First Five-Year Review Report

for

Gilt Edge Mine Superfund Site
Operable Units 2 and 3

Lawrence County
South Dakota

April 2007

PREPARED BY:

U.S. Environmental Protection Agency, Region 8
Denver, Colorado

Approved by: Date:

Carol Rushin
Assistant Regional Administrator
U.S. Environmental Protection Agency, Region 8

4/16/07

The following staff and managers have read and recommend approval of this report:

Mark Lawrensen for SD Dept of Environment & Natural Resources, 7 Dec 06

Rebecca Thomas, 25 January 07

Peggy Churchill, 29 January 07

Karen Kellen, 16 March 07

Ken Wangerud, 21 March 07

Russell Leclerc, 21 March 07

James Hanley, 23 March 07

Bill Murray, 26 March 07

Five-Year Review Report

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List of Acronyms

aml	above mean sea level
ARD	Acid Rock Drainage
ARARs	Applicable or Relevant and Appropriate Requirements
BMC	Brohm Mining Company
BRA	Baseline Risk Assessment
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
HDPE	High-Density Polyethylene
MCL	Maximum Contaminant Levels
MDL	Method Detection Limit
NCP	National Contingency Plan
NPL	National Priority List
O&M	Operation and Maintenance
OU1	Operable Unit 1
OU2	Operable Unit 2
OU3	Operable Unit 3
PRP	Potentially Responsible Party
RAO	Remedial Action Objective
RCRA	Resource Conservation and Recovery Act
RD/RA	Remedial Design/Remedial Action
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SDDENR	South Dakota Department of Environment and Natural Resources
SDWDS	South Dakota Water Discharge System
TSS	Total Suspended Solids
ug/L	Microgram per Liter
USBOR	United States Bureau of Reclamation
EPA	United States Environmental Protection Agency

Executive Summary

The U.S. Environmental Protection Agency (EPA) Region 8 conducted the first five-year review of the remedial actions implemented at Operable Units (OU) Nos. 2 and 3 of the Gilt Edge Mine Site (the Site) near Lead, in Lawrence County, South Dakota. The purpose of the five-year review is to determine whether the Site remedy is protective of human health and the environment. The trigger action for this review is the August 2001 OU3 Record of Decision. Because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unrestricted use and unlimited exposure, a five-year review is required by statute.

The Site is located in Lawrence County, approximately two miles southeast of Lead, South Dakota in the Black Hills. The Site boundaries have not yet been formally established, however the overall study area encompasses the area disturbed by mining as well as a buffer area. The overall study area is bounded by largely undeveloped land. The Site is the location of a former heap leach gold mining operation and is divided into three OUs including:

- OU1 – Site-Wide Conditions
- OU2 – Water Treatment
- OU3 – Ruby Dump and Gulch

This five-year review addresses only OU2 and OU3.

Mining activities began at the Site in 1876 when the Gilt Edge and Dakota Maid claims were located. Historical underground mining extracted sulfide-bearing gold ores from irregular deposits in veins and fracture zones in the igneous rocks. The area was mined intermittently until 1941 and continuously from 1986 through 1998 when the operator, Brohm Mining Company (BMC), announced it would abandon the Site. BMC's parent company, Dakota Mining Corp., filed for bankruptcy in 1999 and the State of South Dakota (the State) assumed responsibility for water treatment at the Site. In 2000, the State also sought National Priority List (NPL) listing from EPA with the listing announced in December. In August 2000, the EPA Region 8 Emergency Response Program assumed responsibility for water treatment.

Wastes associated with mining included waste rock, tailing and spent ores contaminated with a wide array of metals. Some of the original contamination sources were removed from the Site prior to EPA's involvement.

Contamination of primary concern under OU2 and OU3 is Acid Rock Drainage (ARD). The potential impact of the metal content of the mine waste through direct exposure to human and environmental receptors is being assessed under OU1 and currently is incomplete.

The remedy for OU2 requires that ARD be collected from the toe of the Ruby Repository and from seeps in two drainages (Hoodoo Creek and the Upper Strawberry Creek watershed above Pond C) and conveyed to a water treatment facility prior to discharge to Strawberry Creek. The remedy also calls for the conversion of an existing treatment facility employing a sodium hydroxide process to a lime-based neutralization/precipitation process. Treatment facility effluent quality must comply with South Dakota surface water quality standards except for total dissolved solids and selenium. The standards for these two parameters are subject to an interim waiver requiring resolution under OU1. The resolution may take the form of improvements to the water treatment facility such that the effluent meets the standard(s) or the standard(s) will be permanently waived.

The remedy for OU3 included regrading the waste rock dump in the Ruby Gulch drainage, construction of a synthetic cap and vegetative cover, clean water diversion ditches, and an ARD collection gallery. The majority of remedial construction for OU2 and OU3 was completed in March 2003 and April 2006, respectively.

Several issues were identified in connection with OU2 and OU3 during the five year review that should be addressed. State surface water quality limits for the water treatment facility (OU2) have largely been met, however, several parameters for which there are water quality standards have not been analyzed for during most or all of the monitoring period. These include; alkalinity, weak acid dissociable cyanide, total cyanide, chromium VI and dissolved mercury. In addition, when cyanide analyses were performed, the detection limit employed was twice the water quality standard.

In OU3, all of the remedial action objectives (RAOs) are being met and remedy elements are performing as designed with one exception. Sections of the clean water diversion ditches were constructed with a geomembrane liner to minimize infiltration of storm water into the adjacent repository. Portions of the liner system are suspected to be leaking thereby allowing clean water to enter the repository leading to an increase in ARD reporting to the collection system at the repository toe. Other concerns related to the diversion ditches include unlined sections in fractured bedrock and the presence of sediment dams in the ditches. RAOs for OU3 call for control of mine waste erosion and a reduction in the formation of ARD. These RAOs are being met despite the suspected leaking clean water diversion ditches.

An approximately 10-acre area of the Ruby Dump was not capped as part of the Interim Remedy for OU3. This exposed waste rock allows precipitation to infiltrate into the Ruby Repository resulting in ARD generation. The disposition of this portion of the Site will be addressed under OU1.

Several remedy elements are not performing at optimum efficiency. These include clean water diversion ditches (discussed above) and the ability of the water treatment facility to operate at 250 gallons per minute when the influent stream consists exclusively of the highest sulfate waters present at the Site. Although these remedy inefficiencies do not affect protectiveness, EPA is considering improvements to remedy efficiency through modification to the diversion ditches and treatment facility.

RAOs are being met at the Site under the Interim RODs for OU2 and OU3. Therefore, the remedy as implemented is currently protective of human health and the environment. Residual risks associated with remaining contaminated environmental media will be addressed under OU1.

Five-Year Review Summary Form

SITE IDENTIFICATION		
Site name: Gilt Edge Mine Superfund Site, Operable Units 2 and 3.		
EPA ID: SDD987673985		
Region: 8	**State:** SD	**City/County:** Lead/Lawrence
SITE STATUS		
NPL status: Listed 12/00		
Remediation status: Operating		
Multiple OUs: Yes	**Construction completion date:** OU2 — 10/03 OU3 — 4/06	
Has site been put into reuse? No		
REVIEW STATUS		
Lead agency: EPA		
Author name: Rebecca Thomas		
Author title: Project Manager	**Author affiliation:** U.S.EPA, Region 8	
Review period: 8/30/01 to 9/30/06		
Date(s) of site inspection: 08/30/06		
Type of review: Statutory		
Review number: 1 (first)		
Triggering action: OU3 ROD Signature Date		
Triggering action date: 8/30/01		
Due date: 9/06		

* ["OU" refers to operable unit.]

Five-Year Review Summary Form, cont'd.

Issues:

Item No.	Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1	Occasional exceedence of applicable State surface water quality standards (OU2) including temperature, total suspended solids and nitrate.	N	potentially
2	Alkalinity, weak acid dissociable cyanide, total cyanide, chromium VI and dissolved mercury not measured in water treatment facility effluent during most or all of the monitoring period.	potentially	potentially
3	Detection limit for weak acid dissociable (WAD) cyanide is twice the water quality standard	potentially	potentially
4	New effluent standard for ammonia. The standard is calculated using equations in Appendix A referenced in § 74:51:01:49.	potentially	potentially
5	Clean water diversion ditches may discharge to waste rock mass due to suspected leaky channel liner, unlined ditches in fractured bedrock and sediment dams in the ditches.	N	N
6	ROD required site-specific toxicology study of sulfate TDS has not been performed	potentially	potentially

Five-Year Review Summary Form, cont'd.

Recommendations and Follow-up Actions:

Item No	Issues	Recommendations and Follow-up Actions	Party Responsible	Due Date
1	Occasional exceedence of applicable State Surface Water Quality Standards (OU2) including temperature, total suspended solids and nitrate.	Continue monitoring	EPA	NA
2	Alkalinity, weak acid dissociable cyanide, total cyanide, chromium VI and dissolved mercury not measured in water treatment facility effluent during most or all of the monitoring period.	Improve monitoring program	EPA	September 2007
3	Detection limit for weak acid dissociable (WAD) cyanide is twice the water quality standard	Revise analytical detection limits	EPA	September 2007
4	New effluent standard for ammonia. The standard is calculated using equations in Appendix A referenced in § 74:51:01:49.	Revise performance standards	EPA	September 2007
5	Clean water diversion ditches may discharge to waste rock mass due to suspected leaky channel liner, unlined fractured bedrock ditches and sediment dams in the ditches.	Consider repair to suspected leaking channels	EPA	September 2008
6	ROD required site-specific toxicology study of sulfate TDS has not been performed	Conduct study	EPA	September 2008

Five-Year Review Summary Form, cont'd.

