 (gallons of water in one annulus volume).

Log book, One annulus vol. = 15.17 gallons
Drilling fluid lost = 75 gallons

7.71(one well volume) + 15.17(one annulus volume) + 75(fluid lost) = 97.88 gallons (one purge volume). A minimum of 3 well volumes must be removed during development. Additional water may need to be purged to allow the parameters to stabilize and the water to clear up.

Log book, One purge vol. = 97.88 gallons
97.88 x 3 = 293.64 (minimum number of gallons to be purged).
Log book, Min. gal. to be purged = 293.64 gallons

7.2 WELL DEVELOPMENT

Development will be accomplished using surge and bail/pump. In relatively clean and permeable formations where water flows freely into the borehole, bailing, surging and pumping is an effective development technique. First, the bottom of well will be tagged to measure the amount of sand/silt before and after surging that may be present at the bottom of the well. Then a bailer will be lowered down the well to clean out any fines that have settled on the bottom of the well. Then a surge block, slightly smaller than the inside diameter of the well casing, will be used to agitate the water, causing it to move in and out of the screen, thus drawing in fines from the gravel pack and surrounding formation and breaking up any bridges that may have occurred during the placement of the gravel pack. After surging for a few minutes (depending on the height of the water column and length of screen), the bailer will then be lowered again to clean out any fines that were drawn into the casing as a result of surging. This surge/bail technique will continue until minimal fines are being pulled out with the bailer. A submersible pump will then be lowered down the well. Pumping will begin at the top of the saturated portion of the screened interval to prevent sand locking of the pump. The pump

will be lowered at intervals of 5 feet or less until the pump is resting approximately 1 foot off the bottom of the casing. The water level will be monitored continuously during the first few minutes of pumping so as not to draw the water level below the pump intake and break the suction. The discharge flow rate will be increased (if possible) until the well is pumping at its maximum yield without draw down beneath the pump.

Developing low-yield wells is a very lengthy process. If development exceeds five hours, the remaining development will be done in stages (demobilize and remobilize), not to exceed three casing volumes or two return trips to the well. For wells installed in clay or fine-grained silt, the method of development will be bailing only. Surging of such wells has been found to substantially increase the turbidity of the water and does not significantly improve hydraulic well response. These wells will be bailed dry and a record kept on the time it takes for the well to recharge 80 percent.

A *Well Development Record* is provided in Attachment K.

8.0 TOPOGRAPHIC SURVEYING

A licensed surveyor will survey all new monitoring wells. Each point will be surveyed to determine its map coordinates with reference to the State Plane Coordinate System (SPCS), based on North American Datum, 1983 Adjustment (NAD 83) and the local mine coordinate system. The surveys will be connected to SPCS by third order, Class II control surveys in accordance with the Standards and Specifications for Geodetic Control Networks. All points should have a horizontal accuracy of at least ±1 foot.

The elevation of a designated point on the top of the PVC well casing (not protective casing) and/or the ground surface (not the top of the cement well apron) should be surveyed for each monitoring well or soil boring. The elevations should be surveyed to within 0.01 feet and referenced to the National Geodetic Vertical Datum, 1988 Adjustment (NGVD 88).

9.0 PACKER TESTS

Packer tests (borehole pressure tests) will be performed while drilling through saturated bedrock to assess the hydraulic conductivity of the bedrock. A description of the procedures for conducting packer tests is included in the following sections. A form for recording packer test data is included in Attachment M, *Packer Test Form.*

Packer tests will be conducted during drilling using a double-packer system. The borehole will be drilled to total depth and then the most representative interval of the borehole will be tested. The interval to be tested will be determined based on in-field review of the description of the core, as discussed in Section 4.0. Packer tests will generally be performed on one ten-foot interval per borehole that is advanced through bedrock. However, if a specific interval is observed that is not representative of the borehole as a whole, but probably has an unusually high transmissivity that could have a significant impact on groundwater flow through bedrock, it may also be tested. The intervals to be tested will normally be 10 feet long, although some may be from 5 to 20 feet, if conditions warrant (discussed below). Water will be pumped at a constant rate into the test interval, while pressure and flow rate are measured. These parameters will then be used to compute an average hydraulic conductivity value for the tested interval.

The equation used to analyze the packer tests data is (*Bureau of Reclamation, 1963*) shown here.

$$K = \frac{Q}{2\pi LH} \ln\left(\frac{L}{r}\right); L \geq 10r$$

K = hydraulic conductivity
Q = constant rate of flow into the hole
L = length of the portion of the hole tested
H = differential head of water (net pressure)
r = radius of hole tested
ln = natural logarithm

This formula is more accurate when the thickness of the stratum tested is at least 5L and for tests below rather than above the groundwater table.

9.1 FLOW RATE

Two in-line water meters will be used to measure the flow rate: a high-flow meter for measuring flow rates greater than approximately 0.25 gallons per minute (gpm); and a low-flow meter for measuring flow rates from 0.1 to 1 gpm. After flow is initiated at the desired pressure, the high-flow meter will be read at the beginning and end of a specific time interval. Generally, readings will be collected at 2-minute intervals for the first 10 minutes and then at 4- to 5-minute intervals until a constant water loss is observed for three consecutive time periods. For the high-flow meter, the flow rate will be determined by dividing the total flow volume over the interval by the time interval. For example:

$$Q = \frac{62.4\text{gals}}{10\,\text{min}} = 6.24\ \text{gpm}$$

If measured flow rates are less than 1 gpm, then flow will be switched to the low-flow meter. The low-flow meter is a direct reading instrument. Flow rates will be converted from gpm to cubic feet per minute (cfm) using the following conversion:

1 gpm = 1.337 cfm

Based on a comparison of flow measurements within the overlapping flow range of both flow meters and on observations of flow fluctuations during testing at other sites, flow readings are generally accurate to about 5 percent.

9.2 TEST SECTION LENGTH

The test section length will be defined as the current borehole depth (since packer tests are performed as the hole is advanced) minus the depth to the base of the packer. In most cases, this length will be set at approximately 10 feet. If permeable zones are encountered during drilling, as determined by significant loss of circulation water, the bottom 5 feet of borehole will be tested.

9.3 NET PRESSURE

The net pressure applied to the borehole test section (also referred to as the "differential head of water") is the sum of the following three pressure terms:

Net pressure = gauge pressure + column pressure - friction losses

All pressure terms are expressed in units of feet of water. Gauge pressure, column pressure and friction losses are described below.

9.4 GAUGE PRESSURE

The gauge pressure is the water pressure measured on a gauge at or above the ground surface. Gauge pressures are read to +/-1 pound per square inch (psi). However, due to pump vibrations, the gauge pressure may fluctuate up to +/-2 psi. For calculating the net pressure, the gauge pressure is converted from psi to feet of water using the following factor:

Gauge Pressure (psi) x 0.433 = Gauge Pressure (feet of water)

9.5 COLUMN PRESSURE

The column pressure is the static pressure due to the weight of water in the test pipe above the water table. Column pressure is therefore equal to either the depth to the bottom of the packer or the depth to groundwater, whichever is smaller.

Below the water table, the column pressure is always equal to the depth of the water table with respect to the surface reference point. The depth to groundwater is usually measured in the well borehole within a week or two of packer testing.

9.6 FRICTION LOSS

The head loss from friction of the pipe causes a back pressure that is recorded on the pressure gauge but is not applied to the formation. Friction loss is a function of the flow rate and the length of pipe between the pressure gauge and the packer. Friction losses will be obtained from the equipment manufacturer, if available. If they are not available, friction losses will be estimated by performing calibration tests in the field. Flow rates versus head loss are plotted on log-log paper for different lengths of pipe. Values of the gauge pressure (the pressure required to produce a target flow rate) for the target flow rate are then recorded.

9.7 EQUIPMENT AND MEASUREMENT

The basic equipment for packer tests consists of an inflatable wireline packer, ¾-inch galvanized pipe, flexible air and water hoses, water pump, water pressure gauge, water flow meters, water level indicator and stop watch. The water pump will be capable of injecting water at a uniform flow rate.

The basic measurements consist of gauge pressures, flow meter readings, time reading and equipment height and dimension values.

The packer assembly basically consists of two cylindrically shaped, inflatable rubber seals separated by a larger-diameter steel cylinder. The rubber packer is tightened against the borehole walls to prevent water from leaking between the walls of the rock and the rubber seal. The packer is then inflated using compressed nitrogen or other appropriate gas/air.

The packer test is performed using the following procedure (for a typical 10-foot test section).

- The borehole is advanced approximately 10 feet using water rotary.
- After the last core barrel is retrieved from within the drill rods, the entire drill string is raised approximately 12.5 feet from the base of the hole.
- The packer assembly is lowered down the drill string until it rests on the backside of the drill bit. The upper seal of the packer remains inside the drill string, while the lower seal extends 2.5 feet from the bottom of the bit.
- Ten-foot galvanized pipe sections attached to the packer are screwed together as the packer is lowered down the hole. All screwed connections are first wrapped with Teflon tape to minimize leakage at the connections.
- Once the packer is in place, compressed nitrogen is fed to the packer through high pressure air hose until the packers seal against the drill string and the borehole walls. Typical packer inflation pressures range form 120 to 160 psi.
- The water pump, gauging assembly (water pressure and flow gauges) and the uppermost galvanized pipe are connected using flexible hoses.
- After pumping startup, water is allowed to flow through the packer and into the borehole until the desired test pressure is achieved. Typical pressures range from 10 to 30 psi depending on the depth of the packer test.
- Water flow rates are monitored upon initiation of flow down the borehole until steady-state conditions are achieved for a minimum of 5 minutes. Afterward, the pressure is increased 5 to 10 psi and the measurements re-started for an additional test, or the test is terminated.

During a packer test, there is a potential for leakage around the packer. Leakage around the packer is monitored in two ways.

- Leakage moving up through the inside of the drill string is initially monitored using a water level indicator placed down the drill string.
- Leakage moving up along the annular space between the drill string and the borehole walls is visually monitored by watching for return flow into the water circulation pit.

Tests in which leakage is observed will be immediately discontinued.

Calculated hydraulic conductivities below roughly 5×10^{-6} cm/sec, which result from flow rates less than 0.1 gpm, are very approximate due to flow-gauging limitations of the packer test equipment. These conductivity values would represent average values for the interval of borehole being tested.

10.0 PUMPING TESTS

Determining the hydraulic properties of an aquifer is a fundamental component of the site characterization process. This section details aquifer test methods that are commonly implemented to help characterize an aquifer, and evaluate the performance characteristics of a monitoring well.

Aquifer parameters can be determined by employing either ex-situ or in-situ methods. Ex-situ methods involve collecting samples of the aquifer material and testing them in a geotechnical lab. In-situ methods involve determining the hydraulic characteristics of the aquifer by applying a stress to the aquifer and recording the response to that stress over time. In-situ methods are generally considered more representative of aquifer conditions than ex-situ (laboratory) soil permeability testing. As a result, this SOP only describes in-situ aquifer testing. Data resulting from these tests can be used in standard well flow equations to determine the hydraulic parameters of the aquifer and the monitoring/extraction well in which the tests are performed.

Each aquifer test method has certain applications, effort requirements, costs, risks, and limitations, and will be evaluated based on the project goals, design requirements, long-term planning, budget, schedule, and regulatory concerns. In addition, aquifer testing may be conducted in several phases involving one or more of the above methods. This iterative approach may be very effective in that the aquifer-testing program can be tailored to meet the project needs as the site characterization or basin study evolves.

Aquifer tests are typically conducted during the site investigation, although they may also be performed at any phase of an investigation. A great deal of care will be given to data collection methods and data analysis for aquifer tests, as the findings will subsequently be used for long-term resource planning, engineering design, and capitol expenditures. The findings from an aquifer testing program can ultimately be used for several important purposes, including the following:

- Development of the site conceptual hydrogeologic model. Aquifer testing provides the mechanism to quantify and incorporate soil heterogeneity and hydraulic anisotropy into the conceptual model
- Development of analytical groundwater flow solutions (models) such as determination of a groundwater flow velocity
- Evaluation of contaminant fate and transport mechanisms associated with advection
- Generation of parametric data for numerical groundwater flow models and associated solute transport models
- Development of groundwater extraction scenarios for hydraulic containment, collection of contaminants, and aquifer restoration
- Wellhead protection studies (determination of the zone of influence and zone of contribution for production wells) and other groundwater basin studies.

10.1 DEFINITIONS

Various physical properties and hydraulic parameters of aquifers and aquitards are important in describing groundwater flow, and are therefore significant in aquifer testing studies. A thorough understanding of the hydraulic principles involved in aquifer testing is an essential component of aquifer analysis. A brief definition of terms that are used in this section are provided below:

Bailing Line: A line used for rapidly lowering and raising the slug into the water column. Deep wells may require the use of the winch on a drill rig.

Darcy's Law: States that the rate of flow through a porous medium is proportional to the loss of head, and inversely proportional to the length of the flow path, or

(eq. 1) $v = K(dh/dl)$

Where:

v = Q/A, which is the specific discharge, also known as the Darcy velocity or Darcy flux, (length/time),
Q = the volume rate of flow (length^3/time),
A = the cross sectional area normal to flow direction (length^2),
dh/dl = describes the aquifer hydraulic gradient (length/length) and,
K = describes the hydraulic conductivity of the aquifer.

Equation 1 may be rewritten as:

(eq. 2) $Q = K(dh/dl)A$

It should be noted that the specific discharge is in velocity units of length/time. It is important to also note that this is a macroscopic concept, and must be differentiated from microscopic (real) flow velocities, which consider the porosity of the medium, as:

(eq. 3) $$v = \frac{K(dh/dl)}{n}$$

where "n" is the effective porosity of the media.

Data Logger: A small field computer capable of recording a wide range of physical measurements such as pressures, temperatures, electrical conductivities, and flow. For aquifer analysis, pressure is generally the parameter of interest (feet of water in the well). The data logger converts the pressure value sent by the traducer into feet of water above the traducer, and records the values in its memory. The data can then be transferred from the logger to a personal computer via a standard RS-232 port.

Each transducer has specific parameters that must be input to the data logger to make the appropriate conversions from pressure units to feet. It is extremely important that field personnel operating a data logger be properly trained on the use of the instrumentation to ensure proper collection of test data.

Common data logger models are the Hermit 3000 (8-channels plus an internal barometer, very user friendly) and Hermit 2000 (8-channels, less user friendly). The Hermit 3000 data logger also contains a RS-422 communication port.

Drawdown: The amount of water level decline in a well and aquifer due to pumping. Usually measured and reported in terms of feet of drawdown relative to static (non-pumping) conditions ('s' by convention).

Electric Submersible Pump: A pumping device capable of pumping for extended periods of time at a constant discharge rate. Discharge pipe or hose should be fitted with a valve to provide the ability to adjust flow. Adjusting the discharge rate by adjusting the speed of the pump is less desirable than the use of a valve. An exception is the variable-speed 2-inch-OD Grundfos submersible pumps, which are designed for adjustable speed (flow) settings. A shroud is recommended if a 2-inch pump is used in a 4-inch or greater diameter well to ensure long-term cooling of the pump motor. The pump will require a reliable power source.

Flow Gauge: An in-line, "turbine type" flow meter is recommended for most moderate to high flow-rate applications. Other means of gauging flow include the use of calibrated orifice weirs or an orifice bucket. For low flow applications, a container and stopwatch method may be suitable. The container method requires measuring the time it takes to fill a container of known volume, such as a 5-gallon bucket or 55-gallon drum. The flow gauging method should be accurate to +/- 5 percent.

Hydraulic Conductivity: This property is a constant of proportionality that describes fluid flow through a porous media (see Darcy's Law, above). Hydraulic conductivity ("K" by convention) is a function of the permeability of the media and of the physical properties of the fluid. Hydraulic conductivity has the units of length/time. In a normal groundwater setting, where the physical properties of the water are considered relatively constant, hydraulic conductivity can be considered a function of the porous media.

For this reason, the terms permeability and hydraulic conductivity are often used interchangeably for groundwater settings. Because hydraulic conductivity varies over 13 orders of magnitude for earth materials (Freeze and Cherry, 1979), order-of-magnitude approximations are generally considered appropriate for evaluation of aquifer properties.

Potentiometric Surface: An imaginary surface connecting points to which water would rise in cased wells from a given point in an aquifer (Lohman, 1979). It may be above or below the ground surface. The water table is a particular potentiometric surface for unconfined aquifers. "Potentiometric" is preferable to the term "piezometric" used by many in the past.

Pressure Transducer: A device installed in the well below the water surface that is capable of continuously providing very accurate water level measurements. The transducer is connected to a continuous data logger (described above). Transducers are available in different pressure (and accuracy) ranges. The transducers should never be lowered into a water column below the operating pressure range of the transducer. Higher pressure range transducers are less accurate than lower pressure range transducers. As a rule, a multiplier of 2.3 can be used to estimate the maximum total amount of water above a traducer (i.e., a 10-psi transducer can have 23 feet of water above, a 50-psi traducer can have 106 feet of water above, etc.). For example, if a 10-psi traducer is installed at the bottom of the well with 100 feet of water above it, it will no longer function properly, and must be returned to the manufacturer for recalibration.
Please note, the transducer only needs to record the change in water levels, and therefore should be installed immediately below the lowest depth expected. A 10-psi transducer is capable of measuring up to 23 feet of change in water levels to 0.01 foot accuracy, and is therefore the recommended transducer for slug tests. Transducers will operate improperly if lowered into sediment, and therefore should never be lowered to the bottom of the well. The target depth of the transducer should be identified prior to lowering into the well, and then the traducer cable should be marked with duct tape to ensure that the transducer is not lowered too deep.

Residual Drawdown: Once a pump is shut off during a pumping test, water levels in pumping wells, observation wells, or piezometers will rise. This rise in total head results from the principle of superposition, and is commonly known as residual drawdown ('s' by convention). It is expressed as the difference between the static water level and the water level at time t' after the cessation of pumping.

Slug: A solid pipe used to displace water by insertion or withdrawal from a well. Bailers may also be used for slug withdrawal only. The slug volume should be maximized based on field conditions. Different length slugs, capable of threading together, should be brought to the field to provide flexibility to the program. A typical slug used for a 2-inch-diameter monitoring well may be 1.5 inches in diameter and 6 to 10 feet in length. The volume of the slug used for each test must be recorded in the field notes.

Specific Capacity: The specific capacity is defined as the discharge rate per unit length of drawdown for a pumping well. Typically expressed in gallons per minute per foot of drawdown (gpm/ft).

Specific Yield: The specific yield is the volume of water released by gravity drainage from an unconfined aquifer from storage per unit surface area of the aquifer per unit decline in the watertable. Specific yield is also known as unconfined storativity, effective porosity, or drainable pore space. Specific yield is unitless and typically ranges from 0.01 to 0.3 (Kruseman and de Ridder, 1991).

Static Water Level: The non-pumping, stabilized water level in a cased well or piezometer. Usually recorded in the field as depth to water below a datum such as the top of casing. This term is usually reported in feet above mean sea level.

Storativity: The storativity of a confined aquifer is the volume of water released from storage per unit surface area per unit change in head. For confined aquifers, stored water is released via aquifer compression and expansion of water. In an unconfined (watertable) aquifer, the storativity is equivalent to the specific yield and is also known as the storage coefficient. Storativity is dimensionless and typically ranges from $5x10^{-5}$ to $5x10^{-3}$ (Kruseman and de Ridder, 1991).

Total Head: The sum of the elevation head, the pressure head, and the velocity head at any given point in an aquifer.

Transmissivity: The rate at which water is transmitted through a unit width of an aquifer under a unit hydraulic gradient (Fetter, 1980). This term ("T" by convention) is simply the product of the hydraulic conductivity (K) and the aquifer thickness ("b" by convention).

$$T = Kb \qquad \text{(eq. 4)}$$

Transmissivity may vary significantly due to spatial variations in both the thickness and conductivity of the aquifer. Transmissivity carries the units length^2/time. For aquifers, b is the thickness of the confined aquifer. For unconfined aquifers, b is the thickness of the saturated portion of the aquifer.

Water Level Indicator: A device used to measure static water levels. An electrical conductivity-based water level indicator capable of measuring to 0.01 foot accuracy is required for all measurements.

10.2 AQUIFER TESTING METHODS

All aquifer test methods, such as slug tests, pumping tests, and recovery tests, have unique advantages and limitations. This section describes the principles, methodology, and staffing requirements for various selected slug tests, pump tests, and recovery tests. Several methods are described here, paying attention to the limitations of each.

Pumping tests may be subdivided into two categories:

- short-term, variable rate test (also commonly known as step test)
- long-term, constant rate test

In general, pumping tests and recovery tests require pumping groundwater from an aquifer, and are therefore more suitable for relatively high transmissivity zones, such as alluvial sand and gravel aquifers, or extensively fractured aquifers. In these types of aquifers, a long-term pumping test is the most accurate means of evaluating aquifer properties and other hydrogeologic factors such as boundary conditions, heterogeneity, and anisotropy.

10.2.1 SLUG TESTING

Principle: Slug testing involves either introducing or removing a "slug" of known volume into or from a well and recording the water level changes that result. The rate of recovery observed in the well is a function of the hydraulic properties of the aquifer and of the well itself. The transmissivity of the aquifer can then be estimated using appropriate well-flow equations.

Assumptions and Limitations of Slug Testing: Slug tests stress only a small portion of the aquifer adjacent to the well, and therefore, slug tests are incapable of evaluating hydrogeologic boundary conditions, hydraulic anisotropy, storage coefficients, and pumping characteristics of the well. However, slug tests commonly provide a cost-effective means of gathering "point" transmissivities across a screen interval. Slug tests are commonly considered as a first step in characterizing an aquifer because of the relative low cost and effort requirements. Additionally, slug tests do not generate large volumes of groundwater, and therefore often used to initially characterize water-bearing zones beneath hazardous waste sites, where disposal options of contaminated groundwater may be limited or costly.

It is important to note that slug tests do not provide adequate information regarding the hydraulic characteristics of a pumping well. Additionally, because of the small stress applied to the aquifer, data may be influenced by drilling methods (skin effects), well construction, and development procedures. Slug tests alone cannot provide accurate information regarding boundary conditions, anisotropy, or storage coefficient data, and are therefore not useful for predicting steady-state drawdowns resulting from any given hypothetical pumping scenario. The development of long-term groundwater extraction scenarios, such as in most modeling studies, should therefore not be based solely on slug test data, but require more sophisticated pumping tests, if feasible.

Falling Head Slug Tests: Falling head slug testing involves the insertion of a slug into the well that is screened below the water table. If a slug is rapidly inserted into the water column in a well, it will instantaneously raise the water column in the well. The amount of head change is defined as the instantaneous head (H_O). The water column will then "fall" to the static water level at a rate that is controlled by the hydraulic characteristics of the water-bearing formation and of the well itself. Falling head slug tests are not appropriate for water table wells (i.e., wells in which part of the screen is unsaturated and the screened interval is within the first water encountered).

Rising Head Slug Tests: Rising head slug testing requires submerging the slug under water in a well, and allowing the water level to stabilize to static conditions. The slug is then rapidly withdrawn from the well. After the slug is withdrawn from the well, the instantaneous water level will be at a level that is lower than the static water level. The rate at which the water level recovers to static condition is a function of the aquifer properties and of the well itself.

Both falling and rising head methods can be used in series during a slug testing program. The slug insertion method may be followed by the slug withdrawal with relative ease. However, if a slug insertion method is chosen for unconfined aquifers, groundwater will be displaced above the water table and into the unsaturated sand filter pack of the well and the formation itself. It should be noted that the hydraulic conductivity of the soils overlying the water-bearing zone may differ from those of the aquifer. Additionally, hydraulic conductivity of unsaturated soils varies as a function of moisture content. For these reasons, a slug withdrawal method is generally considered advantageous to slug insertion in unconfined or semiconfined aquifers due to two-phase (air and water) flow. A good rule-of-thumb is that if the static water level is within the screened interval of the well being tested, a slug withdrawal method should be chosen for aquifer analysis.

Selection of the Slug: Several different types of slugs may be used for the test, including:

- Solid pipe fitted with an eye bolt at one end to affix a bailing line
- Stainless steel or Teflon bailers

- A slug of water of known volume.

Introduction of a slug of water (usually distilled, organic-free water) may not be feasible due to regulatory restrictions. In addition, it is generally considered infeasible to "instantaneously" withdraw a slug of water using a pump. The withdrawal of a slug of water is limited to the use of bailers. The most common slug test involves the use of solid pipes (either slug insertion or withdrawal methods), or the use of bailers (slug withdrawal only).

An additional slug testing method involves applying a pressure or vacuum to the well head and measuring changes in water levels that result following the removal of the pressure. This method requires specialized well fittings, generators, and compressors. Details of this method are provided in Kruseman and de Ridder (1991) (Oscillation Method, p.238), and are not included in this SOP.

The remainder of this section focuses on slug tests conducted using a solid slug, although the general methods for slug tests analyses do not vary significantly if other types of slugs are used for the test.
A large slug will stress the aquifer to a greater degree than a small slug, and therefore the size of the slug should be maximized based on field conditions. Three-foot Teflon bailers or sections of solid pipe can be threaded together to optimize slug volume. The size of the slug is limited only by the standing water column in the well and physical limitations in one's ability to instantaneously insert or withdraw the slug.

Slug Insertion (Falling Head) Test Methods: The procedures outlined below will be followed while conducting falling head slug tests.

1. Remove the well head expansion cap and allow the well to equilibrate to atmospheric conditions.

2. Record the static water level using a conductivity-based water level indicator. Measure the total depth of the well. Note: potential sediment at the bottom may have decreased the total depth value recorded during construction.
3. Determine the appropriate depth of 10-psi traducer. This will generally be between 10 and 20 feet below the static water level, or above potential sediment at the bottom of shallow wells. Affix duct tape to traducer cable to indicate the target depth below top of casing.

4. Lower a 10-psi transducer to the target depth. The transducer and transducer cable must hang plumb in the well to minimize entanglement with the slug. Duct-tape the transducer cable to an immovable object, such as the top of casing. Allow the well to equilibrate to static water levels.

5. Connect the pressure transducer to a continuous data recorder. Input the required transducer parameters and other test parameters in the data logger. The data logger will need to be referenced to the top of casing (TOC) or surface (static water level datum). It is recommended that it is "zeroed" to the static water level, and therefore measured water level changes will be relative to static water level. Water levels above static water levels will be recorded as positive, and water levels below static will be recorded as negative values. The slug test requires only measuring the change in head associated with slug insertion or withdrawal. The "surface mode" is therefore the desired data logger "mode" for slug testing. "TOC mode" refers to measuring the absolute value (i.e., total head) of the water level relative to the TOC datum. This is an unnecessary step that may introduce error in the field, and is therefore not recommended for slug testing. An accurate record of all input parameters and field observations will be included in the field logbook.

6. "Zero" the pressure traducer/data logger to static water levels. Confirm static levels with a water level indicator. The data logger should be set to begin the test in the "immediate" mode (i.e., no time delay). The data logger will be set to record water levels as frequently as possible (i.e., using the "log" mode and default settings).

7. Affix a bailing line to the slug. To accurately complete the test, the slug will be completely submerged in the well. Record the volume of the slug in the field log. Determine the total depth required to submerse the slug. A piece of duct tape may be used to identify the desired length of the bailing line. The slug will be lowered to a "ready" position immediately above the static water level. The slug must not be tangled with the transducer cable.

8. ***Critical step.*** On a pre-determined count, ***lower*** the slug rapidly (but gently) to total submersion and trigger the data logger to begin recording water levels. The slug should remain motionless once it has been lowered into the well. The bailing line for the slug will be tied to an immovable object (tailgate of truck, etc.) once the slug is submerged. Allow the data logger to complete it's logarithmic data recording cycle (approximately 2-3 minutes) prior to confirming water levels with a water level indicator. Wells screened within low to moderately transmissive aquifers may require from 30 seconds to several minutes or even hours to recover to static water levels. If the well recovers within a few seconds, it is likely that the well is screened within a moderate to high transmissivity zone, and therefore the slug test method is likely not an appropriate test method for the determination of aquifer properties.

9. The slug injection test is completed when the water level recovers to static water levels. In many instances, the final few tenths of a foot of recovery may require a significant amount of time (hours). The field team will use their best judgement regarding when to terminate the test. It should be noted that for nearly all methods of data analysis, the last data points are equally significant as the initial data points. The validity of the tests will not be compromised due to impatience of field team members. In many cases, the team can be setting up the next test on a different well while the previous well completes its recovery.

10. Once the well has equilibrated to at least 90 to 95 percent of static water level, the test can be terminated by stopping the data logger. However, at this time, it would be advantageous to initiate a slug withdrawal test (see item #6 below). This may be accomplished by either "stopping" the insertion test, or "stepping" the test by using the "Step" function of the data logger. The original input parameters remain unchanged if you choose to use the "Step" function or stop and start function. Both methods involve restarting the "log cycle" for the data logger (highly desirable for the early time data). An accurate record of test numbers and step numbers will be maintained in the field logbook.

Slug Withdrawal (Rising Head) Test Methods: Follow steps 1 through 5 as described above for the falling head slug test. Steps 6 through 8, below, describe the slug withdrawal test method.

6. Lower the slug into the water column so the slug is fully submerged. For this test, tie the slug bailing line to an immovable object and allow the slug to remain motionless in the well. Ensure that the slug is not entangled with the transducer or transducer cable.

7. Allow the well to equilibrate to the static water level. The well recovers most quickly if a bailer is used for the slug. A solid pipe slug requires a longer period of time to recover. Verify that the well has equilibrated to static water level with a water level indicator.

8. ***Critical step.*** On a pre-determined count, one person will rapidly (and in a fluid motion) ***retrieve*** the slug from the well while the second person simultaneously triggers the data logger to begin recording water levels. Remove the slug from the well while making sure not to disturb the transducer cable. As stated above, allow the data logger to complete it's logarithmic data recording cycle (approximately 2-3 minutes) prior to confirming water levels with a water level indicator. Wells screened within low to moderately transmissive aquifers may require from 30 seconds to several minutes or hours to recover to static water levels. If the well recovers within a few seconds, it is likely that the well is screened within a moderate to high transmissivity zone, and therefore the slug test method is likely not an appropriate test method for determination of aquifer properties.

It is recommended that two slug tests be conducted for each well for data verification purposes. Most data loggers allow the user to view the data or download the data to a field personal computer. Data will be reviewed in the field following completion of the test to ensure that the transducers and data logger are functioning properly.

The initial head values (H_O) which result from instantaneous withdrawal or injection of the slug will be evaluated against the maximum theoretical drawdown. This can easily be completed by calculating the volume of the slug and converting volume of the slug to volume of water in a well. The well volume can then be converted to feet of water in the well column. An example calculation is provided below:

Hypothetical slug size:

0.75-inch outer diameter (OD) x 60-inch length = 106.05 in.^{3}

Conversion to gallons:

106.05 in.^{3} x (0.004329 gallons/in.^{3}) = 0.46 gallons

Conversion to feet (assumes a 2-inch inner diameter (ID) well):

0.46 gallons x (1 foot/0.16 gallons) = 2.88 feet

Therefore, using a slug that is 0.75 inches in diameter and 60 inches (5 feet) in length, the maximum anticipated change in water level with respect to static levels (H_O) would be 2.88 feet. This should be evaluated against the maximum head change observed in the field. Significantly different (greater than 20-30 percent) values may indicate that the transducers or data loggers are not functioning properly. Other possibilities are that the slug is not being inserted or withdrawn rapidly enough, or that the timing between the "trigger" operator and the "slug" operator is off. These factors will be evaluated and resolved prior to conducting additional slug tests.

Data loggers generally have sufficient memory to record an entire day of slug testing. The data will be downloaded daily to minimize the risk of loss of data. An electronic and hard copy will be stored.

10.2.2 PUMPING TESTS

This section details the following elements of pumping tests:

- The Principle
- Assumptions and Limitations
- Test Method Selection
- Equipment Requirements
- Personnel Requirements

The Principle - Pumping Tests: Several different types of pumping tests can be conducted to determine aquifer properties, although the fundamental principles of all tests remains similar. The principle of a pumping tests involves applying a stress to an aquifer by extracting groundwater from a pumping well and measuring the aquifer response to that stress by monitoring drawdown as a function of time in the pumping well and/or observation wells or piezometers at known distances from the well. These measurements are then incorporated into an appropriate well-flow equation to calculate the hydraulic characteristics of the aquifer and pumping well.

General Assumptions and Limitations for Pumping Tests: Numerous different types of pumping tests and well-flow equations exist that may be implemented for nearly all hydrogeologic settings. Each method has a different set of limitations and assumptions. For complex hydrogeologic settings, please see Kruseman and de Ridder (1991). Different assumptions and limitations exist for confined, semi-confined (leaky), and unconfined (water-table) aquifers. In general, the following assumptions apply to most well-flow equations and hydrogeologic settings:

- The aquifer is of infinite areal extent
- The aquifer thickness is of uniform over the entire extent
- Prior to pumping, the potentiometric surface is horizontal (or nearly so) over the area that will be influenced by the pumping test
- The aquifer is pumped at a constant discharge rate, or for variable discharge rate tests, the rate is known
- The pumping well fully penetrates the entire thickness of the aquifer and thus receives water by horizontal flow
- The aquifer is considered homogenous and isotropic

Pumping Test Method Selection: Three types of pumping tests are described in this SOP:

- Variable rate tests (step tests)
- Constant rate tests
- Recovery tests

The overall approach for each test, including capabilities, limitations and assumptions are defined below:

Step Tests: Step tests involve pumping from a single well at a relatively low rate until drawdown has stabilized. The pumping rate is then increased to a higher discharge rate until drawdown once again stabilizes. This procedure is continued for at least three additional steps. Each step is typically 20 to 40 percent greater than the previous step, with a duration of typically 30 minutes to 120 minutes (Kruseman and de Ridder, 1991; Driscoll, 1986). In general, step-tests are relatively short duration tests that are capable of providing general well performance characteristics, aquifer transmissivity, and aquifer storativity in the vicinity of the pumping well. A step-test provides specific capacity data, and therefore should always be conducted prior to conducting a long-term pumping test if no previous pumping data for the well exist. Step-tests are generally considered less effective than long-term pumping tests for determining hydraulic anisotropy, leakage between layers, boundary conditions and recharge areas.

Constant Rate Pumping Test: Constant rate pumping tests involve pumping from a well at a continuous, known, constant discharge rate over an extended period of time. This type of test typically involves monitoring drawdown in several observation wells or piezometers, although the test may also be performed as a single-well test. Long-term, constant discharge pumping tests are the most accurate means of evaluating aquifer hydraulic properties. If properly designed and conducted, these types of aquifer tests are capable of evaluating transmissivity, storativity, hydraulic anisotropy, leakage from overlying or underlying layers, boundary effects, recharge areas, etc. Additionally, well

performance characteristics such as well capacity, well yield, and well efficiency may also be determined

Recovery Test: Constant discharge tests and step tests should generally be accompanied by a recovery test. A recovery test measures the residual drawdown (s') following the pumping test. The recovery test provides the data required to calculate the transmissivity of the aquifer, thus providing an independent check on the results of the pumping test at a relatively low cost (Freeze and Cherry, 1979; and Kruseman and de Ridder, 1991). A recovery test is invaluable if the pumping test is performed without the use of piezometers or observation wells to evaluate potential borehole storage effects of the pumping well. Additionally, residual drawdowns are more reliable than drawdowns measured during pumping due to difficulties in the field of maintaining absolutely constant discharge from a pumping well (i.e., all pumps have a level of discharge variability dependent upon the decreasing column of water above the pump).

Personnel Requirements: Most pumping tests initially require a minimum of three people. More staff may be required for long-term constant rate tests than for step tests and recovery tests, which generally can be performed by two field team members.

One person will be responsible for monitoring the flow gauge and adjusting the discharge rate of the pump, and for ensuring that the data logger is triggered and operating. Another team member will be responsible for taking manual (back-up) water level measurements with a conductivity-based water level indicator.

If the observation wells are located at great distances from one another, or if rapid drawdown is anticipated, it may be advantageous to have several field team members on-site to measure and record water levels. This is particularly helpful during the earlier stages of the test when the most rapid change in water levels is anticipated. As water levels reach a pseudo-steady state, fewer team members may be required.

10.2.3 STEP-TESTS

Provided below is a description of the design and field methodology for completion of a step-drawdown test.

Design of the Step Test: The following design components will be evaluated prior to completion of the step-test:

Choice of pumping well: The pumping well will be fully developed and capable of sustained prolonged pumping. Ideally, the well will be located in the geographic center of the area of interest.

Size of pump: The pump size will be based on the estimated specific capacity, desired total drawdowns, and head requirements. If no previous pumping data are available, development logs or other field observation data will be assessed to aid in sizing the pump.

Duration of each step: Ideally, a step-test will consist of a total of four steps of progressively increasing discharge rate, followed by one step for recovery. Each step generally will range from 30 minutes to 2 hours. A step test typically requires one 10-hour field day to complete.

Initial Discharge Rate: The first step discharge rate should produce approximately 25 percent of the maximum anticipated drawdown estimated from the well specific capacity. If a production well is to be used for the step-test, the initial rate should be approximately 25 percent of the pump capacity. The second step should be approximately 50 percent of the anticipated drawdown and so on. An example is provided below:

Example: A 100-foot-deep well is constructed with a screened interval 80 to 100 feet below TOC. The aquifer is confined. The water column in the well is 50 feet (depth to water is 50 feet below TOC). The pump will be set at 90 feet, allowing 40 feet of water column above the pumping level. The specific capacity is estimated from development data to be approximately 5 gpm/foot of drawdown.

The desired drawdown for the first step is:

$$(0.25)(40 \text{ feet}) = 10 \text{ feet of drawdown,}$$

therefore, the desired pumping rate for the first step is:

$$(10 \text{ feet})(5 \text{ gpm/feet of drawdown}) = \textit{50 gpm}$$

The second step would therefore be 100 gpm, the third step would be 150 gpm, etc.

Please note that the above calculation does not consider well losses from turbulent flow that will likely occur at higher flow rates. A factor of safety may therefore be incorporated in the design of the discharge rates for each step. Given the above conditions and assumptions, a first step pumping rate may be 40 gpm, a second step 80 gpm, etc. Flexibility in the design of the step-test is recommended due to uncertainties associated with estimating specific capacity and well efficiency. Pumping rates for the second and successive steps will be based on field observations of drawdown vs. discharge rate.

Step-Testing Methods:
Remove the well head expansion cap and allow the well to equilibrate to atmospheric conditions. Record the static water level using a conductivity-based water level indicator. Sound the well to determine the total depth. Note: potential sediment at the bottom may have reduced the total depth value recorded during construction.

Determine the appropriate depth of the traducer. Generally a 10-psi transducer (capable of measuring 23 feet of head change) or 50-psi transducer (capable of measuring 106 feet of head change) are well suited for step-testing. The transducer will be targeted for a level 3 to 5 feet above the pump, whenever possible, to minimize interference from the operating pump. Affix duct tape to the transducer cable to indicate the target depth below the top of casing.

Set the pump in the well at the desired pumping level. This is usually the screened interval for shallow wells (<100 feet total depth). For deeper wells, the pumping depth only needs to be greater than the anticipated drawdown. In some cases, it may be cost-effective to hire a pumping subcontractor to operate the pumps, discharge lines, etc., especially for high flow-rate, long-term tests. Contaminated groundwater discharged from the well will be collected and disposed of in an appropriate manner.

Lower the transducer to the target depth. The transducer and transducer cable will hang plumb in the well to minimize entanglement with the pump discharge pipe/hose. Duct tape the transducer cable to an immovable object such as the top of casing. Allow the well to equilibrate to static water levels.

Connect the pressure transducer to a continuous data recorder. Input the required transducers parameters and other test parameters to the data logger. The data logger typically prompts the user to record water levels below the top of casing (TOC) or surface. 'Surface' refers to a static water level datum.

The instrument is therefore "referenced" or "zeroed" to the static water level, and therefore measures changes relative to static water level (the desired mode for step-testing). Water levels below static water level will be recorded as negative values. The step-test requires only measuring drawdown relative to static (and residual drawdown during recovery, if desired). TOC refers to measuring the absolute value (i.e., total head) of the water level relative to the TOC datum. This is an unnecessary

step that may introduce error in the field, and is therefore not recommended for step-tests. An accurate record of all input parameters and field observations will be included in a field logbook or on the Aquifer Test Form (see Attachment O).

"Zero" the pressure traducer/data logger to static water levels. Confirm static levels with a water level indicator. The data logger should be set to begin the test in the "immediate" mode (i.e., no time delay). The data logger will be set to record water levels as frequently as possible (i.e., using the "log" mode and default settings).

STEP #1. On a pre-determined count, simultaneously trigger the data logger and the pump. Quickly stabilize the discharge rate to the desired pumping rate. At the same time, begin recording water levels as rapidly as possible in the pumping well (every 15 to 30 seconds for the first 5 minutes). It is usually helpful to have the data table constructed with pre-determined water level time intervals. The water level measuring interval may be lengthened to every minute or every five minutes as the test progresses. Field observations suggest that 70-80 percent of the total drawdown for each step occurs within the first 15 to 20 minutes following commencement of pumping. The data recorded by the transducers and data logger can be viewed following completion of the logarithmic data recording cycle (approximately 2-3 minutes). Water levels recorded by the traducer/data logger system should be similar to the manually recorded water levels. It is always beneficial to plot the time and drawdown data in the field to ensure that the pumping rate and the drawdowns are adequate. Allow the test to run until the water level in the pumping well stabilizes to a steady state (or nearly so). This typically requires 30-120 minutes. Field plotting of data is helpful in determining when pseudo-steady state drawdown is achieved.

STEP #2 through STEP #4. On a pre-determined count, simultaneously step-up the pumping discharge rate to the desired level (usually by opening a control valve located upstream of the flow gauge), and restart the "logarithmic data recording cycle" on the data logger. This is easily done using a Hermit 2000 by using the "STEP" function. Make sure not to draw the water level down to the pumping level. It is more desirable to abbreviate the duration of any step and get accurate recovery data than to draw the water level down to the pumping level.

STEP #5. Critical Step. On a pre-determined count, simultaneously turn off the pump, "Step" the data logger, and manually record recovery (residual drawdown) data. Continue recording the recovery data until the water level returns to static water levels (or nearly so). The test is completed.
Carefully download the field data logger. Obtain a hard copy and retain a master electronic copy.

10.2.4 CONSTANT RATE PUMPING TESTS

A description of the design and field methodology for the completion of a constant rate pumping test is presented below.

Design Considerations for Constant Rate Pumping Tests: It should be noted that a single pumping test may cost several tens, or even hundreds of thousands of dollars to complete. Qualified and experienced personnel will be consulted during the scoping, project planning, and technical design phase to ensure that the test is conducted in a technically sound and cost-effective manner. Key members of the field team will possess extensive experience conducting aquifer tests. The following design components will be evaluated prior to initiating a constant rate pumping test:

Choice of Pumping Well. The well chosen will be designed as a pumping well, although many monitoring wells have been "converted" to pumping wells for use in a pumping test. In either case, the well will be fully developed and capable of sustained prolonged pumping. Ideally, the well will be located in the geographic center of the area of interest, or in a downgradient location (if remediation involves hydraulic containment and collection downgradient). Nearby observation wells or piezometers are required for distance-drawdown calculations. If an existing pumping well is used in the test, the pumping history of the well will be determined.

Choice of Observation Wells. Ideally, water levels will be monitored in as many nearby observation wells as feasible. Wells screened at different depth intervals will also be monitored to evaluate hydraulic communication across aquitards. It may be advantageous to equip observation wells that are located nearby the pumping well with continuous data recording instruments, and manually record water levels for wells located at greater distances. Prior to conducting the pumping test, estimated zones of influence may be completed using well-flow equations to determine which wells are likely to show a drawdown response. It is beneficial to use observation wells located upgradient, downgradient, and cross-gradient from the pumping well to evaluate hydraulic anisotropy.

Size of Pump. Pump size will be based on the drawdown requirements and estimated specific capacity determined from a step-drawdown test or from actual long-term pumping data. Pumping tests will not be conducted without completing a step-drawdown test, particularly without existing knowledge of the pumping characteristics of the pumping well.

Duration of Pumping Test - Confined Aquifer. Confined aquifers respond to pumping relatively quickly due to small storativity values. A pumping test for a confined aquifer will be conducted over a minimum period of 48 hours (two days) to achieve steady state conditions. Preliminary plotting of data in the field may indicate how the aquifer is responding, thus determining the duration of the test.

Duration of Pumping Test - Unconfined Aquifer. The cone of depression that results from pumping expands much more slowly for unconfined aquifers prior to reaching a steady state. The generally accepted minimum duration pumping test for an unconfined aquifer is therefore 72 hours (three days).

Discharge Rate. The discharge rate will be based on the results of the step-drawdown testing program. The specific capacity calculated from the step test will be used to estimate the desired drawdown and pumping rate. Because of the uncertainty in the step test calculations, a level of safety will be factored into the desired drawdown level to ensure that the water level is not lowered to the pumping level. If the water level is lowered to the pumping level, the test will be terminated immediately (although recovery data will be collected until the aquifer recovers to static conditions).

Frequency of Water Level Measurements. Water levels will be recorded electronically using continuous pressure transducers and a data logger, and manually using a conductivity-based water level indicator. Following the "logarithmic data recording cycle", the pressure traducer can be set to record water levels every minute. Suggested time intervals for manual and electronic measurements of drawdown are presented in Attachment N.

Control Points. It is recommended for control purposes that water levels be monitored in a well located at a distance beyond the area of influence of the test. If no such well is available, a common approach is to construct a "stilling basin". The stilling basin can be constructed of 10 to 20 feet of 2-inch class 125 PVC pipe with a cap placed on one end. The basin will be filled to approximately 75 percent of capacity with water and secured in a vertical position. A transducer will be placed in the bottom of the basin as a control point in the test. A V-notch can be cut in a top cap to allow access for the transducer cable while still minimizing evaporation. The basin should be in equilibrium with the atmosphere. All measurements recorded in observation wells will also be taken for the control station to evaluate instrument drift and error.

Background Water Level Data. Prior to conducting the pumping test, it is useful to monitor water levels in the proposed pumping well and observation wells for a week prior to the test. The background data provides the mechanism to evaluate earth tides, barometric influences, temperature influences, etc.

Background Pumping Data. It is important to understand regional or site-specific groundwater pumping to evaluate well interference, relict drawdown, etc. If a production zone is used for the pumping test, a well canvass should be completed to determine aquifer groundwater uses.

Collection of Water Samples. In many cases, groundwater will be collected during the pumping test to gather data required for treatability testing. At a minimum, groundwater will be monitored during pumping for pH, temperature, electrical conductivity, and turbidity.
Miscellaneous. Precipitation events will be recorded in the field notes, including time of onset, duration, and rainfall total. Barometric readings will be checked and recorded hourly. For shallow zone wells, the passing of heavy equipment or trains will be noted on the field logs.

Constant Rate Pumping Test Methods: The description of the pumping test outlined below assumes several observation wells will be used in the test. Continuous data logging equipment will be used wherever possible, although manual backup measurements will also be taken periodically. All of the data loggers will be synchronized to the correct day, date, and time. All project team members will synchronize their watches to the correct time datum.

Remove the well head expansion caps from all observation wells and piezometers, as well as the test well. Allow all wells to equilibrate to atmospheric conditions. Record the static water level in each well using a conductivity-based water level indicator. Sound each well to determine the total depth. Note: potential sediment at bottom may reduce the total depth from the value recorded at time of construction.

Determine the appropriate depth of the transducer for the pumping well. Generally a 50-psi transducer (capable of measuring 106 feet of head change) is well suited for the pumping well. The transducer will be targeted for a level 3 to 5 feet above the pump level, whenever possible, to minimize interference with the pump. In some instances, installation of the transducer below the pump may be required. Care must be taken to not entangle the transducer with the pump, or to lower the transducer into sediment at the bottom of the well. Affix duct tape to traducer cable to indicate the target depth below top of casing.

Set the pump in the well at the desired pumping level. This is usually the screened interval for shallow wells (<100 feet total depth). For deeper wells, the pumping depth only needs to be greater than the anticipated drawdown (it is wise to consider a margin of error - be conservative). In some cases, it may be cost-effective to hire a pumping subcontractor to operate the pumps, discharge lines, etc., especially for high flow-rate, long-term tests. Contaminated groundwater discharged from the well may require storage in portable tanks and/or require treatment prior to disposal. All groundwater generated from the test will be disposed of as specified in the project-specific work plan. Lower the transducer to the target depth in the pumping well. The transducer and transducer cable must hang plumb in the well to minimize entanglement with the pump discharge pipe/hose. Duct tape the transducer cable to an immovable object such as the top of casing, or protective bollard. Allow the well to equilibrate to static water levels.

Install pressure transducers in all of the oberservation wells included in the test in a manner similar to that described above. In nearly all applications, a 10-psi transducer (highly accurate over a 23-foot range) is ideal for monitoring drawdown in observation wells.

Connect the pressure transducers that have been installed in each well to a continuous data recorder. A single, multi-channel data logger may suffice if observation wells are in close proximity to one another, or several "remote" loggers may be required for wells separated by great distances. Input the required transducer parameters and other test parameters in the data logger. The data logger typically prompts the user to record water levels below the top of casing (TOC) or surface. Surface refers to a static water level datum.

The instrument is therefore "referenced" or "zeroed" to either a static water level or to a value input by the operator. Water levels below static water level will be recorded as negative values. For pumping test purposes, water levels can be recorded relative to either "TOC" or "surface". It is noted that referencing to "surface mode" minimizes mistakes in the field. Additionally, nearly all data reduction techniques evaluate drawdown, not absolute water levels. An accurate record of all input

parameters and field observations will be included in a field logbook or on the Aquifer Test Form (see Attachment O).

"Zero" the pressure traducer/data logger to static water levels (or, alternatively, enter the TOC value for each well). Confirm static levels (or TOC-adjusted values) with a water level indicator.
For the pumping well, and for observation wells close by the pumping well, it is advantageous to record the early time data at frequent intervals. This is best accomplished using the "logarithmic data recording mode" for each transducer.

TEST START-UP. On a pre-determined count, simultaneously start the pump and trigger the data logger. Quickly stabilize the discharge rate to the desired value (determined from a step test). At the same time, another team member will begin recording water levels as rapidly as possible in the pumping well (see frequencies above). It usually helps to have the data table constructed with pre-determined time intervals for water level measurements. The data recorded by the transducers and data logger can be viewed following completion of the logarithmic data recording cycle (approximately 2-3 minutes). Water levels recorded by the transducer/data logger system should be similar to the manually recorded water levels. It is always beneficial to plot the time and drawdown data in the field to ensure that the pumping rate and the drawdowns are adequate. The first couple of hours of the pumping test can be hectic. It is recommended that "more" rather than "less" project team staff be on site to assist in the early stages of the test. The size of the field team can generally be greatly reduced following the initial few hours of the test.

Monitoring Water Levels and Discharge Rates. Water levels will be monitored on the frequency detailed above. The discharge rate will be monitored at least every 30 to 60 minutes, and recorded on a field logbook or on the Aquifer Test Form (see Attachment O).

10.2.5 RECOVERY TESTS

A recovery test will be completed following either a step-test or a constant rate pumping test. As stated above, a recovery test is invaluable if the pumping test is performed without the use of piezometers or observation wells to evaluate potential borehole storage effects in the pumping well. Additionally, residual drawdowns are more reliable than drawdowns measured during pumping due to difficulties in the field of maintaining absolutely constant discharge from a pumping well.

The Principle - Recovery Tests: When the pump is shut down following a pumping test, water levels in the pumping well and observation wells begins to rise. This rise is known as residual drawdown, 's'. As with other types of aquifer tests, the relationship between discharge rate, time, and drawdown measured during the step test can be used in well-flow equations and corresponding "recovery equations" to determine the aquifer transmissivity and storage coefficient, and well characteristics.

Recovery Test Methods:
Complete a step-test or constant rate pumping test in the manner detailed above.
On a pre-determined count, simultaneously turn off the pump, "Step" the data logger, and manually record recovery (residual drawdown) data. The early time data will be recorded using the "log" data recording mode (high data logging frequency). Continue recording the recovery data until the water level returns to static water levels (or nearly so). The test is completed.

Important. Carefully download the field data to a PC computer. Obtain a hard copy and a master electronic copy to be stored.