Protectiveness Statement(s):

The remedy as implemented is currently protective of human health and the environment. All contaminated water reporting to the toe of the Ruby Repository, in the Hoodoo Gulch main channel and emanating from seeps above Pond C is collected and treated prior to discharge to surface water.

Other Comments:

Several remedy elements are not performing at optimum efficiency. These include clean water diversion ditches and the ability of the water treatment facility to operate at 250 gallons per minute when the influent stream consists exclusively of the highest sulfate waters present at the Site. Although these remedy inefficiencies do not affect protectiveness, EPA will consider options to improve remedy efficiency.

EPA recognizes that the interim waiver of State surface water quality standards for total dissolved solids (TDS) and selenium will require resolution under OU1. The resolution may take the form of improvements to the water treatment facility such that the effluent meets the standard(s) or the standard(s) will be permanently waived.

An approximately 10-acre area of the Ruby Dump was not capped as part of the Interim Remedy for OU3. EPA recognizes that this exposed waste rock allows precipitation to infiltrate into the Ruby Repository resulting in ARD generation. The disposition of this portion of the Site will be addressed under OU1.

Formal monitoring reports providing treatment facility effluent quality and flow data have not been prepared.

EPA acknowledges such documentation is necessary to complete the Site files and will take steps to resolve this deficiency in the Site files.

I. Introduction

Purpose of the Review

The purpose of five-year reviews is to determine whether the remedy at the Gilt Edge Mine NPL Site (the Site) is protective of human health and the environment. The methods, findings and conclusions of reviews are documented in Five-Year Review reports. In addition, five-year review reports identify issues found during the review, if any, and recommendations to address them.

Authority for Conducting the Five-Year Review

The U.S. Environmental Protection Agency (EPA) is preparing this five-year review pursuant to CERCLA §121 and the National Contingency Plan (NCP). CERCLA §121 states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the site, the President shall review such remedial action no less often than each five years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The EPA interpreted this requirement further in the National Contingency Plan (NCP); 40 CFR §300.430(f) (4) (ii) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

Who Conducted the Five-Year Review

The EPA Region 8 conducted the five-year review of remedial actions implemented at Gilt Edge Mine NPL Site Operable Units (OU) 2 and 3 near Lead, South Dakota. This review was conducted from August 2006 through September 2006. This report documents the results of the review. HDR Engineering, Inc. (HDR) of Denver, Colorado was retained under a subcontract to Project Resources Inc. (PRI) to prepare this Five-Year Review Report for EPA. PRI was retained by the US Army Corps of Engineers, Omaha District under a Rapid Response Program contract.

Other Review Characteristics

This is the first five-year review for the Site. The triggering action for this review is the release of the Record of Decision for OU3 on August 30, 2001. Because hazardous substances, pollutants or contaminants remain at the Site above levels that allow for unlimited use and unrestricted exposure, a Statutory Five-Year Review is required.

II. Site Chronology

Table 1
Chronology of Site Events

Event	Date
Mining activity begins	1876
Intermittent gold, silver, copper, lead and zinc mining	1876-1941
Permit issued to Brohm Mining Corp. (BMC) for cyanide heap leach operation	1986
Preliminary Assessment (PA) of the Site prepared by South Dakota Department of Environment and Natural Resources (SDDENR)	1991
Cyanide solution released into local drainages	1991
Unpermitted discharge of acid waters and metals.	1992
NPDES permit issued to BMC to address cyanide and metal releases	1993
150,000 tons of tailings removed from Strawberry Creek drainage by BMC as a requirement of the 1986 mining permit.	1993 – 1994
BMC reports it will abandon the Site by May 29, 1998	1998
State of South Dakota obtained a restraining order issued to BMC against Site abandonment	May 29, 1998
BMC's parent, Dakota Mining Corp. files for bankruptcy	July 1999
SDDENR assumes water treatment operation	1999
SDDENR seeks National Priority Site (NPL) listing	February 2000
Site is placed on the NPL	December 2000
Early Action Interim Record of Decision for OU2 (water treatment) transferring interim water treatment operations from SDDENR to EPA Region 8 Emergency Response Program	April 2001
Interim Record of Decision for OU3 (Ruby Ridge Waste Rock Dump)	August 2001
Interim Record of Decision for OU2 requiring conversion of the existing sodium hydroxide treatment plant to a lime-based treatment process.	November 2001
OU3 90% remedial design complete (design/build project)	March 2002
OU2 remedial design complete	March 2003
OU2 remedial construction complete	October 2003
OU3 remedial construction of the Ruby Gulch Waste Rock Dump complete	April 2006

III. Background

Location and Setting:

The Site is located in Lawrence County, approximately two miles southeast of Lead, South Dakota in the Black Hills. An aerial photograph of the Gilt Edge Mine is provided as Figure 1 in Appendix A. Site boundaries have not yet been formally established (to be established as part of OU1) however, the overall study area encompasses the area disturbed by mining as well as a

buffer area. The study area is bounded by largely undeveloped land. Land surface elevation within the study area ranges from 5,680 feet above mean sea level (aml) to 4,880 aml.

The Site is divided into three OUs including:

- OU1 – Site-Wide Conditions
- OU2 – Water Treatment
- OU3 – Ruby Dump and Gulch

This five-year review addresses OU2 and OU3. The remedy for OU1 has not been selected.

The Site has been mined intermittently by several owners from the late 1800s to late 1990s. Cyanide leaching, mercury amalgamation and zinc precipitation among other methods were used to recover gold. The Site currently consists of a heap leach pad in addition to several ore extraction pits (Figure 1 – Appendix A). The heap leach pad covers 37 acres with approximately 3.2 million tons of spent ore. An expansion to this pad was begun before BMC declared bankruptcy; however no ore was processed on the expansion. There are also surge, neutralization and diatomaceous earth ponds with high density polyethylene (HDPE) primary liners and HDPE and soil composite secondary liners.

Ore for the leach pad was obtained from the Dakota Maid/Sunday Pits (29.5 and 17 acres, respectively), the SE Langley Pit (8.1 acres) and the Anchor Hill Pit (23.6 acres). Waste rock from the mining activities and spent ore from the leach pad were transported to the Ruby Waste Dump, a tiered storage area in the Ruby Gulch Drainage. The Ruby Waste Dump was recognized as the main source for acid rock drainage (ARD) at the Site.

During BMCs operations at the Site, ARD discharging from the Ruby Waste Dump was collected in an HDPE-lined containment pond. The ARD was then pumped to the Dakota Maid/Sunday Pit and from there, pumped to a water treatment facility using sodium hydroxide neutralization/precipitation as the treatment process. Treated water was discharged to Strawberry Creek drainage.

Additional sources for ARD include historical deposits of mill tailings in Strawberry and Bear Butte Creek drainages. These wastes were discharged to these drainages prior to 1941, well before BMCs operations at the Site.

Two water-bearing zones were identified; a thin zone of saturated alluvium perched on top of bedrock and a regional deep bedrock aquifer. The direction of flow in the alluvial and bedrock aquifers is to the south and southeast, respectively. Depth to water in the bedrock aquifer ranged from more than 100-feet at the north end of the Site to less than 10-feet at the south end. Flows are influenced by the underground mine workings, exploration boreholes, faults, bedding plains, joints and fracture zones within the bedrock.

The surface water at the Site drains through three sub-basins into Bear Butte Creek. The sub-basins are Strawberry Creek, Hoodoo Gulch and Ruby Creek (Figure 1 - Appendix A).

Site History and Extent of Contamination:

Mining activities began at the Site in 1876 when the Gilt Edge and Dakota Maid claims were located. Historical underground mining extracted sulfide-bearing gold ores from irregular deposits in veins and fracture zones in the igneous rocks. The area was mined intermittently until 1941. In 1984, Gilt Edge, Inc. applied for a permit to begin a heap leach operation. Gilt Edge,

Inc. was acquired by BMC before the permit was issued in 1986. In response to permit requirements, BMC removed over 150,000 tons of tailings from upper Strawberry Creek drainage and constructed a water treatment facility designed to prevent ARD from entering Strawberry or Bear Butte Creeks.

Construction of the open-pit mine and cyanide heap leaching facilities began in 1987. Mining of the Dakota Maid and Sunday open pits was completed in 1992. Subsequent operations by BMC developed the Langley and Anchor Pits.

In 1998, BMC announced it would abandon the Site by May 29th. During that month, the State of South Dakota (the State) filed for and was granted a Temporary Restraining Order to prevent BMC's abandonment of the Site. A Preliminary Injunction followed in June. BMC's parent company, Dakota Mining Corp., filed for bankruptcy in 1999 and the State assumed responsibility for water treatment at the Site. In 2000, the State also sought National Priority List (NPL) listing from EPA with the listing announced in December. In August 2000, the EPA Region 8 Emergency Response Program assumed responsibility for water treatment.

Wastes associated with mining included waste rock, tailing and spent ores contaminated with a wide array of metals. Some of the original contamination sources were removed from the Site prior to EPA's involvement.

Contamination of primary concern under OU2 and OU3 is ARD. A geochemical field reconnaissance in 2000 classified mine waste materials for ability to generate ARD in four categories:

- Non acid generating
- Highly acid generating
- Moderately acid generating
- Initially acid consuming but ultimately acid generating

Different areas of the original heap leach pad and its extension were ranked across the full range of categories. The former Ruby Waste Dump was comprised of highly acid generating material overlain by moderately acid generating materials.

Baseline Risk Assessment:

Estimated risks to humans and the environment from contamination associated with mine wastes are being quantified under OU1 in a Baseline Risk Assessment (BRA) for the overall Site. Risks to humans and the environment above a level of concern as estimated in the BRA will be addressed under OU1. Therefore, review of exposure assumptions, toxicity factors etc., is not appropriate under this five year review.

IV. Response Actions

A series of response actions were conducted beginning in 2000 to address ARD contamination at the Site. Considerable reclamation activities were conducted by BMC under the requirements of their mining permit. However, these actions were not performed under a ROD; therefore they are not discussed herein.

All response actions in OU2 and OU3 were performed as interim remedial actions and focused on minimization, collection and treatment of ARD generated in the Ruby Waste Rock

Repository. Additional ARD was collected from seeps in Hoodoo Gulch in the upper Strawberry Creek watershed and treated prior to discharge.

A summary of the various response actions is provided below by OU.

OU2 – Water Treatment

1. Early Action Interim ROD (4/01) - Remedial action to use an existing ARD collection system at the toe of the Ruby Waste Rock Dump and an existing water treatment facility to treat ARD. The ARD collection system and treatment facility was constructed by BMC during active mining. The ROD required the addition of ferric iron to the treatment system to enhance precipitation of metals from ARD. Modification of sludge management operations to include storage basins was also required.
2. Interim ROD (11/01) – Remedial action requiring the continued collection of ARD from the toe of the Ruby Repository as well as from seeps in Hoodoo Gulch and conveyance to the water treatment facility. Collection of ARD seep flows west of the Heap Leach Pad (upper Strawberry Creek watershed above Pond C) and conveyance to the water treatment facility. Conversion of the existing sodium hydroxide-based water treatment process to a 250-gallon per minute net treatment capacity consisting of a lime-based neutralization/precipitation process with lime slaking and slurry chemical feed equipment upgrades. A high-density sludge process was selected after pilot test evaluations.

OU3 – Ruby Gulch Waste Rock Dump

1. Interim ROD (11/01) - Remedial action to regrade waste rock in the upper Ruby Gulch drainage, construction of a synthetic cap and vegetative cover, clean water diversion ditches and an ARD collection gallery.

V. Progress since the Last Review

This is the first five-year review.

VI. Five-Year Review Process

Administrative Components:

This is the first five-year review for the Site. The five-year review was led by Rebecca Thomas, EPA Project Manager. The following Team Members participated in the review:

- Rebecca Thomas, EPA Project Manager
- Ken Wangerud, EPA Site Remedial Project Manager
- Peggy Churchill, EPA Site Remedial Project Manager
- Nancy Mueller, Community Involvement Coordinator
- Karen Kellen, EPA Attorney
- Mark Kennihan, SDDENR Representative

EPA Contractors:

- Kenneth Napp, HDR Engineering, Inc.

This five-year review consisted of the following activities: a review of relevant documents; a meeting with representatives of EPA and SDDENR during a Site visit; and data review. The schedule for the review extended through September 2006.

Community Involvement:

A display ad was published Thursday, August 24, 2006, in the Rapid City, SD Journal to announce the Five-Year Review and to invite public input. No one contacted EPA as a result of the ad.

Nancy Mueller, Community Involvement Coordinator for the Site, conducted limited community interviews of local stakeholders in September 2006. Interviewees included private citizens, local officials and local business persons. Each person was asked the following questions:

1. What is your overall impression of the project?
2. What effects have Site operations had on the surrounding community?
3. Are you aware of any events, incidents or activities at the Site such as vandalism, trespassing, or emergency responses from local authorities? If so, please give details.
4. Are you aware of any community concerns regarding the site or its operation and administration? If so, please give details.
5. Do you feel well-informed about the Site's activities and progress?
6. Do you have any comments, suggestions or recommendations regarding the Site's management or operation?

The following is a summary of responses, organized by the number of each question:

1. The overall sentiment is that cleanup of the Site needs to occur. Opinions regarding successful reclamation of the Site vary from "impossible" to "looking forward to being able to reuse the land." There is some frustration regarding the slow speed at which things are moving, particularly in the area of resolving issues surrounding land ownership.
2. The persons interviewed indicated there weren't many physical effects in the area (dust, increased traffic, etc.), but that the economic effects have been substantial and quite appreciated. One respondent indicated that she felt that people owning property in the immediate vicinity of the Site are somewhat in limbo due to property ownership issues (unable to get utilities due to easement issues).
3. All of the respondents indicated they were not aware of ANY "emergency" incidents at the Site, and all attributed it to the fact that the Site is so isolated.
4. One respondent indicated that, because abandoned open-pit, heap leach operations are nearly impossible to completely clean up, the area will likely be left with some sort of "mess" forever. Another concern has to due with taxpayer costs (and the fact that it's unlikely EPA will be able to recover much, if any of those costs due to bankruptcy). Other concerns have to do with future land use possibilities (private, public, Tribal), or whether the land will be able to put back into productive use AT ALL.
5. All respondents indicated they felt adequately informed of Site activities. Hands-on attention from EPA staff and management has gone a long way in building positive relationships in the area.
6. One person indicated that he felt that more sampling of the sediments in the creeks on and around the Site needs to occur. Another person is very grateful that, in the process of dealing with the entire Site, "smaller" problems have been taken care of. Resolving

property ownership issues and determining future land use is very important, as is potential beneficial reuse of the area.

In general, community involvement at the Site has been fairly low-key. A number of meetings and availability sessions have been held, and attendance is usually quite good. The general public does not seem overly concerned about the contaminated status of the Site; rather, they are more concerned about what the future might hold for the entire area.

Document Review:

In preparing this Five-Year Review Report, the following documents were reviewed:

- Final Feasibility Study for Gilt Edge Mine Ruby Dump and Gulch Operable Unit 3, March 2001
- Early Action Interim Record of Decision for OU2, April 2001
- Interim Record of Decision for OU3, August 2001
- Interim Record of Decision for OU2, November 2001
- Ruby Gulch Waste Rock Repository and Cap Design Summary for Phases 1, 2, and 3, Gilt Edge Mine Superfund Site OU-3, Draft Report, February 6, 2003.
- Preliminary Feasibility Study Report for Gilt Edge Mine Site, Operable Unit 1, November 2004
- Monitoring data and data plots provided by CDM via email, September 2006
- Monitoring data plots provided by EPA via email, September 2006

Interviews were conducted with the following individuals to provide supplemental technical information:

- Steve Fundingsland – CDM (Consultant to EPA)
- Mike Gobla – US Bureau of Reclamation
- Dave Paul - US Bureau of Reclamation

Data Review:

The remedy includes a treatment facility effluent monitoring program as well as a flow monitoring program designed to track the volume of ARD discharging from OU3. However, monitoring reports presenting and interpreting the monitoring data have not been prepared and so in performing this five-year review, data from the following sources were reviewed and evaluated:

- Water Treatment Facility 30-day average effluent quality data for July 2004 through July 2006 provided by CDM via email.
- Plots of total monthly discharge from the Ruby Waste Rock Dump/Repository for January 1996 through August 2006 (several months of data are missing from late 2005) provided by EPA via email.
- Plots of monthly precipitation vs. monthly discharge from Ruby Waste Rock Dump from January 1997 through November 2002 provided by CDM via email.
- Plots of monthly precipitation vs. monthly discharge from Ruby Repository from December 2002 to February 2005 provided by CDM via email.

A summary of these data and their interpretation for demonstrating remedy performance is provided below.

OU2 – Water Treatment

Performance standards for OU2 are limited to effluent quality standards set according to the requirements of the South Dakota Surface Water Discharge System. Effluent quality standards are monitored at the point of discharge to Strawberry Creek. State surface water quality standards for total dissolved solids (TDS) and selenium were waived with the understanding that they will be part of the final Site remedy objectives under OU1. It is assumed that the waiver of TDS also includes a waiver of the conductivity standard as the two are related.

Monitoring data and corresponding standards are summarized on a table provided in Appendix C. Monitoring data indicate infrequent exceedences of several parameters between August 2004 and August 2006. These exceedences include:

- One exceedence of the monthly average temperature standard.
- Two exceedences of the monthly average total suspended solids (TSS) standard.
- One exceedence of the monthly average nitrate standard.

Many chemicals/parameters for which performance standards exist were not analyzed for during most or all of the monitoring period. These chemicals/parameters include:

- Alkalinity
- Weak acid dissociable (WAD) cyanide
- Total cyanide
- Chromium (VI)
- Dissolved mercury

In addition, the analytical detection limit for WAD cyanide is twice the water quality standard of 0.005 milligrams per liter (mg/L).