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ATTACHMENTS

ATTACHMENT A

GLOSSARY OF TERMS

Absorption - The penetration or apparent disappearance of molecules or ions of one or more substances into the interior of a solid or liquid.

Adsorption - The process by which atoms, ions, or molecules are held to the surface of a material through ion-exchange processes.

Annular Sealant - Material used to provide a positive seal between the borehole and the casing of the well. Annular sealants should be impermeable and resistant to chemical or physical deterioration.

Annular Space - The space between the borehole wall and the well casing, or the space between a casing pipe and a liner pipe.

Annulus - The gap between the well and borehole where the sand, seal and grout are installed.

Aquifer - A geologic formation, group of formations, or part of a formation that can yield water to a well or a spring.

Backwashing - A method of filter pack emplacement whereby the filter pack material is allowed to fall freely through the annulus while clean fresh water is simultaneously pumped down the casing.

Bentonite - Hydrous aluminum silicate available in powder, granular, or pellet form. It is used to provide a tight seal between the well casing and the borehole.

Bailer - A cylindrical tool designed to remove material, both solid and liquid, from a well or borehole. A valve at the bottom of the bailer retains the material in the bailer. The three types of bailers are flat-valve bailer, a dart-valve bailer and the sand pump with rod plunger.

Blow Counts - Number of hammer blows needed to advance a split spoon sampler. Blow counts are usually counted in 6-inch increments.

Borehole - The hole created by drilling through the subsurface.

Bridge - A wedge or build up of sand that occurs when the driller is pouring the sand pack around the screened interval, thus leaving a gap or "open zone" where the natural formation could possibly clog the screen. Also the development of gaps or obstructions in either grout or filter pack materials during emplacement.

Cone Penetrometer - An instrument used to identify the underground conditions by measuring the differences in the resistance and other physical parameters of the strata. The cone penetrometer consists of a conical point attached to a drive rod of smaller diameter. Penetration of the cone into the formation forces the soil aside, creating a complex shear failure. The cone penetrometer is very sensitive to small differences in soil consistency.

Continuous Slot Wire-Wound Intake - A well intake that is made by winding and welding triangular-shaped, cold-rolled wire around a cylindrical array of rods. The spacing of each successive turn of wire determines the slot size of the intake.

Core Barrel - A steel tube used to collect rock core samples. The core barrel receives the rock core cut by the outer barrel as the borehole is advanced.

Cuttings - Formation particles obtained from a borehole during the drilling process.

Drill Rod - The rigid steel rod used to lower and retrieve cutting, coring and sampling equipment down the borehole.

Draw down - Distance between the static water level and water level while the well is being pumped or bailed at a constant rate.

Drilling Fluids_- A water-based or air-based fluid used in the well drilling operation to remove cuttings from the borehole, to clean and cool the bit, to reduce friction between the inner barrel and the sides of the borehole and to seal the borehole.

Dual-Purpose Well - A well that can be used as both a monitoring and extraction or injection well.

Filter Pack - Sand, gravel, or glass beads that are uniform, clean and well-rounded that are placed in the annulus of the well between the borehole wall and the well intake to prevent formation material from entering through the well intake and to stabilize the adjacent formation.

Fines - Silt, clay, fine sand.

Grout - A fluid mixture of neat cement and water with various additives or bentonite of a consistency that can be forced through a pipe and emplaced in the annular space between the borehole and the casing to form an impermeable seal.

Heaving Formation - Unconsolidated saturated substrate encountered during drilling where the hydrostatic pressure of the formation is greater than the borehole pressure causing the sands to move up into the borehole.

Inner Barrel - The tool lowered through the inside of the outer barrel that can be configured for cutting, coring, or sampling.

Kelly Bar - A hollow steel bar or pipe that is the main section of drill string to which the power is directly transmitted from the rotary table to rotate the drill pipe and bit. The cross section of the kelly is either square, hexagonal, or grooved. The kelly works up and down through drive bushings in the rotary table.

Neat Cement - A mixture of Portland cement and water in the proportion of 5 to 6 gallons of clean water per bag (94 pounds) of cement.

Outer Barrel - The steel piping that serves to both cut downwards and to line the borehole walls to prevent hole collapse.

Overshot Tool - The tool that attaches to the inner barrel so that the barrel may be lowered through the outer barrel to depth on the wireline. The overshot tool is designed to attach to, or release from, the inner tube at depth.

Parameters - Groundwater variables, pH, specific conductivity, temperature, turbidity.

Pitch - The distance along the axis of an auger flight that it takes for the helix to make one complete 360 degree turn.

Purge water - Any water removed from the well via bailing, pumping, or air lift.

Rotary Table - A mechanical or hydraulic assembly that transmits rotational torque to the kelly, which is connected to the drill pipe and the bit. The rotary table has a hole in the center through which the kelly passes.

Saturated annulus - The portion of the annulus that is below the aquifer.

Sieve Analysis - Determination of the particle-size distribution of soil, sediment, or rock by measuring the percentage of the particles that will pass through standard sieves of various sizes.

Split-Spoon Sampler - A thick-walled steel tube split lengthwise used to collect soil samples. The sampler is commonly lined with metal sample sleeves and is driven or pushed downhole by the drill rig to collect samples.

Thin-Walled Sampler - A sampling devise used to obtain undisturbed soil samples made from thin-wall tubing. The sampler is also known as a Shelby tube. The thin-wall sampler minimizes the most serious sources of disturbance: displacement and friction.

Tremie Pipe - A device, usually a small-diameter pipe, that carries grouting materials to the bottom of the borehole and that allows pressure grouting from the bottom up without introduction of appreciable air pockets.

VOCs - Volatile organic compounds.

Wireline - The steel cable used to lower and retrieve cutting, coring and sampling equipment down the borehole.

Yield - The rate at which a well will produce water.

ATTACHMENT B

UNIFIED SOIL CLASSIFICATION SYSTEM

TABLE - A
Unified Soil Classification System

CRITERIA FOR ASSIGNING GROUP SYMBOLS AND NAMES			SOIL CLASSIFICATION	
			GROUP SYMBOL	GERERALIZED GROUP DESCRIPTIONS
Coarse-Grained Soils More Than 50% Retained On No. 200 Sieve	Gravels More Then 50% Of Coarse Fraction Retained On No. 4 Sieve	Clean Gravels Less Than 5% Fines	GW	WELL-GRADED GRAVELS
			GP	POORLY-GRADED GRAVELS
		Gravels With Fines More Than 12% Fines	GM	GRAVEL AND SILT MIXTURES
			GC	GRAVEL AND CLAY MIXTURES
	Sands 50% Or More Of Coarse Fraction	Clean Sands Less Than 5% Fines	SW	WELL-GRADED SANDS
			SP	POORLY-GRADED SANDS
		Sands With Fines More Than 12% Fines	SM	SAND AND SILT MIXTURES
			SC	SAND AND CLAY MIXTURES
Fine-Grained Soils 50% Or More Passes The No. 200 Sieve	Silts And Clays Liquid Limit Less Than 50	Inorganic	CL	NON-PLASTIC AND LOW PLASTICITY CLAYS
			ML	NON-PLASTIC AND LOW PLASTICITY SILTS
		Organic	OL	NON-PLASTIC AND LOW PLASTICITY ORGANIC CLAYS
				NON-PLASTIC AND LOW PLASTICITY ORGANIC SILTS
	Silts And Clays Liquid Limit 50 Or More	Inorganic	CH	HIGH PLASTICITY CLAYS
			MH	HIGH PLASTICITY SILTS
		Organic	OH	HIGH PLASTICITY ORGANIC CLAYS
				HIGH PLASTICITY ORGANIC SILTS
Highly Organic Soils	Primarily Organic Matter, Dark In Color, And Organic Odor		PT	PEAT

TABLE - B
Relative Density Or Consistency
Utilizing Standard Penetration Test Values

NONCOHESIVE SAMPLES (a) Relative Density	No. Blows/PerFt. (c)	COHESIVE SAMPLES (b) Consistency	No. Blows/PerFt.
Very Loose	0 To 4	Very Soft	0 To 2
Loose	4 To 10	Soft	2 To 4
Compact	10 To 30	Firm	4 To 8
Dense	30 To 50	Stiff	8 To 15
Very Dense	Over 50	Very Stiff	15 To 30
		Hard	Over 30

(a) Soils consisting of gravel, sand, and silt, either separately or an combination, processing no characteristics of plasticity, with average particle diameter greater than 0.002 millimeters.

(b) Soils consisting generally of the Clay fraction, possessing the characteristics of plasticity with an average particle diameter of less than 0.002 millimeters.

(c) Refer to text or ASTM D 1586-84 for a definition of N.

TABLE - C
Component Definitions By Gradation

COMPONENT	SIZE RANGE
Boulders	Greater than 12in. (300mm)
Cobbles	12in. to 3in. (300mm to 75mm)
Gravels	3 in. To No.4(4.76mm)
Coarse Gravel	3 in. To 3/4 in. (75mm to 19mm)
Fine Gravel	3/4 in. (19mm) To No.4 sieve (4.76mm)
Sand	No.4(4.75mm) To No.200(0.074mm)
Coarse Sand	No.4(4.75mm) To No.10(2.0mm)
Medium Sand	No.10(2.0mm) To No.40(0.42mm)
Fine Sand	No.40(0.42mm) To No.200(0.074mm)
Silt & Clay	Smaller Than No.200(0.074mm)

TABLE - D
Descriptive Terminology Denoting Component Proportions

DESCRIPTIVE TERMS	RANGE OF PROPORTION
Trace	0-5%
Little	5-12%
Some	12-30%
And	30-50%

TABLE - E
Descriptive Terms Denoting Gradation Of Granular Components

GRADATION DESIGNATION	ABBREVIATION SYMBOLS	DEFINING PROPORTIONS
Coarse To Fine Or Coarse Medium To Fine	C-F C-M-F	(All fractions greater than 10% of the component, but the medium component dominates)
Coarse To Medium	C-M	Less Than 10% Fine
Medium To Fine	M-F	Less Than 10% Coarse
Medium	M	Less Than 10% Coarse & Fine
Fine	F	Less Than 10% Coarse & Medium

TABLE - F
Sample Test Taken

- STANDARD PENETRATION TEST
- SHELBY TUBE
- GRAB SAMPLE
- CUTTINGS
- PENETRATION SAMPLER (3" O.D.)
- SPLIT SPOON SAMPLER (2.5" O.D.)
- WATER LEVEL DURING DRILLING
- MEASURED WATER LEVELS

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AUTOCAD FILE: SOILINDX.DWG

ATTACHMENT C

CRITERIA FOR DESCRIBING PLASTICITY

CRITERIA FOR DESCRIBING PLASTICITY	
Description	**Criteria**
Nonplastic	A 1/8-in. (3-mm) thread cannot be rolled at any water content
Low	The thread can barely be rolled and the lump cannot be formed when drier than the plastic limit
Medium	The thread is easy to roll and not much time is required to reach the plastic limit. The thread cannot be rerolled after reaching the plastic limit. The lump crumbles when drier than the plastic limit.
High	It takes considerable time rolling and kneading to reach the plastic limit. The thread can be rerolled several times after reaching the plastic limit. The lump can be formed without crumbling when drier than the plastic limit.

ATTACHMENT D

CRITERIA FOR DESCRIBING DENSITY AND CONSISTENCY

DENSITY/CONSISTENCY BASED UPON BLOW COUNTS							
Density (Sand and Gravel) Blows/ft*				Consistency (Silt and Clay) Blows/ft*			
Term	**1.4" ID**	**2.0" ID**	**2.5" ID**	**Term**	**1.4" ID**	**2.0" ID**	**2.5" ID**
very loose	0-4	0-5	0-7	very soft	0-2	0-2	0-2
loose	4-10	5-12	7-18	soft	2-4	2-4	2-4
medium dense	10-29	12-37	18-51	medium stiff	4-8	4-9	4-9
dense	29-47	37-60	51-86	stiff	8-15	9-17	9-18
very dense	>47	>60	>86	very stiff	15-30	17-39	18-42
				hard	30-60	39-78	42-85
				very hard	>60	>78	>85
* 140 lb. hammer dropped 30 inches							

CRITERIA FOR DESCRIBING CONSISTENCY BASED UPON THUMB TEST	
Description	**Criteria**
Very soft	Thumb will penetrate soil more than 1 in. (25 mm)
Soft	Thumb will penetrate soil about 1 in. (25 mm)
Firm	Thumb will indent soil about 1/4 in. (6 mm)
Hard	Thumb will not indent soil but readily indented with thumbnail
Very Hard	Thumbnail will not indent soil

ATTACHMENT E

CRITERIA FOR DESCRIBING STRUCTURE

CRITERIA FOR DESCRIBING STRUCTURE	
Description	**Criteria**
Stratified	Alternating layers of varying material or color with layers at least 6 mm thick; note thickness
Laminated	Alternating layers of varying material or color with the layers less than 6 mm thick; note thickness
Fissured	Breaks along definite planes of fracture with little resistance to fracturing
Slickensided	Fracture planes appear polished or glossy, sometimes striated
Blocky	Cohesive soil that can be broken down into small angular lumps which resist further breakdown
Lensed	Inclusion of small pockets of different soils, such as small lenses of sand scattered through a mass of clay; note thickness
Homogeneous	Same color and appearance throughout

ATTACHMENT F

SOIL BORING LOG FORM

BORING LOG NUMBER:

SHEET ___ OF ___

LOC. ID: ELEVATION: DATUM:

PROJECT NAME.: DRILL DATE:

INCLINATION: AZIMUTH: HAMMER WEIGHT: DATE FINISHED:

LOCATION SKETCH

DEPTH (UNITS)	BORING METHOD	SOIL PROFILE: SOIL DESCRIPTION	GRAPHIC LOG	SAMPLES: USCS	NUMBER	TYPE	BLOW COUNT/6"	RECOVERY	ADDITIONAL COMMENTS
0									
5									
10									
15									
20									
25									
30									
35									
40									
45									

DEPTH UNITS: _____

DRILLING CONTRACTOR: _____

DRILLER: _____

LOGGED BY: _____

CHECKED BY: _____

REV. NO.	REVISIONS	REV. DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY

MWH

PROJECT No.:

AutoCAD FILE:

SCALE: FIGURE No.:

SOIL BORING LOG FORM

ATTACHMENT G

ROCK CORE LOG FORM

PROJECT NAME: _____ DATE: _____ BOREHOLE NUMBER: _____

BOREHOLE LOCATION: _____ LOGGED BY: _____

ELEVATION: _____ REFERENCE POINT: _____ DATUM: _____ DRILL RIG: _____

INCLINATION: _____ AZIMUTH: _____ FLUSH: _____ FEED: _____

TOTAL DEPTH: _____ BIT TYPE: _____ PAGE ____ OF ____

CORE DIA. / DEPTH (Tick Mark = 1 Ft.)	CASING DIA. / DEPTH	WATER NOTES	ROCK TYPE		DEPTH SCALE	CORE RECOV. DATA												DISCONTINUITY DATA	STRENGTH DATA		ADDITIONAL COMMENTS
			DEPTH	DESCRIPTION		T.C.R. (Length - %)				R.Q.D. (Length - %)				FRACTURES	TYPE & SURFACE DESCRIPTION	WEATHERING INDEX	STRENGTH INDEX	
							25	50	75		25	50	75					

ABBREVIATIONS

T.C.R. - Total Core Recovery
R.Q.D. - Rock Quality Description

S - Shear
B - Bedding
FO - Foliation

U - Undulating
ST - Stepped
I - Irregular

SM - Smooth
R - Rough
VR - Very Rough

C - Curved
J - Joint = Fracture
F - Fault

PL - Planar
P - Polished
K - Slickensided

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ROCK CORE LOG FORM

MWH

PROJECT No.:
AutoCAD FILE:
SCALE:
FIGURE No.:

ATTACHMENT H

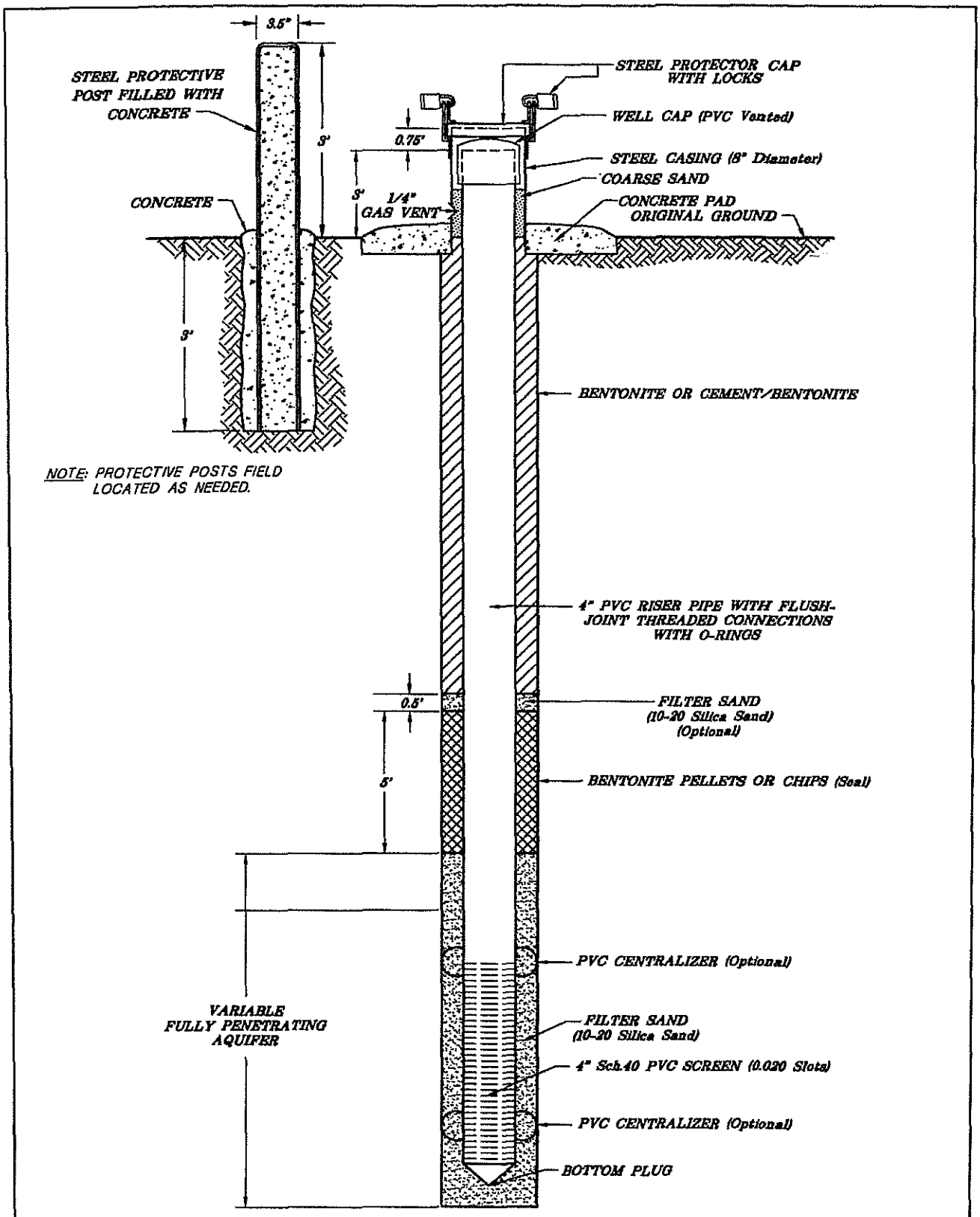
WEATHERING AND INTACT ROCK STRENGTH CLASSIFICATION

WEATHERING CLASSIFICATION		
TERM	**DESCRIPTION**	**SYMBOL**
Fresh	No visible sign of rock material weathering; perhaps slight discoloration on major discontinuity surfaces.	W1
Slightly Weathered	Discoloration indicates weathering of rock material on discontinuity surfaces. All the rock material may be discolored by weathering and may be somewhat weaker than in its fresh condition	W2
Moderately Weathered	Less than half of the rock material is decomposed and/or disintegrated to soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.	W3
Highly Weathered	More than half of the rock material is decomposed and/or disintegrated to a soil. Fresh or discolored rock is present either as a discontinuous framework or as corestones.	W4
Completely Weathered	All rock material is decomposed and/or disintegrated to soil. The original mass structure is still largely intact.	W5

INTACT ROCK STRENGTH CLASSIFICATION		
TERM	**DESCRIPTION**	**SYMBOL**
Extremely Weak Rock	Indented by thumbnail	R0
Very Weak Rock	Crumbles under firm blows with point of geological hammer, can be peeled by a pocket knife.	R1
Weak Rock	Can be peeled by a pocket knife with difficulty, shallow indentations made by firm blow with point of geological hammer	R2
Medium Strong Rock	Cannot be scraped or peeled with a pocket knife, specimen can be fractured with a single firm blow of geological hammer to fracture it.	R3
Strong Rock	Specimen requires more than one blow of geological hammer to fracture it.	R4
Very Strong Rock	Specimen requires many blows of geological hammer to fracture it.	R5
Extremely Strong Rock	Specimen can only be chipped with geological hammer.	R6

ATTACHMENT I

TYPICAL MONITORING WELL INSTALLATION DIAGRAM



Project No.:	Design By:	Scale: N.T.S.
File: TYP-WELL.DWG	Drawn By:	Date:

MWH

TYPICAL MONITORING WELL INSTALLATION

ATTACHMENT J

MONITORING WELL CONSTRUCTION FORM

Facility/Project Name: _____ Date Well Installed: From _____ To _____

Well Number: _____ Well Installed By (Person's Name & Firm) _____

Type of Protective Cover: Above-Gound ☐ Flush-To-Ground ☐

NOTE: Use Ground Surface (BGS or AGS) for all depth measurements

(A) - Protective casing _____ ft. BGS ☐ or AGS ☐

(B) - Well casing, top _____ ft. BGS ☐ or AGS ☐

(C) - Surface seal, bottom _____ ft. BGS

(D) - Bentonite seal, top _____ ft. BGS

(E) - Primary filter, top _____ ft. BGS

(F) - Screen joint, top _____ ft. BGS

(G) - Screen joint, bottom _____ ft. BGS

(H) - End cap bottom _____ ft. BGS

(I) - Filter pack, bottom _____ ft. BGS

(J) - Borehole, bottom _____ ft. BGS

(K) - Borehole, diameter _____ in. to _____ ft. BGS
_____ in. to _____ ft. BGS

(L) - O.D. well casing _____ in.

(M) - I.D. well casing _____ in.

(N) - 24 hr. water level after completion _____ ft. BGS _____ ft. TOC

(1) - Cap and Lock? Yes ☐ No ☐

(2) - Protective posts? Yes ☐ No ☐ No. of Posts _____
a. Height AGS: Feet: _____ b. Depth BGS: Feet: _____

(3) - Protective casing:
a. Inside diameter: Inches: _____ b. Depth: Feet: _____

(4) - Drainage port (s)? Yes ☐ No ☐

(5) - Surface seal material a. Cap: _____ b. Annular space seal _____

(6) - Material between well casing and protective casing: _____

(7) - Annular space seal: Mix: _____
- How installed: Tremie ☐ Tremie pumped ☐ Gravity ☐

(8) - Centralizers: No ☐ Yes ☐ Depths (BGS) _____

(9) - Bentonite seal:
a. Bentonite granules ☐ or b. Bentonite pellets 1/4in. ☐ 3/8in. ☐ 1/2in. ☐
c. _____ ☐ other

(10) - Filter pack material: Manufacturer, product name, & mesh size
a. _____
b. Volume added _____ ft./3 _____ Bags/Size

(11) - Well casing: Flush threaded PVC schedule 40 ☐
Flush threaded PVC schedule 80 ☐
_____ Other ☐

(12) - Screen material: _____
a. Screen type: _____
Factory cut ☐ Continuous slot ☐ Other ☐ _____
b: Manufacturer _____
c: Slot size: _____
d: Slotted length: _____

(13) - Backfill material (below filter pack): None ☐
_____ Other ☐

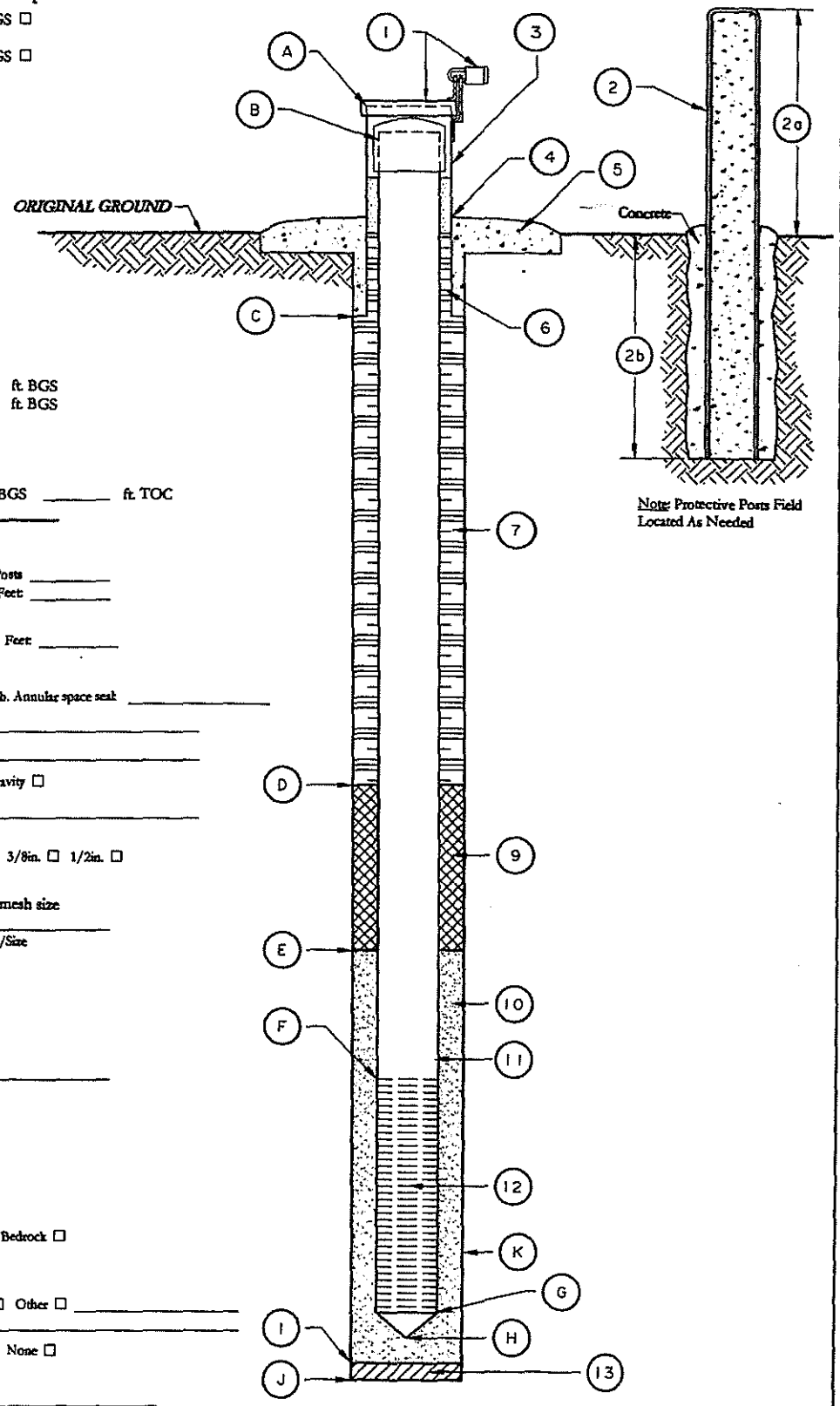
(14) - USCS classification of soil near screen None ☐
GP ☐ GM ☐ GC ☐ GW ☐ SW ☐ SP ☐
SM ☐ SC ☐ ML ☐ MH ☐ CL ☐ CH ☐ Bedrock ☐

(15) - Sieve analysis attached? Yes ☐ No ☐

(16) - Drilling method used: Rotary ☐ Hollow Stem Auger ☐ Other ☐ _____
_____

(17) - Drilling fluid used: Water ☐ Air ☐ Drilling Mud ☐ None ☐

(18) - Drilling additives used? Yes ☐ No ☐
Describe: _____



REV. No.	REVISIONS	REV. DATE	DESIGN BY	DRAWN BY	REVIEWED AND SIGNED BY

MWH

PROJECT No.: 100400101803
AutoCAD FILE: Well Construction Form
SCALE: Not To Scale
FIGURE No:

WELL CONSTRUCTION FORM

ATTACHMENT K

WELL DEVELOPMENT RECORD
WELL VOLUME CHART

WELL DEVELOPMENT RECORD

Well Number: _____

Job No. _____ Project Name: _____ Page: ___ of ___

Date(s): _____ Comments: _____

Developed by: _____

Measuring Point (MP) of Well: _____

Screened Interval (ft bgs): _____

Filter Pack Interval (ft bgs): _____

Development Method: _____

Starting H_2O Level (BMP): _____

Casing Stickup TOC (ft): _____

Casing Diameter (in ID): _____

Casing Volume (gal): _____

QUALITY ASSURANCE

Methods (describe)

Cleaning Equipment:

Development:

Disposal of Purge Water:

Instruments (indicate make, model, id.)

Water Level: Thermometer:

pH Meter: Field Calibration:

Conductivity Meter: Field Calibration:

Turbidity Meter: Field Calibration:

Other: Field Calibration:

DEVELOPMENT MEASUREMENTS

Date/Time	Cumul. Vol. (gal)	Temp. (C)	Field EC (_____)	Color	Turbidity	Other _____	Remarks

Total Discharge (gal): _____ Casing Volumes Purged: _____

Observations/Comments: _____

Abbreviations:

BMP = below measuring point

BGS = below ground surface

Cumul. Vol. = cumulative volume removed

ID = inside diameter

C = Celsius

gal = gallons

ft = feet

in = inches

MWH

Filename: Well-devel.dwg

ATTACHMENT L

WATER LEVEL READINGS FORM

RECORD OF WATER LEVEL READINGS

Job No. _____ Project Name _____ Location _____

Loc. ID	Date	Time	Measuring Device/ Unit Number	Reference Point	Depth to Water	By	Comments

MWH

Filename: Wtr_lvl.dwg

ATTACHMENT M

PACKER TEST FORM

PACKER TEST DATA FORM

Job No. _____ Location _____ Gauge Ht _____ ft Page ____ of ____

Job Name _____ Depth to Groundwater _____ ft bgs Borehole Dia. _____ in

Boring No. _____

[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	Comments

Gauge Pressure (ft water) = Gauge Gressure (psi)/0.433

Column Pressure = Gauge Heigth plus Top Depth or Depth to GW, whichever is smaller.

Net Pressure = Gauge + Column + Frict. Loss

K (cm/s) = K (ft/min) x 0.508

MWH

Filename: Packer_test.dwg

ATTACHMENT N

TIME INTERVALS FOR MANUAL AND ELECTRONIC MEASUREMENTS OF DRAWDOWN

SUGGESTED MANUAL MEASUREMENT FREQUENCY USING CALIBRATED ELECTRONIC WATER-LEVEL INDICATORS

ELAPSED TIME	MEASUREMENT FREQUENCY
0-20 minutes	30 seconds
20-40minutes	2 minute
40-60 minutes	5 minutes
60-120 minutes	10 minutes
2-12 hours	1 hour
12 hours to 3 days	2 hours

LOGARITHMIC TIME INTERVAL SCHEDULE FOR PRESSURE TRANSDUCERS AND DATA LOGGERS

LOG CYCLE	MEASUREMENT INTERVAL	TOTAL DATA POINTS PER CYCLE
0-20 seconds	0.2 second	101
20 -60 seconds	1 second	40
1-10 minutes	12 seconds	45
10-100 minutes	2 minutes	45
100-1,000 minutes	20 minutes	45
1,000-10,000 minutes	200 minutes	45

ATTACHMENT O

AQUIFER TEST FORM

AQUIFER TEST FORM

Well Number ID: _____

Page ____ of ____

Observer's Name: _____

Location: _____

Job No. _____

Pumped/Observation Well (x-out one)

Date Test Started: _____

Total Depth: _____ Blank Casing Length: _____

Date Test Ended: _____

Screened From ____ to ____

Static Water Elevation: _____

Type of Screen/Casing: _____

Static Water Depth: _____

Gravel Pack O.D.: _____

Groundwater Temperature: _____

If observation well, bearing and distance from pumped well: _____

Depth to Aquifer Top: _____

Initial Pumping Rate: _____

Depth to Aquifer Bottom: _____

Additional Well Details or Comments: _____

Saturated Thickness: _____

Constant Discharge Maintained?

Yes ___ No ___

How Measured?: _____

MEASUREMENTS

Time of Day	Elapsed Time (min)	Depth to Water	Drawdown	Remarks (note fluctuation or change in discharge rate, cessation of pumping, etc.)

Additional Comments/Observations: _____

PROJECT NAME:

MWH

Filename: Aquifer-T1.dwg

Appendix H

Standard Operating Procedures

Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

July 30, 1996
Revision 2

U.S. ENVIRONMENTAL PROTECTION AGENCY
REGION I

LOW STRESS (low flow) PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUND WATER SAMPLES FROM MONITORING WELLS

I. SCOPE & APPLICATION

This standard operating procedure (SOP) provides a general framework for collecting ground water samples that are indicative of mobile organic and inorganic loads at ambient flow conditions (both the dissolved fraction and the fraction associated with mobile particulates). The SOP emphasizes the need to minimize stress by low water-level drawdowns, and low pumping rates (usually less than 1 liter/min) in order to collect samples with minimal alterations to water chemistry. This SOP is aimed primarily at sampling monitoring wells that can accept a submersible pump and have a screen, or open interval length of 10 feet or less (this is the most common situation). However, this procedure is flexible and can be used in a variety of well construction and ground-water yield situations. Samples thus obtained are suitable for analyses of ground water contaminants (volatile and semi-volatile organic analytes, pesticides, PCBs, metals and other inorganics), or other naturally occurring analytes.

This procedure does not address the collection of samples from wells containing light or dense non-aqueous phase liquids (LNAPLs and DNAPLs). For this the reader may wish to check: Cohen, R.M. and J.W. Mercer, 1993, DNAPL Site Evaluation; C.K. Smoley (CRC Press), Boca Raton, Florida and U.S. Environmental Protection Agency, 1992, RCRA Ground-Water Monitoring: Draft Technical Guidance; Washington, DC (EPA/530-R-93-001).

The screen, or open interval of the monitoring well should be optimally located (both laterally and vertically) to intercept existing contaminant plume(s) or along flowpaths of potential contaminant releases. It is presumed that the analytes of interest move (or potentially move) primarily through the more permeable zones within the screen, or open interval.

Use of trademark names does not imply endorsement by U.S.EPA but is intended only to assist in identification of a specific type of device.

Proper well construction and development cannot be overemphasized, since the use of installation techniques that are appropriate to the hydrogeologic setting often prevents "problem well" situations from occurring. It is also recommended that as part of development or redevelopment the well should be tested to determine the appropriate pumping rate to obtain stabilization of field indicator parameters with minimal drawdown in shortest amount of time. With this information field crews can then conduct purging and sampling in a more expeditious manner.

The mid-point of the saturated screen length (which should not exceed 10 feet) is used by convention as the location of the pump intake. However, significant chemical or permeability contrast(s) within the screen may require additional field work to determine the optimum vertical location(s) for the intake, and appropriate pumping rate(s) for purging and sampling more localized target zone(s). Primary flow zones (high(er) permealability and/or high(er) chemical concentrations) should be identified in wells with screen lengths longer than 10 feet, or in wells with open boreholes in bedrock. Targeting these zones for water sampling will help insure that the low stress procedure will not underestimate contaminant concentrations. The Sampling and Analysis Plan must provide clear instructions on how the pump intake depth(s) will be selected, and reason(s) for the depth(s) selected.

Stabilization of indicator field parameters is used to indicate that conditions are suitable for sampling to begin. Achievement of turbidity levels of less than 5 NTU and stable drawdowns of less than 0.3 feet, while desirable, are not mandatory. Sample collection may still take place provided the remaining criteria in this procedure are met. If after 4 hours of purging indicator field parameters have not stabilized, one of 3 optional courses of action may be taken: a) continue purging until stabilization is achieved, b) discontinue purging, do not collect any samples, and record in log book that stabilization could not be achieved (documentation must describe attempts to achieve stabilization) c) discontinue purging, collect samples and provide full explanation of attempts to achieve stabilization (note: there is a risk that the analytical data obtained, especially metals and strongly hydrophobic organic analytes, may not meet the sampling objectives).

Changes to this SOP should be proposed and discussed when the site Sampling and Analysis Plan is submitted for approval. Subsequent requests for modifications of an approved plan must include adequate technical justification for proposed changes. All changes and modifications must be approved before implementation in field.

II.EQUIPMENT

A. Extraction device

Adjustable rate, submersible pumps are preferred (for example, centrifugal or bladder pump constructed of stainless steel or

Teflon).

Adjustable rate, peristaltic pumps (suction) may be used with caution. Note that EPA guidance states: "Suction pumps are not recommended because they may cause degassing, pH modification, and loss of volatile compounds" (EPA/540/P-87/001, 1987, page 8.5-11).

The use of inertial pumps is discouraged. These devices frequently cause greater disturbance during purging and sampling and are less easily controlled than the pumps listed above. This can lead to sampling results that are adversely affected by purging and sampling operations, and a higher degree of data variability.

B. Tubing

Teflon or Teflon lined polyethylene tubing are preferred when sampling is to include VOCs, SVOCs, pesticides, PCBs and inorganics.

PVC, polypropylene or polyethylene tubing may be used when collecting samples for inorganics analyses. However, these materials should be used with caution when sampling for organics. If these materials are used, the equipment blank (which includes the tubing) data must show that these materials do not add contaminants to the sample.

Stainless steel tubing may be used when sampling for VOCs, SVOCs, pesticides, and PCBs. However, it should be used with caution when sampling for metals.

The use of 1/4 inch or 3/8 inch (inner diameter) tubing is preferred. This will help ensure the tubing remains liquid filled when operating at very low pumping rates.

Pharmaceutical grade (Pharmed) tubing should be used for the section around the rotor head of a peristaltic pump, to minimize gaseous diffusion.

C. Water level measuring device(s), capable of measuring to 0.01 foot accuracy (electronic “tape”, pressure transducer). Recording pressure transducers, mounted above the pump, are especially helpful in tracking water levels during pumping operations, but their use must include check measurements with a water level “tape” at the start and end of each record.

D. Flow measurement supplies (e.g., graduated cylinder and stop watch).

E. Interface probe, if needed.

F. Power source (generator, nitrogen tank, etc.). If a gasoline generator is used, it must be located downwind and at least 30 feet from the well so that the exhaust fumes do not contaminate the samples.

G. Indicator field parameter monitoring instruments - pH, Eh, dissolved oxygen (DO), turbidity, specific conductance, and temperature. Use of a flow-through-cell is required when measuring all listed parameters, except turbidity. Standards to perform field calibration of instruments. Analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846. For Eh measurements, follow manufacturer's instructions.

H. Decontamination supplies (for example, non-phosphate detergent, distilled/deionized water, isopropyl alcohol, etc.).

I. Logbook(s), and other forms (for example, well purging forms).

J. Sample Bottles.

K. Sample preservation supplies (as required by the analytical methods).

L. Sample tags or labels.

M. Well construction data, location map, field data from last sampling event.

N. Well keys.

O. Site specific Sample and Analysis Plan/Quality Assurance Project Plan.

P. PID or FID instrument (if appropriate) to detect VOCs for health and safety purposes, and provide qualitative field evaluations.

III.PRELIMINARY SITE ACTIVITIES

Check well for security damage or evidence of tampering, record pertinent observations.

Lay out sheet of clean polyethylene for monitoring and sampling equipment.

Remove well cap and immediately measure VOCs at the rim of the well with a PID or FID instrument and record the reading in the field logbook.

If the well casing does not have a reference point (usually a V-cut or indelible mark in the well casing), make one. Describe its location and record the date of the mark in the logbook.

A synoptic water level measurement round should be performed (in the shortest possible time) before any purging and sampling activities begin. It is recommended that water level depth (to 0.01 ft.) and

total well depth (to 0.1 ft.) be measured the day before, in order to allow for re-settlement of any particulates in the water column. If measurement of total well depth is not made the day before, it should not be measured until after sampling of the well is complete. All measurements must be taken from the established referenced point. Care should be taken to minimize water column disturbance.

Check newly constructed wells for the presence of LNAPLs or DNAPLs before the initial sampling round. If none are encountered, subsequent check measurements with an interface probe are usually not needed unless analytical data or field head space information signal a worsening situation. Note: procedures for collection of LNAPL and DNAPL samples are not addressed in this SOP.

IV.PURGING AND SAMPLING PROCEDURE

Sampling wells in order of increasing chemical concentrations (known or anticipated) is preferred.

1. Install Pump

Lower pump, safety cable, tubing and electrical lines slowly (to minimize disturbance) into the well to the midpoint of the zone to be sampled. The Sampling and Analysis Plan should specify the sampling depth, or provide criteria for selection of intake depth for each well (see Section I). If possible keep the pump intake at least two feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well. Collection of turbid free water samples may be especially difficult if there is two feet or less of standing water in the well.

2. Measure Water Level

Before starting pump, measure water level. If recording pressure transducer is used-initialize starting condition.

3. Purge Well

3a. Initial Low Stress Sampling Event

Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet but remains stable, continue purging until indicator field parameters stabilize.

Monitor and record water level and pumping rate every three to five minutes (or as appropriate) during purging. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump (for example, 0.1 - 0.4 l/min) to ensure stabilization of indicator

parameters. Adjustments are best made in the first fifteen minutes of pumping in order to help minimize purging time. During pump start-up, drawdown may exceed the 0.3 feet target and then "recover" as pump flow adjustments are made. Purge volume calculations should utilize stabilized drawdown value, not the initial drawdown. Do not allow the water level to fall to the intake level (if the static water level is above the well screen, avoid lowering the water level into the screen). The final purge volume must be greater than the stabilized drawdown volume plus the extraction tubing volume.

Wells with low recharge rates may require the use of special pumps capable of attaining very low pumping rates (bladder, peristaltic), and/or the use of dedicated equipment. If the recharge rate of the well is lower than extraction rate capabilities of currently manufactured pumps and the well is essentially dewatered during purging, then the well should be sampled as soon as the water level has recovered sufficiently to collect the appropriate volume needed for all anticipated samples (ideally the intake should not be moved during this recovery period). Samples may then be collected even though the indicator field parameters have not stabilized.

3b. Subsequent Low Stress Sampling Events

After synoptic water level measurement round, check intake depth and drawdown information from previous sampling event(s) for each well. Duplicate, to the extent practicable, the intake depth and extraction rate (use final pump dial setting information) from previous event(s). Perform purging operations as above.

4. Monitor Indicator Field Parameters

During well purging, monitor indicator field parameters (turbidity, temperature, specific conductance, pH, Eh, DO) every three to five minutes (or less frequently, if appropriate). Note: during the early phase of purging emphasis should be put on minimizing and stabilizing pumping stress, and recording those adjustments. Purging is considered complete and sampling may begin when all the above indicator field parameters have stabilized. Stabilization is considered to be achieved when three consecutive readings, taken at three (3) to five (5) minute intervals, are within the following limits:

turbidity (10% for values greater than 1 NTU),
DO (10%),
specific conductance (3%),
temperature (3%),
pH (± 0.1 unit),
ORP/Eh (± 10 millivolts).

All measurements, except turbidity, must be obtained using a flow-through-cell. Transparent flow-through-cells are preferred, because they allow field personnel to watch for particulate build-up within the cell. This build-up may affect indicator field parameter values

measured within the cell and may also cause an underestimation of turbidity values measured after the cell. If the cell needs to be cleaned during purging operations, continue pumping and disconnect cell for cleaning, then reconnect after cleaning and continue monitoring activities.

The flow-through-cell must be designed in a way that prevents air bubble entrapment in the cell. When the pump is turned off or cycling on/off (when using a bladder pump), water in the cell must not drain out. Monitoring probes must be submerged in water at all times. If two flow-through-cells are used in series, the one containing the dissolved oxygen probe should come first (this parameter is most susceptible to error if air leaks into the system).

5. Collect Water Samples

Water samples for laboratory analyses must be collected before water has passed through the flow-through-cell (use a by-pass assembly or disconnect cell to obtain sample).

VOC samples should be collected first and directly into pre-preserved sample containers. Fill all sample containers by allowing the pump discharge to flow gently down the inside of the container with minimal turbulence.

During purging and sampling, the tubing should remain filled with water so as to minimize possible changes in water chemistry upon contact with the atmosphere. It is recommended that 1/4 inch or 3/8 inch (inside diameter) tubing be used to help insure that the sample tubing remains water filled. If the pump tubing is not completely filled to the sampling point, use one of the following procedures to collect samples: (1) add clamp, connector (Teflon or stainless steel) or valve to constrict sampling end of tubing; (2) insert small diameter Teflon tubing into water filled portion of pump tubing allowing the end to protrude beyond the end of the pump tubing, collect sample from small diameter tubing; (3) collect non-VOC samples first, then increase flow rate slightly until the water completely fills the tubing, collect sample and record new drawdown, flow rate and new indicator field parameter values.

Add preservative, as required by analytical methods, to samples immediately after they are collected if the sample containers are not pre-preserved. Check analytical methods (e.g. EPA SW-846, water supply, etc.) for additional information on preservation. Check pH for all samples requiring pH adjustment to assure proper pH value. For VOC samples, this will require that a test sample be collected during purging to determine the amount of preservative that needs to be added to the sample containers prior to sampling.

If determination of filtered metal concentrations is a sampling objective, collect filtered water samples using the same low flow procedures. The use of an in-line filter is required, and the filter

size (0.45 um is commonly used) should be based on the sampling objective. Pre-rinse the filter with approximately 25 - 50 ml of ground water prior to sample collection. Preserve filtered water sample immediately. Note: filtered water samples are not an acceptable substitute for unfiltered samples when the monitoring objective is to obtain chemical concentrations of total mobile contaminants in ground water for human health risk calculations.

Label each sample as collected. Samples requiring cooling (volatile organics, cyanide, etc.) will be placed into a cooler with ice or refrigerant for delivery to the laboratory. Metal samples after acidification to a pH less than 2 do not need to be cooled.

6. Post Sampling Activities

If recording pressure transducer is used, remeasure water level with tape.

After collection of the samples, the pump tubing may either be dedicated to the well for resampling (by hanging the tubing inside the well), decontaminated, or properly discarded.

Before securing the well, measure and record the well depth (to 0.1 ft.), if not measured the day before purging began. Note: measurement of total well depth is optional after the initial low stress sampling event. However, it is recommended if the well has a “silting” problem or if confirmation of well identity is needed.

Secure the well.

V. DECONTAMINATION

Decontaminate sampling equipment prior to use in the first well and following sampling of each subsequent well. Pumps will not be removed between purging and sampling operations. The pump and tubing (including support cable and electrical wires which are in contact with the well) will be decontaminated by one of the procedures listed below.

Procedure 1

The decontaminating solutions can be pumped from either buckets or short PVC casing sections through the pump or the pump can be disassembled and flushed with the decontaminating solutions. It is recommended that detergent and isopropyl alcohol be used sparingly in the decontamination process and water flushing steps be extended to ensure that any sediment trapped in the pump is removed. The pump exterior and electrical wires must be rinsed with the decontaminating solutions, as well. The procedure is as follows:

Flush the equipment/pump with potable water.

Flush with non-phosphate detergent solution. If the solution is recycled, the solution must be changed periodically.

Flush with potable or distilled/deionized water to remove all of the detergent solution. If the water is recycled, the water must be changed periodically.

Flush with isopropyl alcohol (pesticide grade). If equipment blank data from the previous sampling event show that the level of contaminants is insignificant, then this step may be skipped.

Flush with distilled/deionized water. The final water rinse must not be recycled.

Procedure 2

Steam clean the outside of the submersible pump.

Pump hot potable water from the steam cleaner through the inside of the pump. This can be accomplished by placing the pump inside a three or four inch diameter PVC pipe with end cap. Hot water from the steam cleaner jet will be directed inside the PVC pipe and the pump exterior will be cleaned. The hot water from the steam cleaner will then be pumped from the PVC pipe through the pump and collected into another container. Note: additives or solutions should not be added to the steam cleaner.

Pump non-phosphate detergent solution through the inside of the pump. If the solution is recycled, the solution must be changed periodically.

Pump potable water through the inside of the pump to remove all of the detergent solution. If the solution is recycled, the solution must be changed periodically.

Pump distilled/deionized water through the pump. The final water rinse must not be recycled.

VI. FIELD QUALITY CONTROL

Quality control samples are required to verify that the sample collection and handling process has not compromised the quality of the ground water samples. All field quality control samples must be prepared the same as regular investigation samples with regard to sample volume, containers, and preservation. The following quality control samples shall be collected for each batch of samples (a batch may not exceed 20 samples). Trip blanks are required for the VOC samples at a frequency of one set per VOC sample cooler.

Field duplicate.

Matrix spike.

Matrix spike duplicate.

Equipment blank.

Trip blank (VOCs).

Temperature blank (one per sample cooler).

Equipment blank shall include the pump and the pump's tubing. If tubing is dedicated to the well, the equipment blank will only include the pump in subsequent sampling rounds.

Collect samples in order from wells with lowest contaminant concentration to highest concentration. Collect equipment blanks after sampling from contaminated wells and not after background wells.

Field duplicates are collected to determine precision of sampling procedure. For this procedure, collect duplicate for each analyte group in consecutive order (VOC original, VOC duplicate, SVOC original, SVOC duplicate, etc.).

If split samples are to be collected, collect split for each analyte group in consecutive order (VOC original, VOC split, etc.). Split sample should be as identical as possible to original sample.

All monitoring instrumentation shall be operated in accordance with EPA analytical methods and manufacturer's operating instructions. EPA analytical methods are listed in 40 CFR 136, 40 CFR 141, and SW-846 with exception of Eh, for which the manufacturer's instructions are to be followed. Instruments shall be calibrated at the beginning of each day. If a measurement falls outside the calibration range, the instrument should be re-calibrated so that all measurements fall within the calibration range. At the end of each day, check calibration to verify that instruments remained in calibration. Temperature measuring equipment, thermometers and thermistors, need not be calibrated to the above frequency. They should be checked for accuracy prior to field use according to EPA Methods and the manufacturer's instructions.

VII.FIELD LOGBOOK

A field log shall be kept to document all ground water field monitoring activities (see attached example matrix), and record all of the following:

Well identification.

Well depth, and measurement technique.

Static water level depth, date, time and measurement technique.

Presence and thickness of immiscible liquid (NAPL) layers and

detection method.

Pumping rate, drawdown, indicator parameters values, and clock time, at the appropriate time intervals; calculated or measured total volume pumped.

Well sampling sequence and time of each sample collection.

Types of sample bottles used and sample identification numbers.

Preservatives used.

Parameters requested for analysis.

Field observations during sampling event.

Name of sample collector(s).

Weather conditions.

QA/QC data for field instruments.

Any problems encountered should be highlighted.

Description of all sampling equipment used, including trade names, model number, diameters, material composition, etc.

VIII. DATA REPORT

Data reports are to include laboratory analytical results, QA/QC information, and whatever field logbook information is needed to allow for a full evaluation of data useability.

EXAMPLE (Minimum Requirements) Page____of____

Well PURGING-FIELD WATER QUALITY MEASUREMENTS FORM

Location (Site/Facility Name)_____ Depth to _____/_____ of screen
Well Number_____Date_____ (below MP) top bottom
Field Personnel_____ Pump Intake at (ft. below MP)_____
Sampling Organization_____ Purging Device; (pump type)_____
Identify MP_____

Clock Time 24 HR	Water Depth below MP ft	Pump Dial[1]	Purge Rate ml/min	Cum. Volume Purged liters	Temp. °C	Spec. Cond.[2] µS/cm	pH	ORP/ Eh[3] mv	DO mg/L	Turb-idity NTU	Comments

1. Pump dial setting (for example: hertz, cycles/min, etc).
2. µSiemens per cm(same as µmhos/cm)at 25 °C.
3. Oxidation reduction potential (stand in for Eh).