OU3 – Ruby Repository

Numerical performance standards were not established for OU3. Instead, qualitative performance standards (Remedial Action Objectives (RAOs)) were established for the Ruby Repository as described in the OU3 ROD and subsequent Design Summary Report and includes the following:

1. Control erosion of mine waste contaminants into Ruby Gulch and Bear Butte Creek.
2. Reduce formation and volume of ARD
3. Reduce leaching and migration of contaminants from mine waste into surface water.
4. Reduce leaching and migration of contaminants from mine waste that may enter groundwater.

The construction of the Ruby Repository cap constitutes "control" of mine waste erosion thereby meeting RAO No. 1.

Monitoring data provided by EPA and CDM support the conclusion that the OU3 remedy is meeting RAOs 2 through 4. RAOs 2 through 4 require a reduction in the generation of ARD and subsequent discharge to either surface water or groundwater.

ARD potentially reporting to surface water is measured as ARD collected at the toe of the Ruby Repository prior to treatment. Monthly ARD volumes collected at the toe of the Ruby Repository (Ruby Waste Rock Dump prior to 2003) is illustrated on Figure 2 (Appendix A) for the period 1996 through 2006. A review of this figure suggests that greater quantities of ARD were collected prior to construction of the Ruby Repository cap (largely completed by January 2003) than afterwards. This conclusion may be considered overly simplistic for two reasons:

1. Variability in the quantity of precipitation over the monitoring period can greatly influence the generation of ARD.
2. Clean water leaked into the repository in 2005 and 2006 during the testing of clean water diversion channel integrity, thereby artificially increasing the amount of ARD reported during those years.

In order to compensate for these two variables, plots of precipitation versus volume of ARD reporting to the collection system were prepared for the period prior to and after construction of the cap. The plot for the period after cap construction does not include the time over which the clean water diversion channel integrity testing was conducted. These plots are presented as Figures 3 and 4, respectively (Appendix A). A review of these plots shows the slope of the best fit line is flatter for the period after the cap was installed. This supports the conclusion that for each unit of incident precipitation, the quantity of ARD generated is much less after cap construction than before. This conclusion speaks to RAO's Nos. 2 and 3. It is also reasonable to assume that the overall reduction in the generation of ARD also speaks to RAO No. 4.

Site Inspection:

The Site Inspection was performed on August 30, 2006 by the EPA Remedial Project Manager for the Site, Ken Wangerud; Mark Keenihan of SDDENR; and Kenneth Napp, the HDR Project Manager. The purpose of the Site Inspection was to observe the current Site condition and remedy elements. At the time of the inspection it appeared that all physical remediation elements had been constructed. No construction completion reports were available for review.

In OU2, the water treatment plant was observed to be operational and in good condition. A photograph of the facility exterior is provided in Appendix B (photo No. 4). The ARD seep collection system in Hoodoo Gulch consists of a french drain constructed across the drainage with an adjacent lift station ultimately delivering water to the treatment facility. The french drain itself was not observed, as it is subsurface. The lift station was not operating at the time of the inspection but reportedly is in working order (Photo No. 5, Appendix B).

The ARD seep collection system upstream of Pond C reportedly was constructed in accordance with the design documents and consists of the following:

- A concrete head structure constructed in an unlined channel directing flow into a 12-inch diameter flexible pipe.
- Conveyance of ARD to Pond C via the 12-inch pipe.
- Discharge of ARD from Pond C to a smaller diameter pipe (Photo No. 7, Appendix B) delivering ARD to Pond E (water in Pond E is pumped to the treatment facility).

In OU3, the Ruby Repository reportedly was constructed as designed with the exception of clean water diversion ditches which reportedly are leaky due to a damaged liner system, unlined ditches constructed in fractured bedrock, and sediment dams redirecting water under liners.

However, visual evidence of such damage was not apparent, nor is it expected to be. A photograph of a typical section of clean water diversion channel is shown on Photo No. 3 (Appendix B). The vegetative cover was observed to be in good condition (Photo Nos. 1 and 2, Appendix B). The ARD storage pond at the toe of the repository appeared to be in good condition with no obvious damage to the portion of the liner above the water level. The lift station below the collection pond was not operating at the time of the inspection but reportedly is in working order.

VII. Technical Assessment

Question A: Is the remedy functioning as intended by the decision documents?

The remedy for OU2 consists of the following elements:

1. Continued collection of ARD from the toe of the Ruby Waste Rock Dump and conveyance to the Sunday Pit for water treatment.
2. Collection of ARD seeps in Hoodoo Gulch and conveyance to the Sunday Pit for water treatment.
3. Collection of ARD seep flows upstream of Pond C and conveyance to Pond D for water treatment.
4. Conversion of the existing sodium hydroxide-based water treatment process to a 250-gallon per minute (gpm) net treatment capacity system consisting of a lime-based neutralization/precipitation high density sludge process with lime slaking and slurry chemical feed equipment upgrades. Effluent quality performance standards (based on South Dakota surface water quality standards) are summarized on a table provided in Appendix C.

The remedy would be considered to be protective if Hoodoo Gulch ARD seeps and seeps above Pond C are collected and delivered to the water treatment facility (along with ARD generated in OU3) and treated to the effluent quality standards.

The performance of each remedy element is discussed below:

1. ARD is collected from the toe of the former Ruby Waste Rock Dump (present Ruby Repository- OU3) and conveyed to the Sunday Pit prior to being pumped to the treatment facility.
2. The Hoodoo Gulch seep collection system is constructed and operating. No flows were observed in the channel at the time of the Site Inspection. In addition, the collection system is below-ground. Therefore, a favorable performance assessment is based on personal communications with the EPA Project Manager.
3. An ARD collection system for seeps above Pond C was observed during the Site Inspection. No flows were observed in the channel at the time of the Site Inspection. However, most system components are above-ground and were observed to be in working order.
4. Water treatment facilities were constructed in accordance with the ROD requirements. Effluent quality conforms to numerical performance standards during the monitoring period (July 2004 to July 2006) with the following exceptions:

- One exceedence of the monthly average temperature standard.
- Two exceedences of the monthly average total suspended solids (TSS) standard.
- One exceedence of the monthly average nitrate standard.

Additional exceedences of performance standards may have occurred prior to the monitoring period examined for this 5-Year Review (July 2004 through July 2006).

Remedial action objectives for OU2 include the following statement:

"Achieve compliance, to the extent possible and practicable for the interim, with currently applicable water quality standards"

Based on this RAO, it appears the few exceedences of water quality standards described above are not inconsistent with ROD requirements (and the TDS and Selenium interim waiver). However, many chemicals/parameters for which performance standards exist were not analyzed for during most or all of the monitoring period. These chemicals/parameters include:

- Alkalinity
- Weak acid dissociable (WAD) cyanide
- Total cyanide
- Chromium (VI)
- Dissolved mercury

According to a representative of CDM (EPA's contractor), these parameters were dropped from the analyte list after multiple sample results showed consistent concentrations below the corresponding standard. The analytical data presented in Appendix C supports this explanation with one exception. The analytical detection limit for WAD cyanide is twice the water quality standard of 0.005 mg/L. Therefore, it is not possible to determine whether sample results showed consistent concentrations below the corresponding standard

An additional concern involves the reported inability of the water treatment facility to operate at 250 gpm when the influent stream consists exclusively of the highest sulfate waters present at the Site. EPA is considering improvements to remedy efficiency through modification of the treatment facility.

The remedy for OU3 consists of the following elements:

1. Regrading of waste rock, including placement in the upper Ruby Gulch drainage.
2. Construction of a composite cap using a geomembrane liner.
3. Installation of lateral drainage structures to limit erosion and convey runoff
4. Construction of a protective layer for the synthetic cap, and benches to carry clean water off of the repository.
5. Construction of clean-water diversion ditches.
6. Seeding the repository.
7. Construction of vault collection system, overflow pond and upgraded pumping facility at the repository toe.

8. Although not required by the ROD, a resistivity geophysics monitoring system to supplement a limited number of wells, was part of the remedial design.

All of these remedy elements (i.e. the cap-cover, lateral bench drains, and perimeter diversion conveyance ditches) were constructed as designed (personal communication with EPA Project Manager). Based on conversations with the EPA Project Manager, bedding material was not placed (because of high cost) beneath a geocomposite-membrane liner that was installed in the sections of clean water diversion ditches where native materials were known to have unacceptably high vertical permeability. As a result, some degree of damage to and/or displacement of the geocomposite-membrane liner is suspected to have occurred during placement of overlying rip-rap. Other concerns related to the diversion ditches include unlined sections that were constructed in more tightly-fractured bedrock and the post-construction influx of a sediment dam in one of the ditches. Several design and construction factors are suspected to be the cause of losses during storm water conveyance in the diversion channels. These water losses enter the waste rock mass and report to the collection system at the toe of the repository. However, the relative proportion of these losses to total annual runoff, ditch conveyance volumes, and repository discharge is not yet well known.

An approximately 10-acre area of Ruby Gulch waste rock remains outside of the capped area (Figure 1 – Appendix A). This area was deliberately excluded from the design (personal communication, USBOR) and would be addressed under OU1 during closure of the Heap Leach Pad, if appropriate.

The RAOs for OU3 called for control of mine waste erosion into Ruby Gulch and a reduction in the formation of ARD. As previously discussed, these RAOs are being met in spite of the leaking clean water diversion ditches.