STANDARD OPERATING PROCEDURE

LOW STRESS PURGING AND SAMPLING PROCEDURE FOR THE COLLECTION OF GROUNDWATER SAMPLES FROM MONITORING WELLS

(Based on EPA Region 1, Revision 2. July 30, 1996.)

1.0 INTRODUCTION

This standard operating procedure (SOP) is intended to serve as a reference for the proper equipment and techniques for collecting groundwater samples by low-stress sampling techniques. The purpose of this SOP is to enable the user to collect representative and defensible groundwater samples, and to plan the field sampling effort. The techniques presented will be followed whenever applicable, although site-specific conditions or project-specific requirements may warrant adjustments in methodology. This SOP is based on EPA Region 1, Low Stress Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells, Revision 2, July 30, 1996, which is attached as Attachment A.

This SOP describes groundwater sample collection by low-stress sampling methods, only. All other groundwater sampling procedures will be performed in accordance with the Field Sampling Plan of the

MONITORING WELL LOW-STRESS SAMPLING

Monitoring wells can be sampled with bladder pumps using lower flow rates. Studies have shown that groundwater in the screened interval of a standard monitoring well can be representative of groundwater in the formation, even though stagnant water lies above in the casing. This occurs when flow is generally horizontal and naturally purges the screened interval. However, the insertion of a sampling device, such as a bailer or pump, can disrupt this equilibrium and cause mixing of the screened and cased interval waters. The mixture of stagnant and screened interval water can even be forced into the aquifer, resulting in chemical and microbiological effects that may affect data quality. Therefore, low-stress sampling techniques are most accurate using dedicated sampling devices that can be left in place within a monitoring well. Considerations also need to be made for switching between standard purge volume and low-stress sampling methods.

The objective of low-stress sampling is to minimize the velocity/stress on the sample water as it exits the formation into the screened interval of the well and as it enters the

pump. Flow rates from 0.1 to 0.5 liter/minute (l/min) are typical for this sampling procedure. When performed correctly, water sampled using the low-stress technique is produced from the screened interval without disturbing stagnant water in the well casing. By using low flow rates to stabilize drawdown at less than the goal of 0.30 feet, only screened interval water will be sampled. Depth to water measurements during purging are recorded to verify that less than 0.3 feet of drawdown has occurred. In those cases where drawdown is observed to be greater than 0.3 feet, the pumping rate will be reduced by decreasing the pumping rate. If the pumping rate is reduced to less than 0.25 liters per minute and the drawdown still exceeds 0.3 feet after two 2-minute intervals, pumping will be halted. Project-specific work plans should be developed in cases where low-stress sampling with less than 0.30 feet of drawdown can not be achieved. Under these cases, the Project Manager must approve of alternative sampling methods prior to sampling. If drawdown is ever observed to be greater than 0.5 feet, pumping will be halted and the will be allowed to recover before resuming low-stress sampling or purging at a lower pumping rate.

The following procedures will be used while performing low-stress purging and sampling:

1. Install a bladder pump in the well (if one does not already exist). Slowly lower the bladder pump into the well to minimize disturbance of the stagnant water within the well. Place the pump inlet in the screened interval at the appropriate depth, which should be near the midpoint of the screened interval unless site-specific conditions dictate placing the pump at a different point within the screened interval. Wait at least 48 hours after pump installation before purging and sampling.

2. Before initiating purging, place an electric water level indicator down to the top of the static water table and record the depth to groundwater.

3. Begin purging groundwater at a rate between 100 to 500 ml/min, making sure to minimize drawdown to less than 0.3 feet as a goal. Rates up to approximately 1 l/min may be feasible in high hydraulic conductivity formations, only if the

drawdown continues to be less than 0.3 feet. Measure drawdown at intervals of five minutes or less during purging. Adjust the purge rate to balance the desired (low) purge rate and water level drawdown. If the recharge to the well is less than 100 ml/min (i.e., excessive drawdown is occurring), proceed to Step 6.

4. The minimum volume to be purged from the well is two times the volume of the tubing and pump (available from the manufacturer). The tubing volume will be determined by multiplying the volume per foot of tubing (available from the manufacturer) by the total length of tubing.

5. During purging, measure the following groundwater quality parameters: pH, temperature, electrical conductivity, turbidity, DO, and ORP. The parameters will be considered stable when three consecutive readings, collected at intervals of at least five minutes, are within:

Conductivity	±10%
pH	±0.2 units
Temperature	±1 degree Celsius
Dissolved Oxygen	±0.2 mg/l
ORP	±10 millivolts
Turbidity	<5 NTU.

However, if the turbidity is not ≤5 NTU, but is stable (within ± 10 percent between readings) within a four-hour period, and all other parameters are stable, the samples will be collected. Once the parameters have stabilized, collect the samples.

6. If the well produces water at an extremely slow rate and excessive drawdown is occurring (> 0.30 feet.), even at a pumping rate of 100 ml/min, low-stress procedures may not be the best sampling method for the well. It is recommended that the standard practice for sampling low-recharge rate wells using bladder pumps be followed.

Appendix I
Draft 2005 Phase II Supplemental SI Groundwater
Health and Safety Plan

MEMORANDUM

MWH
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Phone: (425) 602-4000
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To: Mary Kauffman, IDEQ
Cc: Bob Geddes, P4 Production, LLC
From: Paul Stenhouse, MWH

Date: October 13, 2005

Reference: P4 Production Southeast Idaho Mine-Specific Selenium Program

Subject: Supplemental Health and Safety Plan to Support the Phase II Groundwater Investigation

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Draft 2005 Phase II Supplemental SI Groundwater Health and Safety Plan

MWH will conduct water well drilling operations at P4 Production, LLC (P4) mines as part of the second phase of the site investigation. Phase II of this site-specific investigation work will focus on groundwater flow characterization, natural attenuation, and chemical speciation. P4 is proposing to install a limited number of monitoring wells on historical phosphate mines to satisfy investigation needs.

The purpose of this memorandum is to supplement the existing project health and safety plan, *Southeast Idaho Mine-Specific Selenium Program Comprehensive Site Investigation Program Health and Safety Plan–Final*, (MWH, 2004), so that well drilling operations and their hazards are well documented. Its purpose is also to provide field crews with guidelines for working safely around water well drilling operations and supports Section 12.2.8.1, *Drilling Operations* of the MWH 2004 program health and safety plan. In addition, the flash freezing process during sample collection was not anticipated while drafting the project health and safety plan (HASP).

Attached to this supplemental HASP memorandum is Attachment 1, *MWH ES&H Procedure No. 811, Drilling Safety.* This procedure outlines health and safety requirement for MWH employees and subcontractors and will be followed by MWH personnel and subcontractors involved in drilling operations as part of the Phase II SI groundwater investigation. This procedure covers topics related to drilling operations, such as OSHA requirements, drilling at hazardous waste sites, safety equipment, subcontractor selection and oversight, and planning activities. Procedures for drilling, including safe work practices, site preparation, drill rig requirements, equipment travel and set-up, equipment operation, drill rig maintenance, and a self-assessment checklist also cover the more specific tasks involved directly with drilling operations. Attachment A of this procedure, *Subcontractor Safety Program Criteria—Drilling Operations* will also be discussed with AK Drilling of Butte, Montana to ensure that the minimum acceptable standards for subcontractors can be met. MWH personnel at each new drill location shall fill out Attachment B, *Self-Assessment Checklist—Drilling Operations*, as it contains site location criteria, which must be met prior to drilling operations.

shall fill out Attachment B, *Self-Assessment Checklist—Drilling Operations*, as it contains site location criteria, which must be met prior to drilling operations.

SAMPLING HANDLING

MWH will ship samples to a laboratory that can conduct analytical speciation. Speciation analysis requires that groundwater samples be flash frozen in the field (frozen to -70° C). Flash freezing will be facilitated by immersing filled high-density polyethylene (HDPE) water bottles in a dry ice (carbon dioxide)/ethanol slurry. Ethanol will be obtained from a commercial source. Dry ice will be obtained in sufficient quantities from a local source.

MWH personnel will be required to transport quantities of these materials in amounts sufficient to complete the flash freezing process on the days that ground water will be sampled. MWH intends to transport these materials under the materials of trade exemption. The materials of trade exemption for these chemicals is as follows:

- Carbon Dioxide (Dry Ice)—30 kg or 66 lbs.
- Ethanol (Ethyl Alcohol)—30 L or 8 gal.

These materials will be secured and transported in the bed of a pickup, so that inhalation hazards will be minimized.

During the flash freezing process, MWH personnel will minimize the likelihood of cryogenic burns from contact with a dry ice/ethanol slurry. This will be facilitated by immersing water bottles in an insulated cooler with metal tongs, which will be placed on a flat surface, and physically separated from other personnel who may be working in the area. In addition to the level D personal protective equipment (PPE) worn by MWH field personnel and subcontractors while in the field, the following increase in PPE will be worn by MWH personnel when flash freezing samples:

- Protective face shield (with safety glasses) or goggles.
- Loose fitting gloves, such as cryo-gloves.
- Protective apron without pockets.
- Rubber boots.

Material safety data sheets (MSDS) for ethanol and carbon dioxide (dry ice) will be attached to this memorandum as Attachment 2.

Table 1 contains the Activity Hazard Analysis (AHA), which covers drilling operations and flash freezing.

TABLE 1 ACTIVITY HAZARD ANALYSIS FORM		
ACTIVITY: *Flash Freezing Water Samples*	***ANALYZED BY/DATE:*** *Paul Stenhouse, 10-11-05*	***REVIEWED BY/DATE:***
Principal Steps	**Potential Hazards**	**Recommended Controls**
Identify the principal steps involved, <u>including the equipment and machinery to be used</u>, and the sequence of work activities.	Analyze each principal step for its potential chemical/ toxicological, radiological, biological and physical hazards.	Develop specific controls for each potential hazard. Also: • List inspection requirements for the equipment / machinery listed. • Specify worker training requirements.
• Transport dry ice and ethanol • Prepare the dry ice/alcohol slurry for flash freezing in a insulated cooler, on a flat, hard surface away from other workers. • Immerse water samples in slurry using metal tongs. • Slowly whirl water samples until sample is frozen (~7 minutes). • Remove water samples and place in cooler.	<u>Chemical/Toxicological Hazards</u>: Carbon dioxide, ethanol. Chemical exposure hazards are listed in Attachment 2. <u>Radiological Hazards</u>: No radiological hazards are anticipated. <u>Biological Hazards:</u> No biological hazards are anticipated. <u>Physical Hazards:</u> 1. Driving Hazards. 2. Cryogenic burns.	<u>Chemical/Toxicological Hazards:</u> 1. Air monitoring is not required for this task; see Attachment 2 for the specific MSDS. Slurry mixture will be prepared in a well ventilated outdoor area. <u>Radiological Hazards:</u> No radiological hazards are anticipated. <u>Biological Hazards:</u> No biological hazards are anticipated. <u>Physical Hazards:</u> Driving hazards are addressed in the SI HASP, section 12.2.4, *Motor Vehicle Hazards*. Dry ice and ethanol will be transported in the bed of a pickup, and secured in a suitable container with straps or chains. First aid for cryogenic burns: 1. Remove from cryogen hazard. 2. Remove any clothing that affects circulation. Frozen clothing should be removed slowly, to prevent skin removal. 3. Immerse affected area in warm water (~105°F) and rewarm slowly (up to 60 minutes). 4. Seek immediate medical attention. 5. Cover thawed area with sterile dressings if thawing occurs prior to medical help. 6. Avoid alcohol and nicotine. Warm drinks and food are acceptable. <u>PPE Required:</u> • Level D as initial level, with supplemental protective garb when flash freezing samples.

TABLE 1 ACTIVITY HAZARD ANALYSIS FORM		
ACTIVITY: *Monitoring Well Installation*	***ANALYZED BY/DATE:*** *Paul Stenhouse, 10-11-05*	***REVIEWED BY/DATE:***
Principal Steps	**Potential Hazards**	**Recommended Controls**
Identify the principal steps involved, including the equipment and machinery to be used, and the sequence of work activities.	Analyze each principal step for its potential chemical/ toxicological, radiological, biological and physical hazards.	Develop specific controls for each potential hazard. Also: • List inspection requirements for the equipment / machinery listed. • Specify worker training requirements.
MWH personnel will observe and assist with the following: Mobilization or drilling rig and support equipment Set up of rig (e.g., brush clearing, leveling) Set up of rods, drill strings, etc. Drill to depth and retract Use borehole to: Install well casing and screen – develop and collect water samples. Complete borehole by: Grouting hole Seal well with sand and grout, may inert depth-discrete sampling sleeve Create surface completion – well stove pipe, marker, cap etc. Document work Make sure site is tidy prior to moving to next work area.	Chemical/Toxicological Hazards: Silica from grout Hydraulic oil spill Radiological Hazards: No radiological hazards are anticipated Biological Hazards: Ticks, mosquitoes, spiders. Physical Hazards: Slip / Trip / Fall on same or lower level Contact with buried or overhead utility • Heat stress, sunburn • Hand injury from hand tools, brush clearing equipment and drilling equipment • Heavy lifting of drilling rods, augers and packed sample coolers, waste containers, and awkward postures while cleaning tools and sampling equipment • Rig tip-over on uneven terrain • Being struck by or caught by / between something – especially if a backhoe is used to clear brush. • Fires from dry brush • Foreign object to eye from rotating equipment and dust • Noise • Spill or damage to equipment not secured in vehicles during travel.	Chemical/Toxicological Hazards: a) Personal Protective Equipment (PPE), Level D b) Review MSDS for grout – stand upwind of the contractor while dry grout is being poured. The drilling subcontractor may wear half-face APR with dust filter while mixing grout. c) Ensure that the driller has the means to contain and handle a hydraulic oil release from the rig. Radiological Hazards: None required. Biological Hazards: • PPE: Long pants, light colored clothing, ankle high boots, Tyvek and gloves optional. • First Aid Kit: Insect repellent with the active ingredient DEET at no more than 30%; bug bite supplies. • Conduct self inspection for ticks or insect bites. Physical Hazards: • Observe terrain for holes and trip hazards. Wear boots with significant tread. Work above six feet over the ground requires fall protection (guard rail, safety net or harness and lanyard). If drill rig mast must be climbed a 5-point harness and lanyard must be worn and tied to an approved anchorage point. Maintain 3 points of contact when mounting the rig. • Prior to drilling an underground utility survey must be completed. Try to allow a five foot clearance to marked underground utilities. Before raising the drill mast or drill string walk around the rig looking up for any overhead lines. If a 20-foot clearance can not be maintained contact the utility and arrange to have the power turned off or insulated. • On hot days (e.g., over 90 degrees F) wear light colored clothing. It is recommended that sunscreen be used if working in direct

		sunlight. • Use heavy work gloves when handling tools or equipment with sharp edges. Select hand tools carefully, considering the relative safety of the tool compared to others (e.g., choose cutters over knives for cutting things). Cut away from the body and be sure that no one else is within two arms' lengths of the tool. • Practice safe lifting. • Ensure that the drilling contractor inspects the rig, keeps a tidy workplace around the rig, and replaces any faulty or suspect items. Stay away from rotating parts (ask driller to identify pinch points – do not touch anything you are not familiar with and know is safe), approach only when the operator knows you are there (e.g., make eye contact). • Never stand underneath a suspended load. Always verify with a rig operator that the drilling platform area is safe to approach. • Be sure that the rig and support vehicles have emergency brakes set and wheels chocked. Use leveling jacks as necessary to stabilize the rig. • Verify that no dry brush is under parked vehicles. • Wear brightly colored safety vest if any moving heavy equipment is on site. Do not stand or get within the swing radius of a backhoe or similar piece of equipment. • Wear safety glasses when in the exclusion zone. • Wear hearing protection when standing within ten feet of the rig while split spoon samplers are driven and within 30 feet of air rotary casing hammer rigs. Hearing protection may be discarded if a noise survey indicates that levels are below 85 dBA. • As a standard rule of practice ensure that items being hauled in vehicles are secured in sturdy containers and held from sliding with bungee cords, ties, or compartments. Any compressed gas cylinders (e.g., for equipment calibration must be secured upright or in a carry case).

Attachment 1
MWH ES&H Procedure No. 811, Drilling Safety

811 DRILLING SAFETY

I. PURPOSE

This procedure provides information on the hazards, regulatory requirements, and safe work practices for using drilling equipment and performing drilling operations. This procedure address all forms of drilling, including cable tool, rotary, geo-probe, rotosonic, and hollow-stem auger drilling used for most geotechnical, investigation, groundwater, and subsurface exploration drilling projects.

II. REGULATORY REVIEW

There are no specific Occupational Safety and Health Administration (OSHA) regulations for drilling activities; however, general guidelines may be found in 29 CFR 1926.800, *Underground Construction,* section (q). In addition, some of the OSHA standards that are applicable to drilling operations include:

29 CFR 1926, Subpart E, *Personal Protective and Lifesaving Equipment*
29 CFR 1926.65, *Hazardous Waste Operations and Emergency Response*
29 CFR 1926.251, *Rigging Equipment for Material Handling*
29 CFR 1926.307, *Mechanical Power-transmission Apparatus.*
29 CFR 1926.550, *Cranes and Derricks*
29 CFR 1926, Subpart Z, *Toxic and Hazardous Substances*

Some state OSHA plans may have additional requirements for drilling. Also, the client may have specific permits or operation practices that will be applicable to MWH drilling operations. Contact the Regional ES&H Manager for additional information.

Additional information may be obtained from the following non-regulatory references:

- ATEC Associates, Inc. 1991. *Drilling Safety: Working in the Danger Zone.*
- Diamond Core Drill Manufacturers Association (DCDMA) and the National Drilling Contractors Association (NDCA). *Drilling Safety Guide.* National Drilling Federation.
- Driscoll, Fletcher. 1989. *Groundwater and Wells.*
- West Hazmat Drilling. 1991. *Workplace Injury & Illness Prevention Program.*
- U S Army Corps of Engineers, EM385-1-1, *Safety and Health Requirements* Chapter 16.

III. ROLES AND RESPONSIBILITIES

A. ES&H Director

The ES&H Director is responsible for establishing a program that provides for the protection of MWH employees and subcontractors and that meets the applicable regulatory requirements for the use of, and work adjacent to, drilling equipment.

B. Regional ES&H Manager

The Regional ES&H Manager is responsible for:

- Ensuring that this procedure is implemented within his or her region.
- Ensuring assessments are completed to verify compliance with regulatory and procedure requirements.

C. ES&H Representative

The ES&H Representative is responsible for the following:

- Evaluating work sites and activities to ensure drilling operations are conducted in compliance with the requirements of this procedure and regulatory standards.
- Verifying that equipment inspections are completed and that equipment used is in serviceable condition.
- Verifying that employees are following safe work practices for work with, and adjacent to, drilling operations.

D. Employee

Each employee is responsible for the following:

- Understanding the hazards and following the required safe work practices for drilling operations.
- Using the personal protective equipment (PPE) specified for the task being performed.

IV. DEFINITIONS

Annulus: The space between the drill string (length of connected drill pipe) or casing and the wall of the borehole or outer casing.

Auger Drilling: A general type of drilling in which the borehole is drilled by rotating augers (either hollow-stem or solid-stem), and cuttings are removed by being pushed up the "flights" (corkscrew-like flanges) of the augers. (Note: the term "flight" is often used to indicate the lengths of hollow-stem or solid-stem augers, as well as the flanges on the augers.) Hollow-stem augers allow drillers to send split-spoon samplers down through the center of the augers, thereby eliminating the need to pull out the augers first. Solid-stem augers are used for smaller-diameter holes and for drilling through formations where more concentrated downward force is necessary.

Bit: The cutting tool attached to the bottom of the drill string. Used in rotary drilling.

Blowout: An uncontrolled escape of drilling fluid, gas, oil, or water from the well caused by the formation pressure being greater than the hydrostatic head of the fluid in the borehole. Also, an uncontrolled escape of grout from the borehole or well caused by malfunctioning pressure grouting apparatus.

Cone Penetrometer Testing (CPT): This was originally a method of performing geotechnical evaluations of subsurface soils, now additionally used to obtain rough estimates of aquifer properties. The CPT rig uses a direct-push method to advance a cone equipped with electronic sensors. As the cone is pushed downward, measurements are collected by the sensor and are recorded on the CPT aboveground equipment. Some CPT rigs are also capable of collecting soil gas, soil and groundwater samples at shallow depths (usually less than 50 feet).

Cuttings: Formation particles obtained from a borehole during the drilling process.

Direct-Push Soil Gas/Soil/Groundwater Sampling: A method of sampling either soil gas, soil, or groundwater by advancing a small sampling probe. The probe is hydraulically pushed downward, generating virtually no cuttings and eliminating waste disposal concerns. Direct-push sampling is applicable where no permanent wells are desired, and/or where sampling is required at relatively shallow depths (usually less than 50 feet). Direct-push equipment may be truck-mounted (on a vehicle), or mounted on a modified hand truck.

Drill Collar: A length of extremely heavy steel tube. It is placed in the drill string immediately above the bit to minimize bending caused by the weight of the drill pipe.

Drill Pipe: A special pipe used to transmit rotation from the rotating mechanism to the bit. The pipe also transmits weight to the bit and conveys air or fluid, which removes cuttings from the borehole and cools the bit.

Drilling Fluid or Mud: A water-based or air-based fluid used in the well drilling operation to remove cuttings from the borehole, to clean and cool the bit, to reduce friction between the drill string and the sides of the borehole, and to seal the borehole.

Grouting: The operation by which grout is placed between the casing and the sides of the borehole to a predetermined height above the bottom of the well. This secures the casing in place and excludes water and other fluids from the borehole. A pressure grouting operation injects grout from the surface under high pressure, in order to move grout laterally in the subsurface and ensure an adequate seal.

Kelly: A hollow steel bar or pipe that is the main section of drill string to which the power is directly transmitted from the rotary table to rotate the drill pipe and bit. The cross section of the kelly is either square, hexagonal, or grooved. The kelly works up and down through drive bushings in the rotary table.

Limited Access Drill Rig: A type of drill rig, usually equipped with solid-stem augers, which allows drilling in tight spaces or in areas with low overhead clearance (less than 12 feet). Limited access drill rigs may be mounted on a small lawnmower-like vehicle, or on a modified hand truck.

Rotary Drilling: A general type of drilling in which the borehole is drilled by rotating a bit, and cuttings are removed by continuous circulation of a drilling fluid (e.g., mud, water, air, foam) as the bit penetrates the formation. The bit is attached to the lower end of a string of drill pipe, which transmits the rotating action from the rig to the bit.

Rotary Table: A mechanical or hydraulic assembly that transmits rotational torque to the kelly, which is connected to the drill pipe and the bit. The rotary table has a hole in the center through which the kelly passes.

Split-Spoon Sampler: A thick-walled steel tube split lengthwise used to collect soil samples. The sampler is commonly lined with metal sample sleeves and is pounded or pushed downhole by the drill rig to collect samples.

V. PLANNING

A. Training

Only trained and experienced personnel who are familiar with the use, limitations, and maintenance requirements of the equipment are permitted

to operate the drill rig. The drill rig must be operated in accordance with the manufacturer's instructions and recommendations.

The drill crew shall be familiar with the hazards associated with the drilling operations, personal protective equipment requirements, location of emergency stops, site-specific safety requirements, and the content of this procedure.

Additional training requirements may be required based on the location of the drilling activities. This training may include:

- Hazardous Waste Operations training if work is conducted at a hazardous waste site.
- Waste management training, where waste streams (e.g., drill cuttings, purge water, decontamination water, contaminated personal protective equipment) will be generated.

Site-specific training requirements will be outlined in the project-specific HASP.

B. Medical Surveillance

There are no medical surveillance requirements specific to drilling activities. However, drilling at hazardous waste sites that involve toxicological hazards may require medical surveillance.

Medical surveillance requirements will be addressed in the Project HASP.

MWH drilling subcontractors are responsible for ensuring that their employees receive medical surveillance as required.

C. Safety Equipment

MWH will provide required PPE and safety equipment for its employees and operations. Subcontractors are responsible for providing all PPE and safety equipment necessary for safe operation. Safety equipment will be provided by the subcontractor as delineated in the subcontract and referenced documents. The minimum safety equipment for drilling activities includes safety-toed boots, hard hats, and safety glasses with side shields. Other safety equipment that may be required for drilling operations includes:

- Hearing protection when working in proximity to drilling machinery.
- Body protection (e.g., gloves and protective coveralls) when chemical hazards exist.

- Detection equipment shall be provided if the exact location of underground utilities cannot be determined.
- Air monitoring instruments shall be provided if the potential for a hazardous atmosphere exists in the drilling location.
- High-visibility warning vests are to be worn by all workers exposed to vehicle traffic.
- Fall protection equipment is required if working from unprotected platforms or surfaces greater that 6 feet above the lower level.

D. Subcontractor Selection and Oversight

The *Subcontractor Safety Program Review Criteria—Drilling Operations*, Attachment A, provides the minimum criteria for subcontractor drilling safety procedures. These criteria will be used by the ES&H Representative or ES&H Staff to review subcontractor programs and procedures

Responsibilities for environment, safety and health are expressly defined in the subcontract terms and conditions, and MWH's ES&H practices in the field are determined based on these defined responsibilities. MWH employees shall not direct the means and methods of the subcontractor's operations or direct the details of corrective actions except when MWH employees are responsible for the work activity by contract.

E. Planning Activities

Depending on the contract with the client, the subcontract with a drilling subcontractor, and the physical location of the drilling operation, MWH, may be responsible for some of the following functions to support drilling operations. The responsible party for these items should be clearly defined in the contract and subcontract requirements and included in the Project ES&H Plan.

1. Utility Location

The location of underground utilities, such as electric, fuel, water, cable, telephone, and sewer (either in service or abandoned), and underground installations such as foundations, underground storage tanks, piping, and any other structures need to be identified before drilling is permitted. Utility companies and/or installation owners shall be contacted to provide exact locations of their equipment or structures. Some states have a one-call phone number for locating underground utilities. Most utilities and call

centers require a minimum 48-hour-notice (excluding Saturdays, Sundays, and holidays) to identify utilities before drilling work can begin.

If underground utilities cannot be positively located, or where drilling is performed in areas known or suspected to contain buried objects (e.g. drums, tanks, or cylinders), the area will be surveyed with the aid of audio and radio frequency transmitters and receivers, ground penetrating radar, ultrasonic testing, metal detectors, or other means necessary to ensure safe drilling operations.