Question B: Are the exposure assumptions, toxicity data, cleanup levels and remedial action objectives used at the time of the remedy selection still valid?

Numerical performance standards are restricted to water treatment facility effluent quality. All other performance standards are qualitative. Therefore, assessment of exposure assumptions and toxicity data related to risk-based remediation goals is not appropriate, as risk-based remediation goals have not be set for OU2 or OU3. A baseline risk assessment is in preparation under OU1.

Clean-up levels, as they apply to treatment facility effluent remain valid with one exception. The EPA approved South Dakota water quality standards now contains pertinent equations to determine the total ammonia concentrations that cannot be exceeded (Appendix A referenced in § 74:51:01:49). In addition, the 30-day average is now seasonal.

RAO's used at the time of the remedy selection remain valid. Final RAO's for the Site are being addressed under OU1.

Question C: Has other information come to light that could call into question the protectiveness of the remedy?

There is no other information that calls into question the protectiveness of the remedy.

Technical Assessment Summary

According to the data reviewed and the Site inspection, the remedy is largely operating as intended by the ROD. The physical remedy elements are in place and functioning. The occasional exceedences of water quality standards in treatment facility effluent do not appear to be inconsistent with the intent of the ROD. However, inconsistencies between the required monitoring of treatment system effluent and the actual monitoring program implemented during the review period for OU2 require resolution.

Protectiveness currently is achieved through collection of ARD and its treatment before leaving the Site. Although leaking clean water diversion ditches may be contributing waters to the waste rock mass inside the repository and ultimately increasing the volume of collected ARD, the issue is one of remedy efficiency rather than protectiveness.

VIII. Issues

Based on the information collected during the first five-year review, the following issues were identified:

Table 2
Issues

Item No.	Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1	Occasional exceedence of applicable State Surface Water Quality Standards (OU2) including temperature, total suspended solids and nitrate.	N	potentially
2	Alkalinity, weak acid dissociable cyanide, total cyanide, chromium VI and dissolved mercury not measured in water treatment facility effluent during most or all the monitoring period.	potentially	potentially
3	Detection limit for weak acid dissociable (WAD) cyanide is twice the water quality standard	potentially	potentially
4	New effluent standard for ammonia. The standard is calculated using equations in Appendix A referenced in § 74:51:01:49.	potentially	potentially
5	Clean water diversion ditches may discharge to waste rock mass due to suspected leaky channel liner, unlined fractured bedrock ditches and sediment dams in the ditches.	N	N
6	ROD required site-specific toxicology study of sulfate TDS has not been performed	potentially	potentially

IX. Recommendations and Follow-up Actions

Table 3
Recommendations and Follow-up Actions

Item No	Issues	Recommendations and Follow-up Actions	Party Responsible	Due Date
1	Occasional exceedence of applicable State Surface Water Quality Standards (OU2) including temperature, total suspended solids and nitrate.	Continue monitoring	EPA	NA
2	Alkalinity, weak acid dissociable cyanide, total cyanide, chromium VI and dissolved mercury not measured in water treatment facility effluent during most or all the monitoring period.	Improve monitoring program	EPA	September 2007
3	Detection limit for weak acid dissociable (WAD) cyanide is twice the water quality standard	Revise analytical detection limits	EPA	September 2007
4	New effluent standard for ammonia. The standard is calculated using equations in Appendix A referenced in § 74:51:01:49.	Revise performance standards	EPA	September 2007
5	Clean water diversion ditches may discharge to waste rock mass due to suspected leaky channel liner, unlined fractured bedrock ditches and sediment dams in the ditches.	Consider repair to suspected leaking channels.	EPA	September 2008
6	ROD required site-specific toxicology study of sulfate TDS has not been performed.	Conduct study	EPA	September 2008

X. Protectiveness Statement(s)

RAOs are being met under the Interim RODs for OU2 and OU3. Therefore, the remedy as implemented is currently protective of human health and the environment. Residual risks associated with remaining contaminated environmental media will be addressed under OU1.

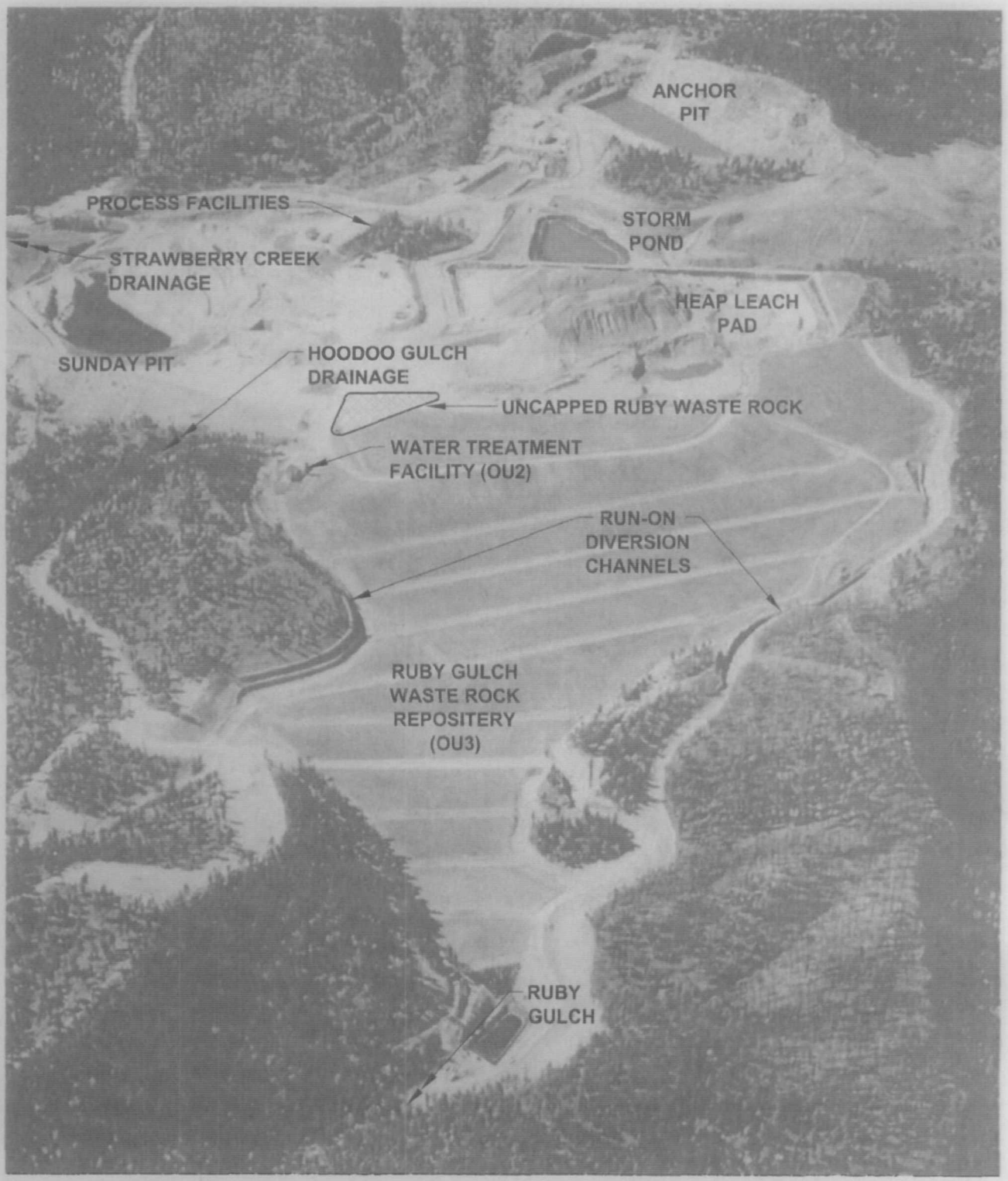
XI. Next Review

The Site requires ongoing five-year reviews in accordance with CERCLA § 121 (c). The next five year review for the Site will be performed by September 2011, five years from the date of this review.

APPENDICES

APPENDIX A

FIGURES



HDR

Gilt Edge Mine
Lawrence County, South Dakota

PRIMARY SITE FEATURES

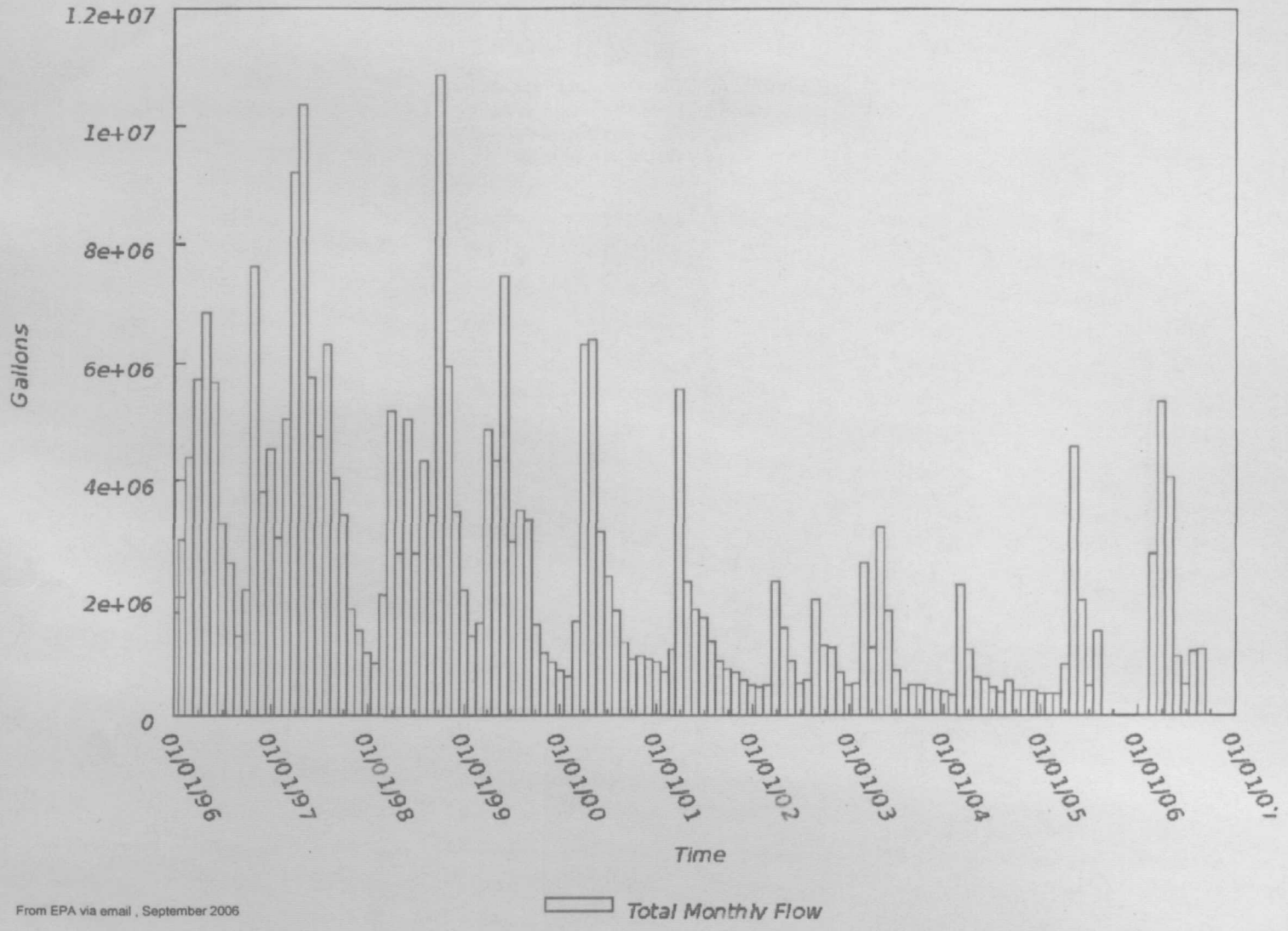
DATE
SEPT. 2006

FIGURE
1

9/21/2006 3:28:14 PM, RNelson

Figure 2

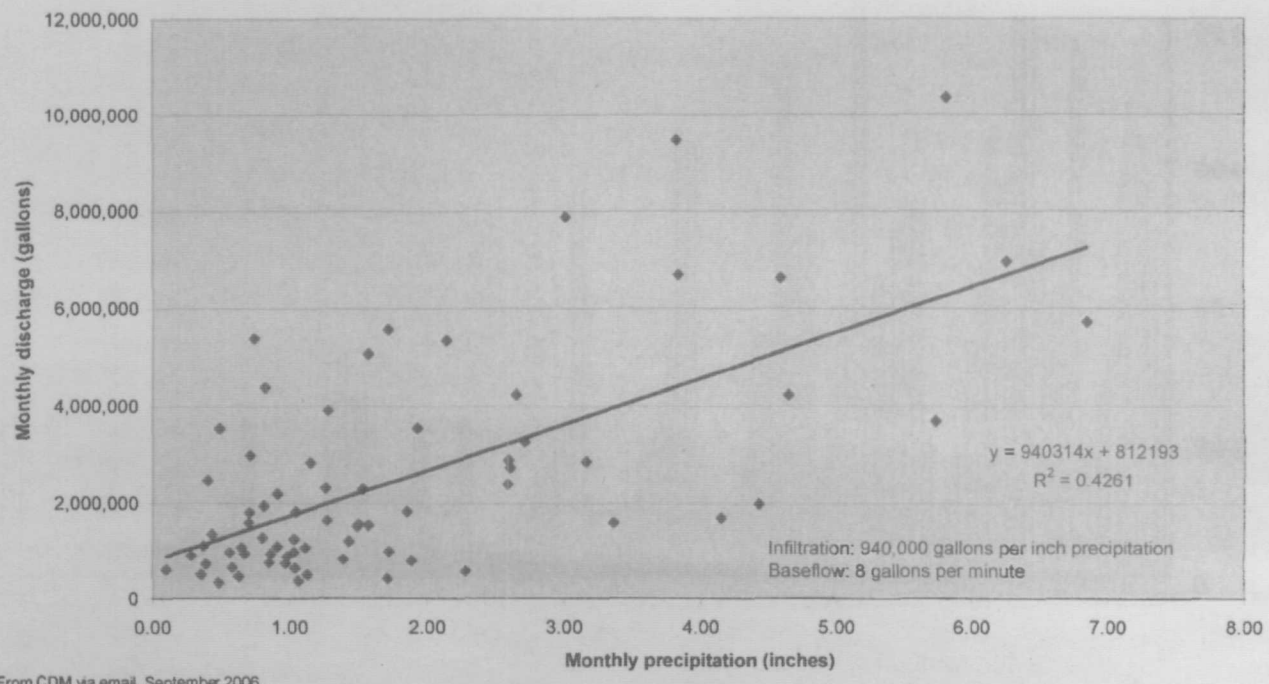
Monthly ARD Flow from Ruby Repository 1996-2006



From EPA via email , September 2006

Figure 3
Monthly ARD Flow versus Precipitation

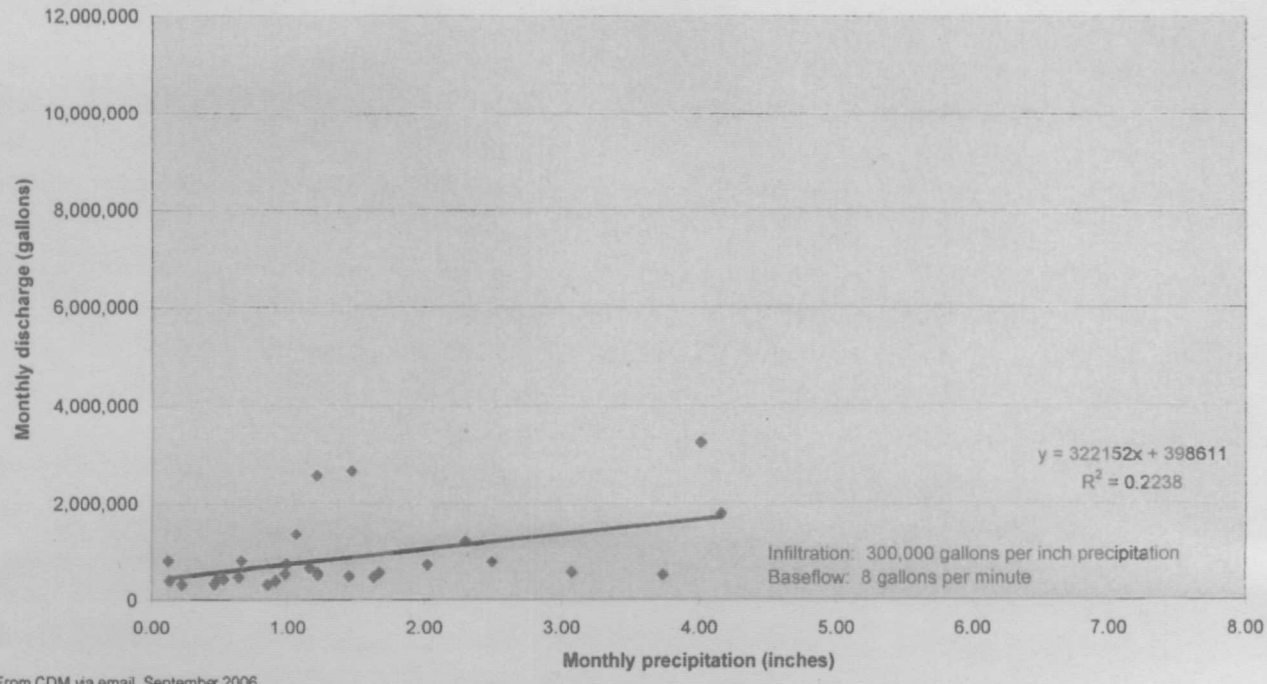
Ruby Waste Dump: Prior to Cap
January 1997 to November 2002