Overhead electrical transmission and communication lines also need to be identified. If any portion of the drill rig will be within: 10 feet of electrical lines up to 50kV or 10 feet plus 4 inches for every 10 kV over 50 kV, the utility or other facility operating the system will be contacted to have the lines de-energized.

Access to the work location will also be evaluated. Where rigs must travel under energized electrical lines, clearance will be 4 feet for voltages up to 50kV; 10 feet for voltages over 50kV and up to 345kV; and 16 feet for voltages from 345kV up to 750kV.

2. Permits

The following permits and notifications may be required, depending on state, local, and client requirements. The Regional ES&H Manager should be contracted for assistance in determining applicability.

- Well driller license/certification or Professional Geologist requirements: MWH subcontractors will be required to submit licenses or certifications before subcontract award, where applicable.

- Well installation or abandonment notification: Submittal of a well log or inventory may be required after installation or abandonment.

- A groundwater withdrawal permit may be required for large water withdrawals in some states.

- A "drilling permit" may be required at certain client facilities.

3. Waste Management

Drill cuttings and purge water from uncontaminated soil or ground water shall be appropriately.

When drilling is conducted at hazardous waste sites, the Regional ES&H Manager or designee may be consulted on the proper evaluation, disposal, and decontamination procedures involving potential hazardous waste.

- All waste generated shall be evaluated for appropriate disposal and handled in accordance with the appropriate waste management procedure.

- If drilling involves hazardous waste, MWH decontamination procedures shall be followed. No potentially contaminated equipment shall be permitted to leave the work site.

4. Drilling at Ordnance Explosives (OE) or Unexploded Ordnance (UXO) Sites

If the project site is suspected of OE contamination, the requirements of the ES&H procedure for *Unexploded Ordnance, Open Firing Ranges, and Chemical Warfare Agents,* shall be followed. The following procedures will be implemented, at a minimum:

- Drilling operations on OE sites will not be conducted until a complete plan for the site is prepared and approved by MWH ES&H, and the UXO Safety Officer. OE/UXO avoidance must be conducted during drilling operations on known or suspect OE sites.

- The UXO team will identify and clearly mark the boundaries of a clear approach path for the drilling crews, vehicles, and equipment to enter the site. This path will be, at a minimum, twice the width of the widest vehicle. No personnel will be allowed outside any marked boundary.

- If OE is encountered on the ground surface, the UXO team will clearly mark the area where it is found, report it to the proper authorities, and divert the approach path around it.

- The UXO team will conduct an access survey using the appropriate geophysical instrument over the approach path for avoidance of OE that may be in the subsurface. If a magnetic anomaly is encountered, it will be assumed to be OE and the

approach path will be diverted around the anomaly. Only UXO personnel will operate the appropriate geophysical instrument and identify OE.

- An incremental geophysical survey of the drill hole location(s) will be initially accomplished by the UXO team using a hand auger to install a pilot hole. If OE is encountered or an anomaly cannot be positively identified as inert material, Hazardous Toxic Radiological Waste sampling personnel will select a new drill hole location.

- Once a drilling site has been surface cleared and a pilot hole established as described above, the drilling crew or subcontractor will be notified that the site is available for subsurface drilling.

VI. PROCEDURE

A. Safe Work Practices

Only authorized or licensed personnel, based on applicable state or local requirements, shall be permitted to operate drill rigs.

When moving large equipment in a confined area, spotters shall be used. The spotter and equipment operator must use standard hand signals for communication. Spotters shall never place themselves between equipment and fixed structures or equipment.

Drill site work areas shall be demarcated to deter unauthorized individuals from entering the work area.

Personnel not involved in equipment operation shall remain clear of drill rigs.

Personnel shall stay clear of the rotating augers and other rotating components of drill rigs at all times. Stand to the side while tripping and tailing rods and augers. Never stand under the rod/auger or between the rig and service truck while tripping rods or augers.

Stay as clear as possible of all hoisting operations. Loads shall not be hoisted over personnel. Never work around or under drilling rods or augers being hoisted.

Keep footwear and work area free of mud and drilling fluids. Maintain 3 points of contact when mounting and dismounting a drill rig. Do not climb the drill rig mast without the use of fall protection.

Augers shall not be stored standing up and shall be secured from rolling.

Hand tools shall be inspected before use. Wrench jaws must be periodically inspected and replaced when necessary.

Understand and be aware of all pinch points including breakout wrenches, pull down cables, and pulling jacks. These points should be color-coded. Experienced employees must show new employees these pinch points on the first day of work.

Good housekeeping shall be maintained at all times. Litter will be properly stored, and hand tools and other hardware will be properly secured on the drill rig. Before moving a drill rig, a check shall be made for loose tools and hardware.

All work areas, platforms, walkways, scaffolding, and other accessways should be maintained free of materials, debris, obstructions, and substances, such as ice, grease, or oil.

Drill rods and augers should be placed on dunage and secured to prevent movement. Always use a sling or strap while manually handling rods and augers.

Be aware of your footing to prevent slips, avoid stepping between rods and augers to prevent crushed ankles from their movement.

Do not wear loose-fitting clothing or other items, such as rings or watches, that could get caught in moving parts. Individuals with long hair should have it restrained.

Personnel shall not smoke around drilling operations.

Personnel shall wear the appropriate PPE. Minimum protection includes safety-toed boots, hard hats, safety glasses, and hearing protection.

A daily safety briefing shall be conducted with all work site personnel to discuss the work planned for the day and the ES&H requirements.

Unattended boreholes shall be covered or protected to avoid the possibility of animals or people accidentally falling into them.

Wellheads on roads and parking lots should be flush-mounted.

B. Site Preparation

Verify that underground utilities and structures have been located and marked, and overhead utilities de-energized as required.

As applicable, the drilling site shall be prepared, cleared, and leveled, particularly on steep slopes or areas that are covered with dry dead grass and weeds. Care should be taken in constructing pads if extensive cutting into existing slopes or surfaces is required to level the area. Areas where extensive fill is required should be avoided. Compaction is recommended if significant amounts of fill are needed; the ground must be capable of supporting the impact imposed by the drill rig and associated equipment. Clean fill or gravel can be brought in to cover areas with surface contamination.

Before drilling equipment is mobilized to the drilling pad, the travel route shall be surveyed for overhead and terrain hazards. Access roads shall be designed, constructed, and maintained to safely accommodate the movement of the drill rig and other equipment.

Material Safety Data Sheets (MSDSs) shall be available for all drilling fluids, grout, bentonite, or other substances used in the drilling process.

C. Drill Rig Requirements

All self-propelled drill rigs shall be equipped with the following safety features:

- Seatbelts,
- Multipurpose dry chemical fire extinguisher rated at not less that 2A:10B:C
- Multidirectional alarm
- Operator's Manual
- Horn
- Lights
- Other warning devices specified by the manufacturer

Self-propelled off-road drill rigs will be equipped with roll-over protective structures (ROPS) meeting Society of Automotive Engineers requirements.

The drilling equipment shall be equipped with two easily accessible emergency shutdown devices.

Control levers on the drill rig shall be clearly labeled indicating the function and direction of the movement.

All machine guards shall be in place while the rig is in operation.

Where drill rigs are equipped with a platform, the platform shall be constructed from material strong enough to support the weight of the load that will be placed on the platform. The platforms shall be accessed using a ladder or steps. Platforms over 6 feet above ground surface shall be equipped with a guardrail system that includes a toeboard.

The drill rig and associated equipment shall be inspected each day before use by a qualified mechanic or an operator knowledgeable of the specific equipment. Inspections and tests will be conducted in accordance with the manufacturer's recommendations. A written record of the inspections shall be kept on the equipment or in a project file. Consideration shall be given to the following items in the performance of equipment inspections.

- Missing nuts, bolts, pins, loose fittings and couplings.
- Cracked paint, frayed cables and hoses, evidence of fluid leakage on equipment or ground, and loose tracks and pads.
- Fluid levels in the battery, hydraulic system, brake system, and cooling systems; engine lubrication; and fuel supply. CAUTION: Never use your hands to check for hydraulic leaks. An open flame shall not be used to check fluid levels or look for leaks.
- Condition of glass in cab clean and not broken, gauges checked for proper function and readings; test of brake lights, horn, backup alarm, steering, and other controls.
- All emergency shutdown and warning systems to ensure that they are working correctly.

When deficiencies that affect the safe operation of equipment are identified, the equipment will be immediately taken out of service until unsafe conditions are corrected. A "DO NOT OPERATE" tag indicating that the equipment is not to be operated will be placed on the operator controls. When required or necessary, lockout procedures will be used. When corrections are made, the equipment will be re-tested for safe use before being returned to service.

D. Equipment Travel and Set-up

Safe clearances from overhead electrical transmission lines shall be maintained.

The operator shall ensure ground is stable and that grades, especially side traverses, are within the operating limits of the vehicle.

The mast shall be lowered and rig placed in appropriate configuration for travel. Drilling equipment shall not be transported for even a short distance with the mast up.

The drill rig must be leveled and stabilized with leveling jacks. Cribbing shall be used as necessary. Outriggers shall be extended per the manufacturer's specifications. Cribbing materials should be made from materials that are capable of supporting the weight of the rig. Care should be taken in muddy, soggy soils, or partially frozen areas. In addition to cribbing, guy wires should be used as required by the manufacturer to improve stability if the rig is located on wet, partially frozen ground, or in areas with loose, caving soil, or in an area subject to frequent gusty winds.

Prior to raising the mast (derrick) the operator shall look up for overhead obstructions. The drill rig operator shall verify that all personnel are cleared from the area immediately to the rear and the side of the mast.

Unsecured equipment shall be removed from the mast and cables; mud lines and cat line rope must be secured before raising the mast.

Before starting drill operations, the mast shall be secured and locked in accordance with the manufacturer's recommendations.

E. Equipment Operation

The drill rig shall be provided with a "kill" switch that, when activated, will shut down the rig. The switch should be clearly identified and tested daily to confirm operational status. All drilling crew members should be made aware of the location and purpose of this switch.

The rope, wire rope, or cable on the drill rig should never be wrapped around any part of the body.

The drill rig should not be operated during severe inclement weather, such as lightning storms, high winds, or severe rain. The mast should be lowered during these conditions.

Before starting, the operator shall verify that all gear boxes are in neutral; all hoist levers are disengaged; hydraulic levers are in the correct non-actuating positions; and the cathead rope is not on the cathead.

The operator shall verbally alert workers and visually verify that workers are clear from the dangerous parts of equipment before starting the equipment.

Drill crew members shall not wear loose clothing or clothing with loose ends, straps, drawstrings, belts, or otherwise unfastened parts that might catch on rotating or translating components of the drill rig. Rings and jewelry shall not be worn during a work shift.

The drill rig shall always be operated from the control panel. The operator must never leave the control panel while the drill is in operation. Only one person should operate the machine. If the operator must leave the area of the controls, the operator must shift the transmission controlling the rotary drive into neutral and place the feed control level in neutral. The drill rig shall be shut down before he operator leaves the vicinity of the drill.

Pressurized lines, such as airlines, mud hose, etc. shall be equipped with safety-type couplings and secured with wire or chain at each coupling to prevent whipping in the event of failure. Lines and safety connection shall be inspected daily. Pressurized lines shall not be disconnected until shut off and bled to reduce the pressure.

Drilling fluid discharges shall be channeled away from the work area to prevent the accumulation of water. Mud pits and drainage channels should be safely sloped and located to provide minimum interference with the work. Where necessary, suitable barricades or temporary fencing should be provided to protect the work area and reduce the possibility of injury to persons.

Where compressed air drilling is conducted, the exhaust shall be directed into an approved dust collection system. The cuttings shall be directed to the side away from employees. Workers shall be required to use protective clothing and respiratory protection, when required.

1. Tool Handling – Hoist Line

All wire ropes and rigging hardware shall be thoroughly inspected before use. Defective equipment shall not be used. Shop fabricated rigging or hooks without latches are not permitted. Where a chain sling is used, it shall be an alloy chain and shall be properly labeled.

Hoist and rigging hardware shall be used only for their designated intent and shall not be loaded beyond their rated capacity. Steps shall be taken to prevent two-blocking of hoist.

The tool handling hoist shall only be used for vertical lifting of tools. The tool hoist must not be used to pull on objects away from the drill rig, unless specifically designed for that purpose.

Drill rods shall be neither run nor rotated through rod slipping devices: no more than 1 foot of drill column shall be hoisted above the top of the drill mast. Drill rod joints shall not be made up, tightened, or loosened while a rod-slipping device supports the rod column.

Chuck jaws shall not be used to brake a string of drill rods while being lowered into the hole. A cat line or hoisting cable or plug should be used for braking before tightening the chuck.

- Drilling rods shall not be lowered into the hole with a pipe wrench.

- When stuck tools or similar loads cannot be raised with a hoist, disconnect the hoist line and connect the stuck tool directly to the feed mechanism of the drill. Do this only when the rope is secured with a wrench or dog collar. Do not use hydraulic leveling jacks for added pull to the hoist line or feed mechanism of the drill.

Loads shall not be hoisted over the head, body, or feet of any person. Loads shall not be left suspended when the hoist is unattended. Work is not permitted under a suspended load.

Hoist lines shall not be used to ride up the mast of a drill rig.

When wire rope hoist lines are used, the following precautions shall be followed:

- Wire rope must be properly matched with each sheave. (If too large, the rope will pinch; if too small, the sheave will groove. Once a sheave is grooved, it will pinch and damage the larger rope.)

- Most sheaves on rigs are stationary and designed for a single-part line. Never increase the number of sheaves, winch lines, or part lines unless approved by the drill manufacturer.

- Minimize the shock to wire rope. Pull loads smoothly and steadily, especially in cold weather. Never use frozen ropes.

- Protect wire rope from sharp corners and edges. Replace faulty guides and rollers.

- When handling wire rope, always wear gloves. Do not guide rope onto hoist drums with your hands. Replace the wire rope

according to manufacturer's specifications. When new rope is installed, first lift a light load to allow the rope to adjust.

2. Auger Drilling

Use an auger guide to facilitate the starting of a straight hole through hard ground or pavement, as applicable. Apply an adequate amount of down pressure before rotation to seat the auger head below the ground surface.

The operator and tool handler shall establish a system of responsibility for the series of activities required for auger drilling, such as connecting and disconnecting auger sections, and inserting and removing auger fork.

The operator shall verify that the tool handler and others are clear from the auger column and that the auger fork is removed before starting rotation.

The manufacturer's recommendations must be followed for securing the auger to the power coupling. Workers shall not touch the coupling or the auger with their hands, a wrench, or any other tools during rotation.

Only tight-fitting pins designed for the auger shall be used to secure auger flights. The use of mismatched augers shall be avoided.

Augers shall be cleaned only when the rotating mechanism is in neutral and the auger stopped. Long-handled shovels may be used to move auger cuttings away from the auger.

Workers shall not place their hands or fingers under the bottom of auger section when hoisting the auger over the top auger section in the ground or over hard surfaces such as drill rig platform.

Workers shall, stay clear of the rotating auger and other rotating components of the drill rig. Never reach behind or around a rotating auger for any reason.

3. Cathead Operations

The cathead shall be inspected before use. Inspection shall be made with the engine off. The cathead shall be kept clean and free of rust, oil, and grease. When 1/8-inch or greater rope groves form, the cathead should be replaced. In wet or icy conditions, a cathead cannot be used.

Always use a clean, dry rope. An oily rope may grab on the cathead. Never use a rope that is longer than necessary.

If the rope grabs or tangles, alert personnel to back away and stay clear. If tools are suspended, carefully shutdown the drill and back away. Once you have resolved the situation, the drill may be restarted and the tools lowered to safety.

Hoist lines shall be positioned to prevent contact with the cathead rope.

The following precautions shall be used to prevent cathead incidents:

- The operator should be on a level surface with firm footing.
- Do not wear loose clothing or gloves with loose straps or cuffs.
- Never wrap the rope around your hand, wrist, arm or other body parts. Never stand on the end of the cathead rope.
- Maintain a distance of 18 inches clearance between operating hand and drum.
- Be aware, the rope advances with each hammer blow.
- Do not leave a cathead unattended with the rope wrapped on the drum.

4. Rotary and Core Drilling

Water swivels, hoist plugs, rod chuck jaws etc. shall be inspected before use. Defective equipment shall not be used.

Only the operator of the drill rig shall brake or set a manual chuck so that rotation of the chuck will not occur before removing the wrench from the chuck.

Chuck jaws shall not be used to brake drill rods while lowering rods into hole. Drill rods shall not be held or lowered into the hole with pipe wrenches. If a string of drill rods are accidentally or inadvertently released into the hole, no attempt shall be made to grab the falling rods with hands or a wrench.

When drill rods are hoisted from the hole, they shall be cleaned to facilitate safe handling. The hand should not be used to clean drilling fluids from drill rods.

Drill rods shall never be lifted and leaned unsecured against the mast. Drill rods shall be secured to the upper ends of the drill rod sections for safe vertical storage or shall be laid horizontally.

In the event of a plugged bit or other circulation blockage, the pressure in the piping and hose between the pump and the obstruction should be relieved or bled down before breaking the first tool joint.

The spinning chain is very powerful and must be treated with respect. Spinning chains must have a rope tail. Communication between the driller and tool handler is required for safe operation of the spinning chain.

If freezing weather is expected, all air and water lines should be drained when not in use.

F. Drill Rig Maintenance

Components found to be in defective condition, either during inspections or during rig operation, should be repaired immediately.

Rig maintenance shall only be performed after appropriate lockout/tagout procedures have been implemented.

The cathead should be kept clean and free of rust, oil, and grease. The cathead should be cleaned with a wire brush if it becomes rusty.

Drilling operations may require repair or disentanglement of wire rope on the mast while it is raised. Fall protection shall be used when personnel are exposed to a fall of 6 feet or greater.

Augers should be cleaned only when the drill rig is in neutral and the augers have stopped rotating. Hands or feet should not be used to move cuttings away from the auger.

G. Self-Assessment Checklist

The *ES&H Self-Assessment Checklist – Drilling* provides a method of verifying compliance with established regulations, safe work practices, and industry standards pertaining to drilling operations. The MWH ES&H Representative or ES&H staff may use this checklist when MWH

employees and/or MWH Subcontractors are performing drilling operations or are exposed to the hazards of activities involving drilling.

VII. ATTACHMENTS

Attachment A: *Subcontractor Safety Program Criteria – Drilling Operations*
Attachment B: *ES&H Self-Assessment Checklist – Drilling Operations*

Drilling Operations
ES&H Procedure – 811
Attachment A

Subcontractor Safety Program Criteria – Drilling Operations

MWH

ATTACHMENT A

Subcontractor Safety Program Criteria – Drilling Operations

The following criteria are not intended to be all-inclusive, but are provided as a tool to facilitate review of subcontractor safety procedures. Subcontractors are expected to address the following items, at a minimum, in their safety procedures.

Minimum Acceptable Criteria for Subcontractor Drilling Safety Procedures:

1. Provide name and qualifications of the drilling "competent person" responsible for drilling (years and type of experience, training background, etc.).
2. Describe drill rig and equipment inspection criteria or procedures (frequency of inspections, visual vs. written inspections, items that are inspected).
3. Describe methods of identifying underground utilities (contacting utility companies, detection equipment).
4. Describe methods of avoiding contact with overhead power lines (de-energizing and grounding, insulating, safe clearance distances).
5. Describe methods to identify hazardous atmospheres and controls used to eliminate (detection equipment and controls).
6. Describe leveling and stabilizing methods for drill rig (drilling pad, jacks, cribbing, guy wires).
7. Verify that rig equipment is in good operational condition (including "kill" switch, cathead, ropes, pressurized hoses and lines, operator controls, machine guards, and drilling tools).
8. Describe procedures for operating in inclement weather, including lightning, high winds, and severe rain storms.
9. Describe other safe work practices for equipment operation (drill rig, equipment, tools, rig transportation, rig travel).
10. Describe on-the-job maintenance procedures, including lockout/tagout.
11. Describe safe work practices for other activities to be performed during this project (use of ladders, fall protection, electrical power tools, personal protective equipment, etc.).
12. Describe methods for disposal of non-hazardous drill cuttings and purge water (including accumulation, transport, and disposal).
13. If hazardous waste project, provide documentation of hazardous waste worker training and medical surveillance records for all project personnel (40-hour or 24-hour training, 8-hour refresher training) and describe methods of hazardous waste management (including accumulation, transport, and disposal).
14. Submit a copy of drilling license/certification and drill rig permit.
15. Describe methods and responsibilities for submittal of notifications and logs.
16. Complete the Waste Subcontractor Qualification form for each proposed transport and disposal facility.
17. Describe procedures for drilling site cleanup upon job completion.

<u>If drilling in areas with known or potential Ordance Explosives (OE)/Unexploded Ordnance (UXO) hazards:</u>

18. Provide documentation of UXO qualifications, hazardous waste worker training, and medical surveillance records for all project personnel (40-hour or 24-hour training, 8-hour refresher training).
19. Describe procedures for OE avoidance, identification and marking the boundaries of a clear approach path and work site for the sampling crews, vehicles, and equipment to enter the site.
20. Describe the procedures for drilling and monitoring and the process for encountered OE.

Drilling Operations
ES&H Procedure – 811
Attachment B

ES&H Self-Assessment Checklist – Drilling Operations

MWH

ATTACHMENT B

Self-Assessment Checklist – Drilling Operations

This checklist shall be used by MWH personnel only and may be completed at the frequency specified in the Project HASP or by the ES&H Representative.

This checklist is to be used at locations where (1) MWH employees and/or (2) MWH subcontractors are working on projects involving drilling operations.

During evaluation of MWH subcontractors, the ES&H Representative may consult with subcontractors when completing this checklist, but shall not direct the means and methods of operations nor direct the details of corrective actions unless provided for by contract requirements. Subcontractors shall determine how to correct deficiencies.

If deficiencies are identified that are considered imminent danger (possibility of serious injury or death) hazards, they shall be corrected immediately or all exposed MWH and MWH subcontract personnel shall be removed from the hazard until corrected.

Completed checklists shall be maintained in project ES&H Files.

Project Name: _____ Project No.: _____

Location: _____ PM: _____

Evaluator: _____ Title: _____ Date: _____

This specific checklist has been completed to:

☐ Evaluate MWH employee compliance with requirements

☐ Evaluate an MWH subcontractor's compliance with requirements

Check "Yes" if an assessment item is complete/correct.

Check "No" if an item is incomplete/deficient, section 2 must be completed for all items checked "No."

Subcontractor deficiencies shall be brought to the immediate attention of the subcontractor.

Check "N/A" if an item is not applicable
Check "N/O" if an item is applicable, but was not observed during the assessment

ATTACHMENT B

Self-Assessment Checklist – Drilling Operations

	Yes	No	N/A	N/O
Section 1				
SAFE WORK PRACTICES				
1. Only authorized, licensed operators meeting local requirements.	☐	☐	☐	☐
2. Spotters used for equipment in constricted areas.	☐	☐	☐	☐
3. Drill site work area demarcation in place.	☐	☐	☐	☐
4. Personnel cleared during rig startup.	☐	☐	☐	☐
5. Personnel clear of rotating parts.	☐	☐	☐	☐
6. Personnel not positioned under hoisted loads.	☐	☐	☐	☐
7. Augers and drill strings stored properly.	☐	☐	☐	☐
8. Good Housekeeping maintained on rig and work site.	☐	☐	☐	☐
9. Loose clothing and jewelry removed.	☐	☐	☐	☐
10. Smoking is prohibited around drilling operation.	☐	☐	☐	☐
11. Personnel wearing appropriate personal protective equipment (PPE).	☐	☐	☐	☐
12. Daily safety meeting completed.	☐	☐	☐	☐
13. Traffic control in place, where required.	☐	☐	☐	☐
Site Preparation				
14. Underground utilities & structures identified.	☐	☐	☐	☐
15. Drill site prepared for rig.	☐	☐	☐	☐
16. Travel routes surveyed for obstruction.	☐	☐	☐	☐
17. Required MSDSs on site.	☐	☐	☐	☐
Drill Rig Requirements				
18. Drill rig equipped with emergency stop controls.	☐	☐	☐	☐
19. Drill rig inspected daily, deficiencies corrected.	☐	☐	☐	☐
20. All machine guards are in place.	☐	☐	☐	☐
21. Platforms are properly constructed and accessible.	☐	☐	☐	☐
Equipment Travel and Set-up				
22. Safe clearance from overhead electrical maintained.	☐	☐	☐	☐
23. Mast lowered and equipment secure during travel.	☐	☐	☐	☐
24. Drill rig level and stabilized, proper cribbing used.	☐	☐	☐	☐
25. Mast secured before drilling.	☐	☐	☐	☐
Equipment Operation				
26. Personnel remain clear of cables and ropes.	☐	☐	☐	☐
27. Drilling operations suspended in inclement weather.	☐	☐	☐	☐
28. All gearboxes in neutral before starting.	☐	☐	☐	☐
29. Drill rig is always operated from control panel. Operator never leaves control panel while drill is in operation.	☐	☐	☐	☐
30. Pressurized lines are equipped with safety cables.	☐	☐	☐	☐
31. Drilling discharges channeled away from work area.	☐	☐	☐	☐
32. Compressed-air exhaust is controlled.	☐	☐	☐	☐
33. Wire ropes are inspected before use.	☐	☐	☐	☐
34. Hoist and hardware used only for designed purpose.	☐	☐	☐	☐
35. No more than one foot of drill column hoisted above mast.	☐	☐	☐	☐
36. Chuck jaws are not used as drill rod brake.	☐	☐	☐	☐
37. Wire ropes are properly matched to sleeves and are protected from sharp edges.	☐	☐	☐	☐
38. Operators are not guiding wire ropes with hands.	☐	☐	☐	☐
39. Auger guides are used to start auger in hard surfaces.	☐	☐	☐	☐

ATTACHMENT B

Self-Assessment Checklist – Drilling Operations

	Yes	No	N/A	N/O
40. Operator and tool handler have established responsibilities.	☐	☐	☐	☐
41. Augers are attached to power coupling per Manufacturer's instructions.	☐	☐	☐	☐
42. Auger flights are connected only by pins designed for such use.	☐	☐	☐	☐
43. Workers remain clear of auger and other rotating parts.	☐	☐	☐	☐
44. Cathead inspected before use.	☐	☐	☐	☐
45. Clean dry rope is used on cathead.	☐	☐	☐	☐
46. Proper actions are followed for cathead operations.	☐	☐	☐	☐
47. Drill rods are not leaned unsecured against mast.	☐	☐	☐	☐
48. Prior to disconnection plugged core drill rods, pressure source is isolated and pressure is bled off.	☐	☐	☐	☐
Drill Rig Maintenance				
49. Defects identified during inspection or operation are corrected before continuing operation.	☐	☐	☐	☐
50. Fall protection is used while climbing mast and for other unprotected elevated work.	☐	☐	☐	☐
51. Augers are cleaned only when drill is in neutral and auger has stopped.	☐	☐	☐	☐

ATTACHMENT B

Self-Assessment Checklist – Drilling Operations

SECTION 2

Complete this section for all items checked "No" in Sections 1. Deficient items must be corrected in a timely manner.

Item #	Corrective Action Planned/Taken	Date Corrected

Evaluator:_____ Project Manager:_____

Attachment 2
Material Safety Data Sheets

DRY ICE
MATERIAL SAFETY DATA SHEET

NSN: 685000F002383
Part Number/Trade Name: **CARBON DIOXIDE/DRY ICE**

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General Information

==========

Date MSDS Prepared: 01JUN90
Safety Data Review Date: 06APR94
Preparer's Company: AIR PRODUCTS AND CHEMICALS INC.
Preparer's St Or P. O. Box: 7201 HAMILTON BLVD
Preparer's City: ALLENTOWN
Preparer's State: PA
Preparer's Zip Code: 18195-1501
MSDS Serial Number: BBKVW

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Ingredients/Identity Information

==========

Proprietary: NO
Ingredient: CARBON DIOXIDE
Ingredient Sequence Number: 01
Percent: 100
NIOSH (RTECS) Number: FF6400000
CAS Number: 124-38-9
OSHA PEL: 5000 PPM
ACGIH TLV: 9000 MG/CUM
Other Recommended Limit: 10000 PPM

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Physical/Chemical Characteristics

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Appearance And Odor: COLORLESS, ODORLESS
Boiling Point: -109.3F
Melting Point: -69.9F
Vapor Pressure (MM Hg/70 F): 831 PSIA
Vapor Density (Air=1): 0.115
Specific Gravity: 1.56
Solubility In Water: APPRECIABLE

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Fire and Explosion Hazard Data

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Reactivity Data

==========

Stability: YES

Conditions To Avoid (Stability): MOISTURE
Materials To Avoid: CARBONIC ACID/SALT/CORROSIVE CHEMICALS
Hazardous Polymerization Occurrence: NO

==========

Health Hazard Data

==========

Route Of Entry - Inhalation: YES
Route Of Entry - Skin: NO
Route Of Entry - Ingestion: NO
Health Hazard Acute and Chronic: CONCENTRATION IN EXCESS OF 1.5% CARBON DIOXIDE MAY
CAUSE DEATH. AT HIGHER CONCENTRATIONS, DISPLACES OXYGEN IN AIR BELOW LEVELS
NECESSARY TO SUPPORT LIFE.
Carcinogenicity - NTP: NO
Carcinogenicity - IARC: NO
Carcinogenicity - OSHA: NO
Explanation Carcinogenicity: NONE
Signs/Symptoms Of Overexposure: AT CONCENTRATIONS >1.5%:
HYPERVENTILATION/HEADAHCES/
DYSPNEA/PERSPIRATION. AT 6-10%:
HEADAHCES/DYSPNEA/PERSPIRATION/TREMORS/VISUAL
DISTURBANCES. >10%: UNCONSCIOUSNESS W/OUT WARNING. CRYOGENIC BURNS.
Emergency/First Aid Procedures: INHALATION: REMOVE TO FRESH AIR. ASSISTED RESPIRANT
& SUPPLEMENTAL OXYGEN SHOULD BE GIVEN IF NOT BREATHING. FROZEN TISSUES SHOULD BE
FLOODED/SOAKED W/TEPID WATER. DON'T USE HOT WATER. OBTAIN MEDICAL ATTENTION IN ALL
CASES.

==========

Precautions for Safe Handling and Use

==========

Steps if Material Released/Spill: VENTILATE INDOOR AREAS WELL TO AVOID HAZARDOUS CO2
CONCENTRATIONS. VENTILATE AREA WELL & AVOID CONTACT W/COLD VAPORS/DRY ICE. CO2 IS
HEAVY GAS & WILL REMAIN IN LOW SPOTS W/OUT ASSISTED VENTILATION.
Waste Disposal Method: DON'T ATTEMPT TO DISPOSE OF RESIDUAL CO2 IN
COMPRESSED GAS CYLINDERS. RETURN CYLINDERS TO AIR PRODUCTS W/RESIDUAL PRESSURE,
CYLINDER VALVE TIGHTLY CLOSED/THE VALVE CAP IN PLACE. DISPOSE OF IAW/LOCAL/STAT/
FEDERAL REGULATIONS. NONFLAMMABLE GAS. UN1013.
Precautions-Handling/Storing: COMPRESS GAS CYLINDERS CONTAIN GASEOUS/LIQUID CO2 AT
EXTREMELY HIGH PRESSURE/SHOULD HANDLED W/CARE. KEEP CYLINDERS AWAY FROM HEAT.
Other Precautions: PREVENT CONTACT OF CO2 ON SKIN. USE PRESSURE-REDUCING REGULATOR
WHEN CONNECTING TO LOWER PRESSURE PIPING SYSTEMS. SECURE CYLINDERS WHEN IN USE. KEEP

FROM COMBUSTIBLES. AVOID EXPOSURE TO AREAS WHERE SALT/OTHER CORROSIVE MATERIALS ARE
PRESENT.

==========

Control Measures

==========

Respiratory Protection: SCBA IN OXYGEN DEFICIENT ATMOSPHERES/WHERE CO2 >1.5%.
DON'T USE AIR PURIFYING RESPIRATORS.
Ventilation: LOCAL EXHAUST: AT POINT SOURCES OF CO2 VAPORS.
MECHANICAL(GENERAL): LOW
LYING AREA ARE NOT NATURALLY VENTILATED.
Protective Gloves: IMPERMEABLE/LOOSE FITTING (LEATHER)
Eye Protection: SAFETY GLASSES
Supplemental Safety & Health Data: CO2 IS STORED IN CONTAINERS UNDER ITS OWN VAPOR
PRESSURE. IF THE PRESSURE IS SUDDENLY RELIEVED, THE LIQUID RAPIDLY COOLS AS IT
EVAPORATES & SUBLIMES, FORMING DRY ICE AT -109.3F.

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Transportation Data

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Disposal Data

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Disposal Data Review Date: 89018
Record # For This Disp Entry: 01
Total Disp Entries Per NSN: 001
Landfill Ban Item: YES
Disposal Supplemental Data: BOX 538/ALLENTOWN, PA 18105. ITEM NOT REGULATED AS A
RCRA HAZARDOUS WASTE BY THE FEDERAL EPA, BUT MAY BE REGULATED IN CERTAIN STATES.
1st EPA Hazardous Waste Name New: NOT REGULATED
1st EPA Hazardous Waste Char New: NOT REGULATED BY RCRA
1st EPA Acute Hazard New: NO

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Label Data

==========

Label Required: YES
Technical Review Date: 06APR94
Label Date: 06APR94
Label Status: F
Common Name: CARBON DIOXIDE/DRY ICE
Chronic Hazard: YES
Signal Word: DANGER!
Acute Health Hazard-Severe: X
Contact Hazard-Slight: X
Fire Hazard-Severe: X

Reactivity Hazard-None: X
Special Hazard Precautions: CONCENTRATION IN EXCESS OF 1.5% CARBON DIOXIDE MAY CAUSE
DEATH. AT HIGHER CONCENTRATIONS, DISPLACES OXYGEN IN AIR BELOW LEVELS NECESSARY TO
SUPPORT LIFE.
TARGET ORGANS: RESPIRATORY SYSTEM, SKIN.
CARCINOGEN: FORMALDEHYDE.
Protect Eye: Y
Protect Skin: Y
Protect Respiratory: Y

Material Safety Data Sheet
May be used to comply with
OSHA's Hazard Communication Standard
29 CFR 1910.1200. Standard must be
consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

Identity *(As Used on Label and List)*
ETHANOL (ETHYL ALCOHOL) DENATURED, 190 PROOF

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section 1

Manufacturer's Name THOMAS SCIENTIFIC	Emergency Telephone Number **Call Chemtrec - 800-424-9300 (24 hours a day)**
Address (Number, Street, City, State and Zip Code) P.O. BOX 99	Telephone Number for Information 856-467-200
SWEDESBORO, NJ 08085	Date Prepared 1/3/2005
	Signature of Preparer (Optional

Section II – Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Names(s))		OSHA PEL	ACGIH TLV	Other Limits Recommended	% (optional)
Ethyl Alcohol	CAS 64-17-5	1000ppm	1000ppm	N/A	87
Methyl Alcohol	CAS 6756-1	200ppm	200ppm	N/A	5
Ethyl Acetate	CAS 141-78-6	400ppm	400ppm	N/A	1
Methyl Isobutyl Ketone	CAS 108-10-1	50ppm	50ppm	N/A	1
Hydrocarbon Solvent	N/A	N/A	N/A	N/A	1
Water	CAS 7732-18-5	N/A	N/A	N/A	5

Section III – Physical/Chemical Characteristics

Boiling Point	79.4 Degrees (C)	Specific Gravity (H_20 = 1)	0.81
Vapor Pressure (mm Hg.) 19 Degrees (C)	40	Melting Point	N/A
Vapor Density (AIR = 1)	1.59	Evaporation Rate (Butyl Acetate = 1)	3.3

Solubility in Water
Miscible

Appearance and Odor
Colorless liquid, characteristic odor

Section IV – Fire and Explosion Hazard Data

Flash Point (Method Used) 57 degrees Fahrenheit (CC)	Flammable Limits	LEL 3.3	UEL 19

Extinguishing Media
Carbon Monoxide, dry chemical

Special Fire Fighting Procedures
Wear self contained breathing apparatus and protective clothing.

Unusual Fire and Explosion Hazards
Vapors can travel to ignition sources and flash back.

Section V – Reactivity Data

Stability	Unstable		Conditions to Avoid Heat, Sparks, Open flame
	Stable	X	

Incompatibility (Materials to Avoid)
Oxidizers, Nitric and Sulfuric Acids, Halogens

Hazardous Decomposition or Byproducts
Carbon Monoxide

Hazardous Polymerization	May Occur		Conditions to Avoid N/A
	Will Not Occur	X	N/A

Section VI – Health Hazard Data

Route(s) of Entry:	Inhalation?	Skin?	Ingestion?
	X	X	X

Health Hazards (Acute and Chronic)
Acute- Headache, Nausea, Dizziness, Narcosis; Ingestion can be fatal or cause blindness.
Chronic- Damage to Gastro intestine. Tract liver, Kidneys, Cardiovascular System.
Contact- Irritation to skin and eyes.

Carcinogenicity:	NTP?	IARC Monographs?	OHSA Regulated?

Test on laboratory animals may cause tumors , produce adverse mutagenic and reproductive effects.

Signs and Symptoms of Exposure
Ingestion or inhalation – headache, nausea, dizziness, narcosis.
Contact- irritation to skin and eyes.

Medical Conditions Generally Aggravated by Exposure
Kidney, liver, heart and GI conditions.

Emergency and First Aid Procedures
Skin- Wash with soap and water. Eyes- Flush with water for 15 minutes. Inhalation- Remove to fresh air.
Ingestion- If conscious, induce vomiting.

Section VII – Precautions for Safe Handling and Use.

Steps to Be Taken in Case Material Is Released or Spilled
Dike spill, take up with absorbent, containerize for disposal.

Waste Disposal Method
To be performed in compliance with all local, State and Federal regulations.

Precautions to Be Taken in Handling and Storing
Electrically ground all equipment when handling, residue may make empty container hazardous.

Other Precautions

Section VIII – Control Measures

Respiratory Protection (Specify Type)
Self contained breathing apparatus

Ventilation	Local Exhaust X	Special
	Mechanical (General) X	Other

Protective Gloves	Eye Protection
Neoprene or equivalent	X

Other Protective Clothing or Equipment
As indicated depending on volume being handled.

Work/Hygienic Practices
Avoid breathing vapor; ingesting and all contact with liquid.

Appendix J
Comments Resolutions

Response to Comments
Version 4 Draft Monitoring Well Installation Technical Memorandum for Final 2005 Phase II Supplemental SI Groundwater Work Plan

General

1 The naming convention for sample locations, especially the two Agrium production wells, needs to be consistent. For example, on page 10 the two Agrium production wells are listed as PW006, on page 16 they are listed as PW006A and PW006B. On Drawing 2 they are listed as PW006S and PW006N. On Drawing 3 and the Piper Diagrams they are listed as PW006. In Appendices B, C, and D, they are listed as MWPW006.

Response: Accepted.

2 Non-detects as found in tables in Appendices B and C should be reported as they were in the Draft October 2006 Groundwater Data Validation Report Memorandum, i.e., <0.05 (if detection limit is 0.05), rather than report them as ½ detection limit. Using ½ the detection limit is fine for analysis, but not for reporting.

Response: Accepted.

3 Where the reporting limit for sample results is above the applicable criteria, all samples flagged below the reporting limit will be considered to be at the criteria.

Response: In follow-up to our meeting of August 29, 2006, we were directed to report the reporting limit for censored data, and, for purposes of data evaluation, to assume a concentration of one-half the reporting limit for such censored values. (We use "detection limit" to refer to the data reporting threshold attributable to the standard laboratory methodology for the analysis in question—i.e., method detection limit; we use "reporting limit" to refer to the data reporting threshold attributable to both analytical method and sample-specific deviations [e.g., dilution, small sample mass, detections of analyte in associated blanks]—i.e., sample detection limit.) The request to assume a concentration of the standard in this case appears to conflict with the instructions we've received previously. We are happy to comply with this new request; however, we would appreciate confirmation that you want to change your previous instructions on this topic (the previous instructions that are reinforced in comment #2), and confirmation that this request applies only to data evaluation, not data reporting. Data evaluations produced subsequent to the MWITM will then be conducted under the modified instructions.

4 Please include a table with the identification numbers and names of the waste rock dumps and mine pits associated with each area (e.g., North Henry Dump is MWD085, Henry Mine Canyon Fill Dump is MWD087, West Ballard Pit is MMP035) of each mine.

Response: Accepted.

5 We understand that mining at both Enoch Valley and Henry mines occurred below the water table. Experience in Dry Valley where mining also occurred below the water table, shows that certain constituents in waste rock can become a concern under saturated anoxic conditions. Four of these constituents (aluminum, iron, manganese, and sulfate) fall under the Ground Water Quality Rule's Secondary Constituent Standards (IDAPA

58.01.11.200.01.b). Therefore these four parameters need to be monitored with the same regularity of other parameters (e.g., cadmium, selenium, zinc) listed in Table 6.

Response: Accepted.

6 The assumption is made throughout the document that springs, dump seeps, and headwater streams are surface expressions of groundwater. Yet, the source for seeps could be meteoric water and the source for headwater streams could be runoff water. Mention is made of a survey that looked at 88 springs and determined the provenance of 53 of those. Nothing in the document verifies the source of water or the provenance of the springs, dump seeps, and headwater streams identified in, for example, Figures 2, 3, and 4, Table 3, or Drawings 2, 3, and 10. Please provide the provenance of springs and seeps in the mining areas. Where no provenance exists, then this is a data gap to be filled in future phases of the investigation.

Response: An activity (Activity 3b-9) has been added to the Phase II investigation to test our hypothesis of a groundwater provenance for all springs, seeps, and headwaters denoted as surface expressions of groundwater. The testing will be done by geochemical classification using the expanded groundwater analytes (or a subset thereof).

7 We highly recommend that for all new wells a well screen type referred as a continuous slot, wire wrap screen be used. The screen material may be PVC or stainless steel and crush strength may dictate the material type. Should the opportunity arise, this type of screen better facilitates use of a colloidal borescope for helping to determine groundwater flow paths.

Response: Acknowledged.

8 On the 11 December 2006 monthly conference call, it was reported that the redevelopment of monitoring well MW001 was unsuccessful. It was also understood that another monitoring well to replace MW001 would be proposed in the same area. Please include information (e.g., location, formation, screened interval, depth) on this new well.

Response: P4 Production will replace both monitoring wells MMW001 and MMW002 at Ballard Mine with proposed wells MMW020 and MMW021 as shown in Drawings 10 and 11.

9 Throughout the document mention is made of a particular feature, yet no identification number is cited. For example, Page 25, Section 5.1, Paragraph 3 the site numbers for the receptor wells are not mentioned in the following sentence, "The well will be upgradient of three headwater streams and three receptor wells within the valley." Please include an identification number whenever a well, dump seep, stream, mine pit, waste rock dump, spring, or mine pond is referenced in the narrative as was done in Paragraph 2, Section 4.3.3, Page 23.

Response: Accepted.

10 For the benefit of those readers who are unfamiliar with the difference between censored and uncensored data, please provide a definition of each. Possible definitions might be:

Censored data – laboratories are limited as to the lowest concentration they can accurately measure. When concentrations in samples fall below the 'detection limit' they are reported as <DL (less than the detection limit).

Uncensored data – laboratories are limited as to the lowest concentration they can accurately measure. When concentrations in samples fall below the 'detection limit' they

are assumed to be normally distributed with a mean of 0. Thus, some of the samples below the detection limit will be negative and some positive. Those negative numbers are reported accordingly.

Response: See revised definitions below. Discussion has been added to section 3.

Measurements whose values are known only to be above or below a threshold are called "censored" data in the statistical literature. In environmental studies, censored data are commonly encountered as values below a detection limit. Called "less-thans" or "nondetects," these low values for constituents, such as trace metals, are known inexactly. (Helsel, 2005).

MWH uses the phrase "detection limit" (DL) to denote a method-specific performance parameter. Sample-specific deviations from the method--e.g., sample dilution, small sample size, detections of an analyte in a blank--may result in a lower level of analytical performance in a given sample. Because such sample-specific deviations do not alter the performance of the method, but rather the performance of the analysis for the specific sample in question, MWH uses the phrase "reporting limit" (RL) to denote the value at which a given datum is censored. In most instances the DL and RL will be identical. In some instances the RL will be greater than the DL.

In a blank—a sample containing a zero concentration of the analyte in question—the analytical result should ideally be 0. Due to random errors associated with even the best forms of sampling and analysis, repeated measurements of a blank should ideally be normally distributed with a mean of 0. When a sample contains a trace amount of analyte, the analytical results will behave similar to those of a blank, and for a normal distribution with a mean of zero, half the results will be negative. While negative concentrations do not exist in the environment, they do exist as noise in laboratory analytical results. By reporting the data in the original uncensored format the original quality of the data is preserved. Reporting of uncensored results allows for sampling and analysis noise to be quantified and disclosed on a batch-specific basis. Many agencies and organizations – e.g., USGS, ASTM, USEPA, USACE – advocate against data censorship, and uncensored data is of higher quality because they are more precise, more accurate, more representative, more comparable, and more complete (Rettmann, 2003).

Comments to be Included in Future Documents

11 Differences are seen in springs, seeps, and headwater stream stations within each mine. However, the monitoring proposed in the referenced document does not include any program to determine the reason(s) for these differences in groundwater quality. These differences may be significant if they are due to mining and/or reclamation techniques. A program should be developed and included in future documents to determine the cause(s) of the differences in groundwater quality within each mine site.

Response: Investigation of the cause(s) of the differences in groundwater quality within each mine site will be address in Activity 3b-9 and Activity 3b-8 of the Phase II investigation.

12 A number of mine ponds are shown in Drawings 3 and 10 with the station designation of MSPXXX. However, the analytical data for these mine ponds are not included in the Appendices. The analytical data for the mine ponds is important as pond water may reflect groundwater discharges, sources of recharge to groundwater, or potential surface water

runoff. Therefore, such information should be included in the maps and drawings in future documents.

Response: Accepted.

13 A table similar to Table 4-1 in the Draft 2006 Surface Water & Groundwater Sampling Plans, possibly in the appendix, would be helpful for reference. Information should include: feature (stream, ponds, spring, seep, wells, etc.), sampling station, location (latitude-longitude), and station number.

Response: Accepted. See Table 7.1.

Specific Comments

14 1.0 Introduction
Please move the second paragraph in Section 5.0, page 25 to the Introduction. Current language indicates that there might be an additional phase. As more information needs to be collected regarding the deep groundwater aquifer, an additional phase will definitely be needed as may further phases depending on data gaps identified in earlier phases.

Response: Accepted.

15 Page 3, Section 2.1, Paragraph 1, Line 2. Change *since 1989* to *from 1989 to 2004.*

Response: Accepted.

16 Page 5, Section 2.5, Paragraph 1, Line 2. Eliminate the second period after *biota use.*

Response: Accepted.

17 Page 5, Section 2.6.2. Unless shown otherwise, it should be clarified in future documents that a fault does not always form a conduit or barrier to flow and it is possible that a fault will have little or no effect on groundwater flow, depending on site-specific conditions.

Response: No field data has been obtained for faults specific to P4 Production mine sites. However, there exists field observation data to support the hypothesis that the geologic discontinuity formed by a fault creates anisotropic conditions where flow across the fault is much less than flow along the fault.

18 Page 7, Bullets 2 and 3. Qualitative information on the relative permeabilities was provided in the referenced document. Many of the flow paths described in the conceptual models of Section 4 are based on relative permeabilities of the various formations. Of particular importance is the low permeability of the Phosphoria Formation, especially the Meade Peak member, which is assumed to impede flow to the underlying Wells Formation. Please provide a table with the range of published permeability, hydraulic conductivity, and porosity data for each of the lithologies within the project areas along with the applicable references. Additionally, bedrock in the area appears to be highly fractured. The text should describe how local fracturing may or may not impact local flow patterns, especially the potential for leakage to occur through the Phosphoria Formation and the Meade Peak member.

Response: Accepted.

19 Page 7, Paragraph 3. Please include the date(s) of the spring survey; a brief explanation of how the provenance was determined; a reference where the data can be found that supports determination of the spring waters provenance; and, any subsequent provenance determination of the remaining 35 springs.

Response: The spring survey referenced was conducted by a University of Idaho student, Tom Brooks. This study, along with similar studies within the Program Area, will continue to be reviewed in Activity 3b-8—Review of Available Hydrogeologic Information.

20 Page 7, Section 2.7. The text states that "phosphate ore is only temporarily stockpiled at the mine sites prior to transport … and is therefore not considered to be a continual source of selenium release at the mine sites." Although no individual ore pile remains on site for an extended period, if ore stockpiles are maintained continuously at one location, the potential for selenium release would seem to exist there. This statement needs more explanation, as well as descriptions of any containment or prevention efforts that take place at the ore stockpiles. (If all the ore stockpiles have been removed at this point, that needs to be stated.)

Response: Ore stockpile management will be reviewed in Activity 3b-8—Review of Available Hydrogeologic Information.

21 Page 9, Paragraph 1, Line 4. The statement that the regional investigation was for the IMA from 1997-2002 is misleading since the State took authority for the regional investigation in August 2000. Please correct the sentence.

Response: Accepted.

22 Page 9, Section 3.1.1. The appropriate ARAR for groundwater compliance is the State of Idaho Groundwater Quality Rule rather than the USEPA MCLs as stated. Please correct the text.

Response: Accepted.

23 Page 9, 3.1.1. Although mention is made of agricultural well AW005, it was not found on either Drawing 2 or 3. Revise maps accordingly.

Response: Accepted.

24 Page 9, Sections 3.1.1 and 3.1.2. A table should be provided in future documents comparing filtered and unfiltered groundwater metals data to assist the reader in comparing the two data sets. This information is important in the identification of underdeveloped, improperly constructed, or failing wells.

Response: Accepted.

25 Page 9, Section 3.1.2, Line 9. Delete *a* to read "… to ensure proper seals … "

Response: Accepted.

26 Page 10, Section 3.1.3. The text states that "seeps, springs and headwater streams act as groundwater monitoring locations … ", and then goes on to disclose "elevated total selenium

concentrations" at various seeps and springs. While seeps and springs are surface expressions of groundwater and as such, are of value in evaluating the hydrogeological conceptual model, the applicable ARAR for seeps and springs is the State Water Quality Rule, not the State Grounds Water Quality Rule, and the applicable reference value for "elevated" is the 5 ppb cold water biota criteria for total recoverable selenium in surface water. Please revise this paragraph to reflect discussion of those seeps and springs above the appropriate criteria. Where the reporting limit is above the criteria, it must be assumed that al results are at or above the criteria (example: May 2002 sampling event with an RL for total recoverable selenium of 0.015 mg/L).

Response: Refer to response to Comment 37.

27 Page 10, Section 3.1.4. The text states, in general, most groundwater wells fall within the range of calcium-bicarbonate waters. Please elaborate on the lithology of well completion (Rex chert, Wells Formation, etc.) for the groundwater wells. Are wells DW002 and DW006 completed in the basalt or in the Wells Formation? If they are completed in the Wells Formation, please identify the theorized connection between the basalt and the Wells aquifer. The same type of information needs to be included here for PW006 and PW020. Please include a discussion of what groundwater provenance is theorized for the calcium-bicarbonate waters, vs. the chloride, sodium and potassium-rich waters, vs. the calcium-sulfate waters.

Response: This topic will continue to be reviewed in Activity 3b-9.

28 Page 10, Section 3.1.4. It appears that considerable geochemical data is available to assist with the interpretation and correlation of well screen/open hole intervals (with respect to the screened/open formation). If such an analysis has already been completed, the citation should be provided in future documents. If not, include an interpretation of the geochemical data as it pertains to the evolution of flow paths and apply any relevant findings to the site conceptual models and proposed monitoring programs. A charge balance error summary for major ion data should be provided for samples included in the Piper diagrams of Appendix E to assess the validity of the data. The criteria used to determine "un-impacted seeps and springs," as stated in the last sentence of this section, should also be provided.

Response: An Ion Balance memo has been included as Appendix E. Additional evaluation will be conducted in Activity 3b-9.

29 Page 10, Section 3.1.4, Line 7. " … Enoch Valley Mine production wells PW006…" needs to be reworded to indicate that PW006 is an Agrium production well.