From CDM via email, September 2006

Figure 4
Monthly ARD Flow versus Precipitation

Ruby Waste Dump: After Cap Installed
December 2002 to February 2005



From CDM via email, September 2006

APPENDIX B

PHOTO LOG

Photo Log

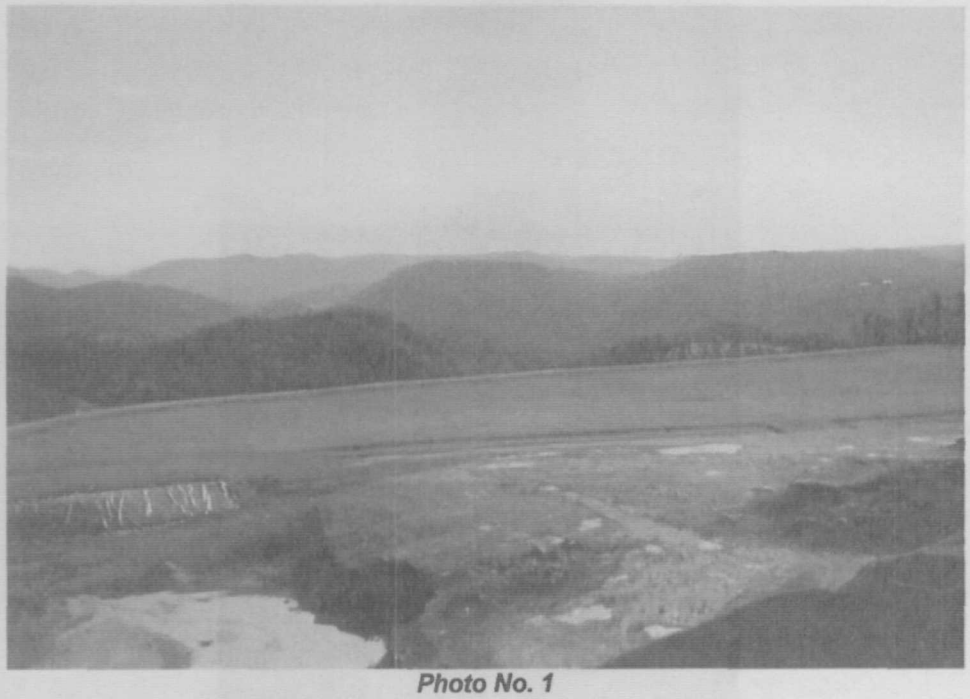


Photo No. 1
Top of Ruby Repository, Seen from Heap Leach Pad
View to East

Photo No. 2
Ruby Repository
View to North

Photo No. 3
North Surface Water Run-on Diversion Channel
View to East

Photo No. 4
Water Treatment Plant
View to West

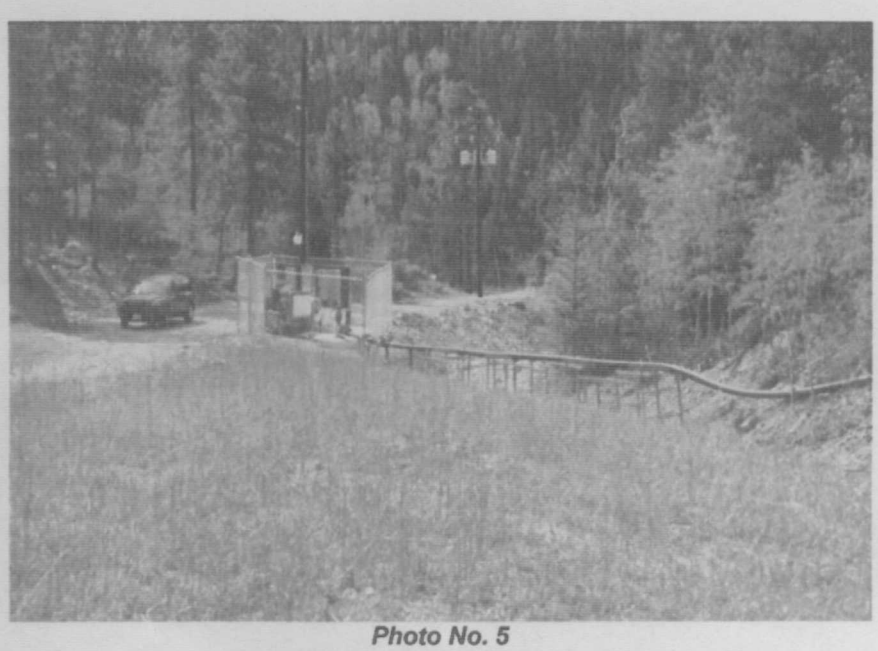


Photo No. 5
Hoodoo Gulch Lift Station
View to South

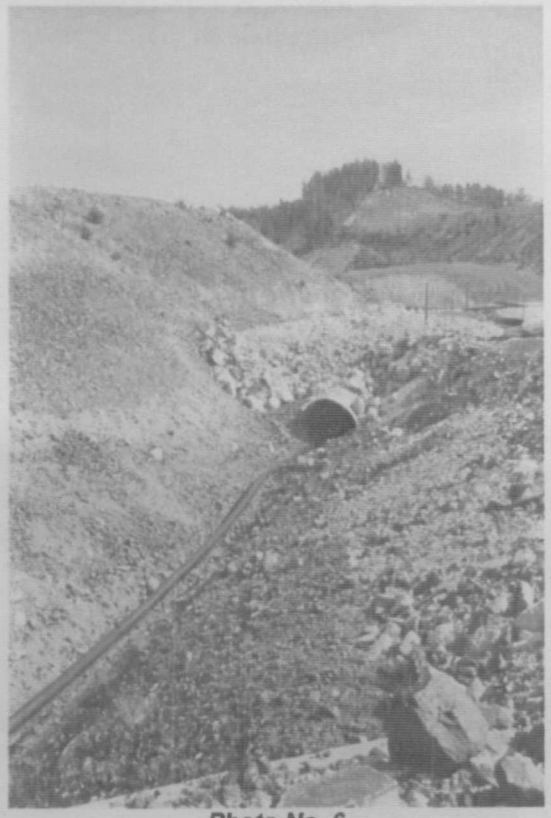


Photo No. 6
Pipeline Conveying ARD Seep Discharge above Pond C
View to North

Photo No. 7
Pond C w/ ARD Intake (90° elbow) and Clean Water Diversion (Pipe Right of Ladder)
View to South

Photo No. 8
36-inch Clean Water Diversion Pipe Staged for Installation
View to South

APPENDIX C

TREATMENT FACILITY EFFLUENT QUALITY DATA AND PERFORMANCE STANDARDS

Table 1

SUMMARY OF SURFACE WATER COMPLIANCE POINT SAMPLING
Analytical Results From Midcontinent Testing Laboratory.

Units are mg/l unless otherwise noted

Water Treatment Plant End-Of-Pipe

Date	Time	Sampler	Temperature (deg C)	Conductivity (umhos/cm)	Hardness	pH	TDS	TSS	Turbidity (NTU)	Alkalinity	CN WAD	CN total	Nitrate	As (trec)	As (diss)	Cd (trec)	Cd (diss)	Ca (diss)	Cr (III) (diss)	Cr (VI) (diss)	Cu (trec)	Cu (diss)	Pb (trec)	Pb (diss)	Mg (diss)	Hg (trec)	Hg (diss)	Ni (trec)	Ni (diss)	Se (trec)	Se (diss)	Ag (trec)	Ag (diss)	Zn (trec)	Zn (diss)
				30-day			30-day	24-hour		30-day	chronic		30-day		chronic		chronic		chronic	chronic		chronic		chronic			chronic		chronic		chronic		acute		chronic
SD AWQC Limits			24.0	2500		6.5-8.8	2500	10		750	0.005		50		0.190		0.003		0.204	0.010		0.037		0.011			0.00001		0.108		0.005		0.037		0.108
9/29/2003	14:40	CDM	13.3	2860	2800	7.51	3694	<10	1.4					<0.005	<0.005	<0.001	<0.001	774	0.005	<0.010	0.012	0.007	0.001	0.001	16.4	<0.0002	<0.0002	<0.005	<0.020	0.006	0.008	<0.001	<0.001	<0.050	<0.050
August 2004 Avg's		CDM	n/a	3480	2170	7.77	3307	12	0.5	27.6	<0.010	<0.010	32.4	<0.005	<0.005	<0.001	<0.001	880	0.009		0.038	0.015	<0.001	<0.001	8.1	<0.0002	<0.0002	0.025	0.020	0.013	0.013	<0.001	<0.001	<0.050	0.069
September 2004 Avg's		CDM	n/a	3420	2420	7.61	4280	33	8.5	29.8	<0.010	<0.010	31.3	<0.005	<0.005	<0.001	<0.001	910	0.009		0.015	0.011	<0.001	<0.001	8.7	<0.0002	<0.0002	0.019	0.019	0.012	0.011	<0.001	<0.001	<0.050	<0.050
October 2005 Avg's		CDM	12.8	2930	1680	7.77	2880	<5		30.0	<0.010		17.8	<0.005	<0.005	<0.001	<0.001	866	0.005		0.012	0.01	<0.001	<0.001	13.0	<0.0002	<0.0002	0.021	0.019	0.011	0.008		<0.001	<0.050	<0.050
November 2005 Avg's			7.5	3000	1685	7.31		<5.5					20.2	<0.005	<0.005	0.001	0.001	850	0.002		0.017	0.011	0.004	<0.001	15.2	<0.0002		0.020	0.018	0.009	0.009		<0.001	<0.050	<0.050
December 2005 Avg's		CDM	4.9	3028	1695	7.3		<5.5					21.7	<0.005	<0.005	<0.001	<0.001	656	0.002		0.019	0.011	0.001	<0.001	14.8	<0.0002		0.020	0.019	0.010	0.009		<0.001	<0.050	<0.050
January 2006 Avg's		CDM	5.5	2868	1654	7.28		<5.2					22.2	<0.005	<0.005	<0.001	<0.001	627	0.001		0.012	0.011	<0.001	<0.001	16.0	<0.0002		0.020	0.015	0.009	0.009		<0.001	<0.050	<0.050
February 2006 Avg's		CDM	3.8	2156	1888	7.31		<5.5					21.4	<0.005	<0.005	<0.001	<0.001	616	0.002		0.014	0.010	<0.001	<0.001	38.0	<0.0002		0.022	0.018	0.011	0.010		<0.001	<0.050	<0.050
March 2006																																			
[illegible]	12:55	CDM	5.2	2640	1400	7.48		<4					23.2	<0.005	<0.005	<0.001	<0.001	541	0.001		0.009	0.009	<0.001	<0.001	11.5	<0.0002		0.014	0.014	0.010	0.008		<0.001	<0.050	<0.050
3/15/2006	9:30	CDM	5.8	2440	1170	7.23		<4					25.9	<0.005	<0.005	<0.001	<0.001	448	0.001		0.011	0.011	<0.001	<0.001	11.9	<0.0002		0.013	0.013	0.009	0.007		<0.001	<0.050	<0.050
[illegible]	n/a	CDM	4.0	2510	1,380	7.40		<4					24.3	<0.005	<0.005	0.001	0.001	498	0.001		0.020	0.020	<0.001	<0.001	10.8	<0.0002		0.010	0.010	0.007	0.008		<0.001	<0.050	<0.050
[illegible]	10:25	CDM	5.0	2350	1220	7.38		<4					22.4	<0.005	<0.005	<0.001	<0.001	473	<0.001		0.011	0.010	<0.001	<0.001	9.7	<0.0002		0.008	0.007	0.006	0.005		<0.001	<0.050	<0.050
March 2006 Avg's		CDM	5.0	2485	1,288	7.37		<4					24.2	<0.005	<0.005	<0.001	0.001	490	0.001		0.013	0.013	<0.001	<0.001	10.9	<0.0002		0.011	0.011	0.008	0.007		<0.001	<0.050	<0.050
April 2006																																			
[illegible]	13:00	CDM	8.8	1870	921	7.53		<4					19.6	<0.005	<0.005	<0.001	<0.001	351	<0.001		0.024	0.010	<0.001	<0.001	10.9	<0.0002		0.007	0.008	0.006	0.006		<0.001	<0.050	<0.050
[illegible]	tba	CDM	10.5	1660	799	7.68		<4					12.9	<0.005	<0.005	<0.001	<0.001	398	<0.001		0.009	0.008	<0.001	<0.001	13.4	<0.0002		<0.005	<0.005	<0.005	<0.005		<0.001	<0.050	<0.050
[illegible]	11:28	CDM	11.8	1740	1020	7.66		<4					12.3	<0.005	<0.005	<0.001	<0.001	329	<0.001		0.006	0.007	<0.001	<0.001	48.5	<0.0002		0.005	0.006	<0.005	<0.005		<0.001	<0.050	<0.050
4/24/2006	9:40	CDM	8.5	1360	628	7.61		<4					7.98	<0.005	<0.005	<0.001	<0.001	241	<0.001		0.008	0.008	<0.001	<0.001	6.5	<0.0002		0.007	0.006	<0.005	<0.005		<0.001	<0.050	<0.050
April 2006 Avg's		CDM	9.4	1658	835	7.62		<4					13.2	<0.005	<0.005	<0.001	<0.001	302	<0.001		0.011	0.008	<0.001	<0.001	19.8	<0.0002		0.008	0.008	0.008	0.006		<0.001	<0.050	<0.050
May 2006																																			
5/1/2006	12:00	CDM	10.0	1650	805	7.62		<4					6.78	<0.005	<0.005	<0.001	<0.001	312	<0.001		0.006	0.006	<0.001	<0.001	5.9	<0.0002		0.007	0.007	<0.005	<0.005		<0.001	<0.050	<0.050
5/8/2006	9:21	CDM	10.9	1930	989	7.41		5.2					12.1	<0.005	<0.005	<0.001	<0.001	379	<0.001		0.007	0.008	<0.001	<0.001	10.3	<0.0002		0.010	0.010	0.006	0.006		<0.001	<0.050	<0.050
5/15/2006	9:45	CDM	11.9	1900	971	7.50		<4					11.6	<0.005	<0.005	<0.001	<0.001	372	<0.001		0.005	0.005	<0.001	<0.001	10.2	<0.0002		0.013	0.012	0.006	0.005		<0.001	<0.050	<0.050
5/22/2006	9:10	CDM	19.0	2050	1150	7.58		<4					11.9	<0.005	<0.005	<0.001	<0.001	445	<0.001		0.007	0.006	<0.001	<0.001	8.1	<0.0002		0.015	0.014	0.006	0.005		<0.001	<0.050	<0.050
5/30/2006	9:45	CDM	18.5	2200	1230	7.67		<4					11.8	<0.005	<0.005	<0.001	<0.001	478	<0.001		0.005	0.005	<0.001	<0.001	9.9	<0.0002		0.013	0.013	0.007	0.008		<0.001	<0.050	<0.050
May 2006 Avg's		CDM	14.1	1948	1029	7.57		<5					10.8	<0.005	<0.005	<0.001	<0.001	397	<0.001		0.008	0.005	<0.001	<0.001	8.9	<0.0002		0.012	0.011	0.006	0.006		<0.001	<0.050	<0.050
June 2006																																			
6/5/2006	11:10	CDM	22.3	2270	1230	7.50		<10					11.5	<0.005	<0.005	0.001	0.001	478	<0.001		0.008	0.007	<0.001	<0.001	9.8	<0.0002		0.015	0.015	0.007	0.006		<0.001	<0.050	<0.050
6/12/2006	8:45	CDM	21.5	2470	1310	7.63		<4					11.0	<0.005	<0.005	<0.001	<0.001	510	0.002		0.008	0.007	<0.001	<0.001	9.4	<0.0002		0.016	0.015	0.007	0.007		<0.001	<0.050	<0.050
6/19/2006	9:05	CDM	24.0	2330	1190	7.93		13.6*	not offsite discharge				9.1	<0.005	<0.005	<0.001	<0.001	461	0.002		0.009	0.008	<0.001	<0.001	8.9	<0.0002		0.015	0.016	0.005	0.005		<0.001	<0.050	<0.050
6/26/2006	9:15	CDM	25.0	2380	1270	7.95		9.2					9.4	<0.005	<0.005	0.001	0.001	497	0.003		0.132	0.017	<0.001	<0.001	7.7	<0.0002		0.013	0.013	0.005	0.005		<0.001	<0.050	<0.050
June 2006 Avg's		CDM	23.0	2345	1,250	7.75		<10					10.3	<0.005	<0.005	<0.001	<0.001	487	0.002		0.039	0.008	<0.001	<0.001	8.9	<0.0002		0.015	0.015	0.006	0.006		<0.001	<0.050	<0.050
July 2006																																			
7/5/2006	9:15	CDM	20.8	2500	1340	7.56		<4					9.6	<0.005	<0.005	<0.001	<0.001	327	0.003		0.007	0.006	<0.001	<0.001	5.2	<0.0002		0.006	0.012	0.005	0.008		<0.001	<0.050	<0.050
7/10/2006	9:25	CDM	25.0	2450	1300	7.90		<4					9.3	<0.005	<0.005	<0.001	<0.001	510	0.001		0.006	0.006	<0.001	<0.001	5.9	<0.0002		0.014	0.014	0.006	0.008		<0.001	<0.050	<0.050
7/17/2006	9:55	CDM	22.2	2430	1310	7.78		<4					9.8	<0.005	<0.005	<0.001	<0.001	525	0.001		0.007	0.007	<0.001	<0.001	5.8	<0.0002		0.012	0.012	0.005	0.005		<0.001	<0.050	<0.050
7/24/2006	7:55	CDM	22.3	2440	1350	7.95		<4					10.2	<0.005	<0.005	<0.001	<0.001	529	0.002		0.008	0.008	<0.001	<0.001	7.1	<0.0002		0.016	0.016	0.007	0.006		<0.001	<0.050	<0.050
July 2006 Avg's		CDM	22.4	2455	1330	7.87		<4					9.7	<0.005	<0.005	<0.001	<0.001	523	0.002		0.007	0.008	<0.001	<0.001	6.0	<0.0002		0.012	0.014	0.006	0.008		<0.001	<0.050	<0.050
August 2006																																			
8/1/2006	9:00	CDM	20.7	2450	1400	7.70		<4					9.5	<0.005	<0.005	<0.001	<0.001	553	0.001		0.008	0.008	<0.001	<0.001	5.4	<0.0002		0.013	0.013	0.005	0.005		<0.001	<0.050	<0.050
8/7/2006	8:50	CDM	22.0	2530	1250	8.32		<4					9.8	<0.005	<0.005	<0.001	<0.001	483	0.001		0.007	0.008	<0.001	<0.001	9.6	<0.0002		0.013	0.013	0.005	0.005		<0.001	<0.050	<0.050

From CDM via email, 9/06