Response: Accepted.

30 Pages 11, 12, 13, 14, Figures 1, 2, 3, 4. It would be helpful to include, possibly in the figure titles, the well site abbreviations, for example, "Figure 1. Unfiltered Selenium Concentration in Agricultural (MAWXXX) and Domestic (MDWXXX) Wells" and "Figure 2. Enoch Valley Mine: Unfiltered Selenium Concentration in Groundwater Monitoring (MMWXXX=monitoring well, MPWXXX=production well, MDSXXX=dump seep, MSGXXX=spring, MSTXXX=stream)."

Response: Accepted.

31 Pages 12, 13, 14, Figures 2, 3, 4. These figures need to be separated into two figures for each, since the applicable criteria for groundwater wells is different than that for seeps, springs and headwaters. Please draft new figures to depict only the groundwater well results. The figures should have a bar indicating the 0.050 mg/: selenium criteria. For the new surface water figures, include a bar indicating the applicable 0.0050 mg/L surface water criteria. It is anticipated that the scale of the figures would need to be modified to accommodate this change and that some values would then be projected off the figure. Also, please change the title of figures to reflect that the results are from seeps, springs and headwaters, rather than groundwater monitoring stations.

Response: Refer to Response to Comment 37.

32 Page 15, Section 3.2.3. Please clarify the status of this effort. Is it underway or awaiting results from Phase II.

Response: Accepted.

33 Page 15, Section 3.2.5. A table should be provided in future documents summarizing the known construction details of all monitoring, production, agricultural, and domestic wells included in the study. Include a determination of the screened/open interval, and interpret the formation that applies to the screened/open interval. In general, more detail about well completion should be offered in a single location, such that the reader does not have to look through the Appendixes to put it all together.

Response: Accepted. See Table 5.1 "Well Completion Details – All Existing and Proposed Wells."

34 Page 16, Section 3.2.5, Downhole Camera Investigation. In the future, consider loading wells with clean water prior to performing downhole camera surveys to clarify the well water and improve the results of the video. Note that this procedure may interfere with other downhole geophysical methods and may not be applicable in some situations.

Response: Acknowledged.

35 Page 16, Section 3.2.5, Water Level Measurements. Please explain why water level measurements were not included for the existing Enoch Valley Mine groundwater monitoring wells.

Response: Accepted.

36 Page 16, Table 2. Is there anything to deduce or any conclusions to be made from these water levels in groundwater wells? For future reference, the May 2004 water level measurement at PW022 is shown as "NA" whereas the table's footnote only included "NM" (not measured).

Response: Evaluation of water levels in wells will be addressed in Activity 3b-11.

37 Page 18, Section 4.0. Please refrain from the continued identification of seeps, springs and headwaters as groundwater sampling locations. They are surface water sampling locations and should be identified as such. These locations can be used in evaluation of the hydrogeologic conceptual model when supported by data that can identify the groundwater provenance of the individual locations, such as in Table 3, but must still be identified as

surface water sampling locations. This distinction is necessary due to the difference between surface water quality criteria and ground water quality criteria.

Response: P4 acknowledges that such stations are surface waters; however, they are also indicative of groundwater quality. Results of such stations (groundwater expressed at the earth's surface via springs, seeps, or headwater streams) will be used to evaluate both surface water and groundwater quality. The term "surface-expressed groundwater" is used for a descriptive purpose only, describing stations that will be sampled for both the surface water and the groundwater analyte lists, and our use of the phrase is not meant to have any regulatory significance. While we shall retain use of the phrase "surface-expressed groundwater", it is not meant to be a regulatory term nor denotes any type of regulatory status of the surface water stream being sampled.

38 Page 18, Section 4.1.1. It is difficult to match the description of the North and South Dumps with Drawing 3. Please identify the dumps on the drawing. From Drawing 3, it appears that there are 3 dumps, yet only MWD091 is identified. It would be helpful to have consistent descriptors for the pits and dumps between the text and the drawings (i.e., the North Pit (MWD091)). The partially backfilled section of the North Dump as depicted in the drawing looks to be ~15% of the total dump, but the text mentions 40% of the partial backfill.

Response: Accepted. Dump and pit outlines in Drawing 3 are approximate and in some cases may be schematic.

39 Page 18, Section 4.1.1. During field trips to Enoch Valley Mine, there was discussion regarding certain locations of the mine that were mined below the water table. Please include a discussion regarding what portions of the mine contain waste rock stored below the water table as backfill and how this might affect the release of selenium and other known COCs associated with waste rock.

Response: Evaluation of excavation and backfill below the water table will be addressed in Activity 3b-8—Review of Available Hydrogeologic Information.

40 Page 18, Section 4.1.1, Paragraph 3, Line 1. Change *art* to *are.*

Response: Accepted.

41 Page 18, Section 4.1.1, Paragraph 3, Line 2. Cherty shales are listed in Table 1 under Members, but black shales are listed only in general description. Is it possible to be more specific than black shales?

Response: The term "black shales" is a descriptive term used to describe one or more of the individual members (Cherty Shale, Rex Chert, and Meade Peak) of the Phosphoria Formation

42 Page 18, Section 4.1.1, Paragraph 1, Line 5. A period is needed at the end of the sentence.

Response: Accepted.

43 Page 19, 21, 23, Sections 4.1.3, 4.2.3, 4.3.3, General. Section 4 of the referenced document would have benefited from additional figures supporting the conceptual models, such as groundwater elevations from existing wells and springs, and more detailed inferred flow directions from waste rock pile areas. As the conceptual models are updated and revised in future documents, they should include appropriate figures and details.

Response: Accepted.

44 Page 19, Paragraph 2. The text states that "The North Dump is partially backfilled into the pit and extends north onto the Dinwoody Formation and alluvium above Enoch Valley." However, according to Drawing 3, the Dinwoody Formation is to the south of the North Dump. Please clarify the text to be consistent with the drawing.

Response: Surficial regional geology of Enoch Valley Mine is presented on Drawing 3. Regional geologic mapping of the program area was conducted in 1927 by the U.S. Geological Survey (USGS) (Mansfield, et al., 1927). Mine features within the program are included on the regional geologic map presented as Drawing 3. Field observations and boring logs, at the local scale, has been used in updating the mine-specific conceptual hydrogeologic models, cross-section drawings, and in determining locations of proposed wells. Discrepancy between Drawing 3 and other drawings and field observation may exist. Efforts to update all drawings are on-going.

45 Page 19, Paragraph 2. The text in future documents should state whether or not runoff has been observed running to the pits and/or waste piles during storm events in the past.

Response: No runoff has been observed running to the pits and/or waste rock dumps during storm events in the past.

46 Page 20, 1st full paragraph. In the March 2006 Monitoring Well Installation Tech Memo it states "…flow from the EVM North Dump will generally move southwest to west…" Please explain what has happened since March that is now believed the flow is northwest toward Lone Pine Creek.

Response: The March 2006 memo contained a typographical error and should have read "…flow from EVM North Dump will generally move northwest to west toward Lone Pine Creek".

47 Page 20, Section 4.2.1. During field trips to Henry Mine, there was discussion regarding certain locations of the mine that were mined below the water table. Please include a discussion regarding what portions of the mine contain waste rock stored below the water table as backfill and how this might affect the release of selenium and other known COCs associated with waste rock. Also, please include a synopsis of the Master's Thesis describing the hydrogeology of Henry Mine (per Dale Ralston).

Response: Evaluation of excavation and backfill below the water table as well as a synopsis of the Master's Thesis describing the hydrogeology of Henry Mine (Brooks, 1982) and several additional student research projects throughout the program area will be addressed in Activity 3b-8—Review of Available Hydrogeologic Information.

48 Page 20, Section 4.2.1. Drawings 2 and 3 appear to include only four of the five mine pits (MMP041, -042, -043, -044) and five of the six waste rock dumps (MWD085, -086, -087, -088, -090).

Response: The text will be clarified per USGS, 2001 "The Henry Mine plan called for five mine panels or pits along five miles of phosphate outcrop. Pits I and II were the site of the initial mining, Pit III was the South Henry Continuation, Pit IV was the Center Henry Continuation, and Pit V was the North Henry Continuation (USGS, 2001). The two middle panels at Henry Mine were mined

separately, but ultimately joined during mining and the designation of WRD089 of an individual dump was discontinued."

49 Page 21, 1st full paragraph. Similar to the comment above, please be consistent with descriptors for the pits and waste rock piles in both the text and on Drawing 3 (i.e., Henry Mine North Dump (MWD085)).

Response: Accepted.

50 Page 21, 1st full paragraph. Please explain why the Phosphoria Formation remains in the base of the pits rather than it being mined out prior to deposition of the waste rock backfill.

Response: It is generally not possible to completely mine out the extent of the Phosphoria Formation. The Phosphoria Formation is a continuous geologic strata that extends to great depths and over large areas. The depth of mining is limited by economics, not the absence of the Phosphoria Formation, and only in very rare geologic conditions due to faulting and/or folding would it be possible to mine out a pit so that no Phosphoria would remain in a pit. As mining advances deeper, the pit must extend outward to provide stable pit out-slopes; therefore, more non-ore waste rock must be mined to reach the ore. Eventually, it becomes cost prohibitive to extract ore and mining in the particular location is terminated.

51 Page 21, Section 4.2.3. Please explain why there is no groundwater path for North Henry Mine.

Response: Accepted. The main source of water to the waste rock dumps and backfilled pits is of direct precipitation and snowmelt. As a result, a relatively limited amount of water is expected to infiltrate through the backfilled Henry mine pits or waste rock dumps.

52 Page 21, Section 4.2.3, Paragraph 1. The text in future documents should state whether or not runoff has been observed running to the pits and/or waste piles during storm events in the past.

Response: No runoff has been observed running to the pits and/or waste rock dumps during storm events in the past.

53 Page 21, Section 4.2.3, Paragraph 4. It is not clear why the Center waste rock dumps are presented as the location of the most significant groundwater flow paths. Based on site description and associated figures, it appears that the North, South, and possibly the Canyon Fill dumps are equally significant. An explanation or justification for this assumption should be provided in future documents.

Response: This statement is supposed to indicate that flow to the alluvial deposit is a more significant flow pathway compared to the flow path to the Wells Formation. It is in the Center waste rock dumps that this most notable. However, "Center" will be removed from the sentence to indicate groundwater transported from the waste dumps to the alluvial system is the most significant pathway. In addition, the Canyon fill dump has a very limited recharge area on the southwest side of the ridge divide and will have limited infiltration and pore water flux. This is not considered a significant flow pathway. Flow in the remaining Canyon fill area will be directed back toward the mine. Other flow paths are being monitored, and this phase of investigation will also include further evaluation of recently identified thesis work to refine the model at the Henry mine.

54 Page 22, Section 4.3.2, paragraph 2, Line 1. The geology shown in Drawing 10 does not appear to be pre-mining for the waste rock piles.

Response: The geology shown in Drawing 10 is pre-mining for features except mine pits and waste rock piles, which are drawn in their respective locations.

55 Page 23, Section 4.3.3, Paragraph 1. It is stated that "very little water is likely to be transported through mine pits or waste rock." It is not clear what prevents water from infiltrating through topsoil so effectively as to result in what appears from the text to be insignificant recharge through disturbed areas. Please provide more detailed information regarding the various types of reclamation of the waste rock dumps that would further limit infiltration. Also, please specify the engineering controls in place at the Ballard waste rock dumps that limit meteoric infiltration through the waste rock. A quantitative estimate, with cited techniques, of the percentage of water deferred by the top soil should be provided to support this statement if it is made in future documents.

Response: Activity 3b-8—Review of Available Hydrogeologic Information will include a study of infiltration through waste rock piles.

56 Page 23, Section 4.3.3, Paragraph 2, Line 6. Please reference the figure number in which cross section C-C' can be found.

Response: Cross-section C-C' is shown in Drawing 4.

57 Page 23, Section 4.3.3, Paragraph 2, Line 7. Should it be *East Ballard Pit, MMP040*?

Response: Accepted.

58 Page 23, Section 4.3.3, Paragraph 3. It is clear that the Phosphoria Formation is of relatively low permeability, but it is very important from an environmental standpoint whether groundwater may flow between the Dinwoody downward to the Wells Formation in these environments. The data to support this assumption should be provided in future documents.

Response: The Mead Peak Member of the Phosphoria Formation has very low hydraulic conductivity but is not impermeable. Very little groundwater is likely to flow from the Dinwoody and across the Phosphoria Formation to the Wells Formation; however we cannot say that no flow can occur. This is valid for any geologic unit designated as a confining layer or aquitard.

59 Page 23, Section 4.3.3, Paragraph 4. The Wells Formation directly underlies a significant portion of the waste rock piles at the Ballard Mine, so it is not clear why the most significant groundwater flow paths are in the alluvial deposits, as stated here. Include information or citations to support this assumption in future documents.

Response: Acknowledged.

60 Page 24, Table 3. Is it valid to assume that all springs emanate from the alluvium? The well in the basalt at Henry mine should be MW019.

Response: Provenance of springs will be investigated during Activity 3b-9—Geochemical typing of wells, seeps, and springs. The proposed well MMW019 has been added to the table.

61 Page 25, Section 5.0, General. The addition of Table 3 was very helpful in demonstrating the link between the planned work and the conceptual site models for each mine. An aquifer testing program should be included in subsequent phases of the groundwater investigation to determine site specific hydraulic conductivities of the screened or open formations. The data can also be applied to future contaminant transport and migration evaluations and risk assessment.
The site conceptual models of the mine sites are based on scant hydrogeological data, and the authors have done a good job in identifying data gaps. However, the proposed number of wells in the *Final 2005 Phase II Supplemental SI Work Plan* appears to be too small to fill these gaps given the unknowns associated with hydraulic gradient, hydraulic separation between units, and hydraulic effects of faulting. Therefore, additional alluvial and deep aquifer wells or piezometers will be required in subsequent phases of the groundwater investigation at the P4 Production Mines to confirm significant groundwater flow directions and gradients as presented in the *Final 2005 Phase II Supplemental SI Work Plan*. The specific locations and number of wells will depend on the findings of each phase of the investigation.

Response: Accepted. This will be addressed in Activity 3b-4—Update of Conceptual Hydrogeologic Site Model.

62 Page 25, Section 5.1, Paragraph 3, Line 7. Please identify the three receptor wells down gradient of the proposed monitoring well, MW012. From the map, it appears that there are only two receptor wells – AW002 and DW002.

Response: Agricultural wells, MAW001 and MAW002, and domestic well, MDW002, are potentially down gradient of proposed monitoring well MMW012.

63 Page 26, MW008, Line 1. It does not appear from the map or discussion that this monitoring well will be located at the toe of the EVM South Waste Rock Dump.

Response: Proposed monitoring well, MMW008, will be installed down gradient of the toe of the EVM South Waste Rock Dump, MDW091.

64 Page 26, MW013, Line 2. Eliminate the space between Dump and the period.

Response: Accepted.

65 Page 29, Section 5.2, General. Briefly explain in future documents why MW004 was not recommended for monitoring or abandonment in the referenced document.

Response: All monitoring wells (except those abandoned), including Henry Mine monitoring well MMW004 will be sampled following new well installation as discussed in Section 5.7.

66 Page 30, MW011, Line 1. Add an *e* to Min.

Response: Accepted.

67 Page 30, Section 5.3, Line 1. Add an *e* to Min.

Response: Accepted.

68 Page 30, Section 5.3, MW-15A and MW-16A. The description in the text indicates that these wells will be installed southeast of overburden dumps MWD080, MWD081, and MWD083. However, Drawing 10 indicates that these wells will be installed southwest of the overburden dumps. This discrepancy should be rectified in future documents.

Response: Wells MMW15A and MMW16A are installed southwest of the overburden dumps MWD080, MWD081, and MWD083. The text was corrected.

69 Page 31, Paragraph beginning with "at Ballard Mine," Line 3. There is an extra period after west.

Response: Accepted.

70 Page 31, Paragraph beginning with "at Ballard Mine," Line 6. Cross-section C-C' is cited. Please indicate in which drawing it is found (Drawing 4?).

Response: Cross-section C-C' is shown in Drawing 4.

71 Page 31, MW006. This location for MW006 is described as an exposed outcrop of Wells Formation, which is inconsistent with Drawing 11. Please reconcile in future documents.

Response: Accepted.

72 Page 31, MW006, Line 4. The title of Drawing 10 should be *Ballard Mine Detail and Conceptual Cross-Section for Proposed Well Location MW006.*

Response: The title of Drawing 10 has been updated.

73 Page 35, MW003, Line 5. There should be a space between *0.005* and *mg/L.*

Response: Accepted.

74 Page 35, MW005. This well was not found on Drawing 2 or 3. Revise maps accordingly in future documents.

Response: Accepted.

75 Page 35, Section 5.8. Specify that a Licensed Idaho Surveyor will survey the wells in future documents.

Response: Accepted.

76 Page 42, Table 6. As mining at both Enoch Valley and Henry mines occurred below the water table, four secondary constituents (aluminum, iron, manganese, and sulfate) need to be included in the sample plan for on-going monitoring. Please remove the asterisks from aluminum, iron, manganese as these parameters will need to be monitored on a regular rather than one-time, screening basis. In the footnote it is mentioned that analysis will be done "as analyte methods allow." Please clarify this comment and explain what situations are anticipated that analyte methods would not allow for analysis.

Response: Accepted.

77 Drawing 2. The elevation contours are not labeled, and the contour interval and a reference to the elevation topographic source are not provided. The absence of contour labels and a contour interval make it difficult to trace drainage pathways and understand headwater monitoring locations. In addition, the BLM land should be shown with a different color than the waste tock piles to limit confusion. The legend for identification of spring stations abbreviates spring as SG whereas the notes abbreviate spring as SP, which looks to be mine pond. Revise maps accordingly in future documents.

Response: Accepted.

78 Drawing 3. Discrepancies between geologic units in Drawing 3 and those shown in blow-ups on later drawings (Drawings 5 and 6) are apparent. At both Enoch Valley and Henry mines, the outlines used to identify mine pits and waste rock dumps are not consistent with the legend. The legend for identification of spring stations SG whereas the notes abbreviate spring as SP, which looks to be mine pond. Revise maps accordingly in future documents. The geology at PW006 (Trd) does not match the surface material in the two PW006 well logs in Appendix F. Please reconcile. The term "basaltic ash" is not a geologic term and should be replaced in the geologic key in the same manner in which it has already been replaced in the text.
As noted above in the comments on Section 4.2.3, it is not clear why the Henry Mine Center waste rock dumps are the location of the most significant groundwater flow paths. From the site description and associated figures, it appears that the North, South, and possibly Canyon Fill dumps are equally significant. Revise maps in future documents to include estimated flow path arrows for the North, South, and Canyon Fill dumps.

Response: The term basaltic ash is retained as this was the term used in the original U.S. Geological Survey publication. However, the term "tuff" has been added parenthetically. In addition, more flow paths have been shown for the Henry Mine, but it is Monsanto's opinion the flow vector associated with the Canyon Fill minor due to a very limited recharge area, and this flow path is therefore not shown

79 Drawings 3 and 10. It is difficult to coordinate between the information presented on these drawings and the water chemistry presented in the various tables in the appendixes. To provide a more convenient understanding of spatial variability in selenium concentrations across each of the sites and between formations, the average and range of unfiltered selenium values (from the various sampling events) should be shown adjacent to each of the seeps, springs, wells, ponds, and headwater stream stations. Furthermore, data should be coded according to the screened or open formation, to give the reader a picture of what areas have been impacted. Revise maps accordingly in future documents.

Response: Unfiltered Selenium concentrations have been added to Drawings 3 and 10. Until a detailed assessment of all groundwater monitoring locations is completed, identification of groundwater source is uncertain. This evaluation will be included in Activity 3b-9—Geochemical typing of wells, seeps, and springs.

80 Drawing 4. There is a tacit assumption that all faults are behaving as barriers to groundwater flow in these cross sections. Although this situation is not uncommon, no field data or regional reports are cited to support this assumption. The appropriate citations should be provided in future documents. The Ballard Mine cross section should indicate where the bend in the section occurs. The geology of the eastern portion does not match that shown in

Drawing 10 – the surface exposure of the Trd should be much greater in Drawing 4. Revise maps accordingly in future documents.

Response: Refer to response to comment 17 regarding faults. The bend in the section has been indicated in the cross- section C-C' shown in Drawing 4.

81 Drawing 5. The location of well MW007 is inconsistent with the text which states that the well is down gradient of seep MDS026. The locations of the proposed monitoring wells MW007 and MW008 at EVM are shown to be in the Trd in Drawing 3, whereas the cross section of Drawing 5 shows the area overlain by alluvium. Please include this cross-section in Drawing 3. Revise maps accordingly in future documents.

Response: Accepted.

82 Drawing 6. The location of Qal does not match that shown in Drawing 3. Revise maps accordingly in future documents.

Response: Refer to response to comment 44. The purpose of Drawing 3 is to provide the regional geologic framework. Because Drawing 3 is the result of regional mapping, relatively minor alluvial and other geologic deposits and features are not shown. The smaller scale geologic maps are the result of focused mapping by mine geologist at a much more detailed level and in smaller more focused areas. Reconciling the differences between the mapping on Drawing 3 provides little benefit, instead a note has been added explaining the differences in the mapping.

83 Drawing 7. The location of mine waste does not match that shown in Drawing 3. Revise maps accordingly in future documents.

Response: Refer to response to comment 44. Proposed well MMW010 was slightly miss-located on Drawing 3. Correcting this improved the correlation between Drawings 3 and 7; however, there still is a minor discrepancy. Because there is not a definitive mapped boundary for the mine waste, this issue will need to be resolve by future mapping.

84 Drawing 8. Well MW019 should be included on this drawing. Revise maps accordingly in future documents.

Response: Accepted.

85 Drawing 9. Well MW019 should be included on this drawing. Revise maps accordingly in future documents.

Response: Accepted.

86 Drawing 10. The stream segments mentioned in the text should be labeled on the map; do not use a colored fill for either the waste rock pile or the mine pit designation because the fill obscures the underlying geologic structure. It is confusing that the waste rock pile areas are filled-in (colored) in Drawing 10, whereas, they are not filled-in in Drawing 3. The colored fill of the waste rock pile symbol in Drawing 10 should be deleted and made consistent with Drawing 3. Also, the legend symbol for the mine pit locations (red dashed line with colored fill) does not match the symbol used on the map (red dashed line, unfilled). As noted in the abovementioned comments for Drawing 4, the section line in Drawing 10 does not match the

surface units shown on the Ballard cross section in Drawing 4, especially on the west and east ends of the section. Revised maps and text accordingly in future documents.

Response: Accepted.

87 Drawing 11 has no title. It looks like it should be *Conceptual Cross-Section for Proposed Well Location MW006 Ballard Mine*. The location of the mine waste does not match that shown in Drawing 3. Revise maps accordingly in future documents.

Response: The proposed title has been added to Drawing 11. Due to the lack of detail shown in Drawing 3 for the Ballard Mine area, the Ballard Mine Detail map has been included as Drawing 10. Both Cross-Section H-H' and I-I' shown in Drawing 11 show waste rock dump locations consistent with those shown in Drawing 10.

88 Appendices B and C. Please report non-detects as was done in the 2005 GW Data Validation Report Memo, i.e., if the detection limit is 0.05 then a non-detect should be reported as <0.05 rather than 0.025. One-half the detection limit is fine for analysis, but not for reporting. Please explain the difference in reporting limits for parameters in tables as compared to EDLs in Table 6. For example, differences are noted in Appendix B in Table 1 (cadmium, chromium, nickel, vanadium, zinc), Table 2 (iron, manganese), Table 3 (vanadium), Table 4a (selenium), Table 5 (mercury, nitrate+nitrite), and in Appendix C Table 1 (potassium), Table 2 (sodium), Table 3 (chloride), Table 5 (sulfate), Table 6 (antimony, arsenic, beryllium), Table 9 (lead), Table 10 (magnesium), table 13 (thallium).

Response: Accepted; non-detected results have been reported with the above format. Reporting limits may be elevated from the laboratory estimated detection limit on a sample-specific basis due to dilution, contamination, or other analytical issues in accordance with the EPA Functional Guidelines for Inorganic Review (EPA, 2004).

89 Appendixes B, C, and D. The analytical data as presented in the tables in these appendixes are confusing and difficult to follow. For future data summaries, the analytical data should be organized such that the data for each station or well are resented on a single page with all of the parameters for that station presented on the same page (or series of pages if the data will not fit on a single page). This presentation will allow the relationships among the various analytical parameters to be more easily understood for each of the stations or wells. If there are multiple sampling events for each station or well, these data can be presented in separate columns. Please remove the word "censored" and "uncensored" from the title of the appendix and the titles of the tables.

Response: P4 Production respectfully disagrees with the request for all data tables to be reformatted to provide results on a sample station-specific basis. Analytical data in this and all previous data summaries have been organized by analyte and not by sample site. Analytical results are presented in a format most accessible for statistical analysis and evaluation for discussion on an analyte by analyte basis, not a sample station-specific basis. An Access database for all project data is in development; in the future data will be displayed in alternate formats as required

90 Appendix B, Table 1. Note that analysis methods for parameters need to be sensitive enough to report at levels well below the applicable water quality criteria. For example, the reporting limit for zinc is 0.16 mg/L, which is greater than the continued monitoring action level of 0.1 mg/L for groundwater as reported in the Area Wide Risk Management Plan.

Response: As shown in Table 6 of the text, laboratory estimated detection limits (EDLs) for all target analytes are well below the applicable water quality criteria. In accordance with the EPA Functional Guidelines for Inorganic Review (EPA, 2004), all analytical data is validated and reporting limits (RLs) are established. RLs may be elevated on a sample-specific basis due to dilution, contamination, or other analytical issues. In the case of the reporting limit for zinc at 0.16 mg/L, a field blank was detected at 0.032 mg/L Zn as narrated in the data validation report. On this basis only results greater than five times the blank detection (0.032×5 = 0.16 mg/L) have been reported unqualified. However, the analytical detection limit for all Zn results in this sampling event was 0.0040 mg/L, which is well below the groundwater action level of 0.1 mg/L.

91 Appendix C. Table 6 lists boron and Table 9 lists fluoride neither of which is listed in Table 6 of the body of the report.

Response: Accepted. The "Groundwater Monitoring Analytes" table has been updated.