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Record of Decision

Rio Tinto Mine Site
Elko County, Nevada

Record of Decision

Rio Tinto Mine Site
Elko County, Nevada

February, 2012

Nevada Division of Environmental Protection
Lead Agency

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List of Acronyms and Abbreviations

AOC	Administrative Order on Consent
ARAR	Applicable or Relevant and Appropriate Requirement
BMPs	Best Management Practices
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CERCLIS	Comprehensive Environmental Response, Compensation, and Liability Information System
CFR	Code of Federal Regulations
cfs	cubic feet/second
COC	Contaminant of Concern
cy	cubic yard
ESD	Explanation of Significant Difference
ET	Evapo-Transpirative
FWP	Fresh Water Pond (Pond 1)
GCL	Geosynthetic Clay Liner
HCP	Hydraulic Control Pond
mg/L	Milligram/Liter
NAC	Nevada Administrative Code
NCP	National Contingency Plan
NDEP	Nevada Division of Environmental Protection
NPL	National Priorities List
NRS	Nevada Revised Statute
O & M	Operation & Maintenance
ROD	Record of Decision
RTWG	Rio Tinto Working Group
TBC	To be Considered
UCL	Upper Confidence Limit
US EPA	United States Environmental Protection Agency
USFS	United States Forest Service
WQCP	Water Quality Compliance Protocol

1. The Declaration

1.1 Site Name and Location

The Rio Tinto Mine Site ("the Site") is a former copper mine located approximately 2.5 miles south of Mountain City, in northern Elko County, Nevada (Figure 1). The Site is located at 41° 48′ 58.5″ north latitude, 115° 58′ 24.0″ west longitude. The Site is composed of two sub-areas, Area A and Area B (Figure2). The former mine was located in Area A on Mill Creek, a tributary of the East Fork of Owyhee River (Figure 3). The Shoshone-Paiute Tribes of the Duck Valley Indian Reservation (the "Tribes") is located approximately ten miles downstream of Area A, on the East Fork Owyhee River.

1.2 Statement of Basis and Purpose

This decision document presents the Selected Remedy for the Rio Tinto Mine, in northern Elko County, Nevada, which was chosen in accordance with State Law; the federal Comprehensive Environmental Response Compensation and Liability Act, as amended by Superfund Amendments and Reauthorization Act; and the National Contingency Plan ("NCP"). This decision is based on the Administrative Record file for the Site.

The State of Nevada, represented by the Nevada Division of Environmental Protection (NDEP), was the lead agency in the selection of the Selected Remedy. The US Environmental Protection Agency (US EPA) concurs with the Selected Remedy as being protective and consistent with the NCP.

1.3 Assessment of Site

The response action selected in this Record of Decision is necessary to protect public health or the environment from actual or threatened releases of pollutants or contaminants from this Site that may present an imminent and substantial endangerment to public health or the environment.

1.4 Description of Selected Remedy

The Selected Remedy will remove mining materials from Tailings Ponds 3 and 4 from the Mill Creek Valley and some amount of underlying materials to an on-site repository. Pond 2 (Sludge Pond) and Pond 1 (Fresh Water Pond) will remain in place though they may be altered to be integrated into a final configuration of Mill Creek Valley. An unlined repository, which will accept mining materials removed from Mill Creek Valley, will be located on the ridge to the east and south of the former town site and will include an evapotranspiration (ET) cover. During construction activities a temporary, seasonal water treatment system will treat water associated with the removal of Ponds 3 and 4 materials and underlying materials. Following the removal, a three foot-thick layer of clean, on-site soils will be placed within the footprint of Ponds 3 and 4. Mill Creek will subsequently be realigned to the center of Mill Creek Valley east of Pond 2. Major elements of the Selected Remedy are illustrated in Figure 4. Additional elements of the Selected Remedy include the collection and evaporation of small seeps from the Heap Leach Pad, construction of channel structures intended to be supportive of fish passage, institutional controls, and monitoring, including the implementation of a Water Quality Compliance Protocol (Appendix 1) to assess remedy protectiveness and compliance with applicable or relevant and appropriate cleanup standards, or "ARARs"; as well as an Ambient Monitoring Protocol (Appendix 2) to identify any discharges from the mine that cannot currently be discerned.

1.5 Statutory Determinations

The Selected Remedy is protective of human health and the environment, complies with Federal and State requirements that are applicable or relevant and appropriate to the remedial action (unless justified by a waiver), is cost-effective, and utilizes permanent solutions and alternative treatment (or resource recovery) technologies to the maximum extent practicable.

The Selected Remedy does not satisfy the statutory preference for treatment as a principal element of the remedy for the following reason. Due to the high volumes of the mine-related materials and low concentrations of metals, it would not be practicable to treat the wastes to the extent necessary to meet the statutory preference for treatment of wastes to reduce their volumes or toxicity or permanently reduce mobility of contaminants. However, the Selected Remedy will reduce mobility of pollutants and contaminants by removing the materials from continuing contact with water in the drainage, drying the mine-related materials and placing them in a repository that will be designed to limit infiltration of meteoric water and reduce or eliminate the generation of acidic, metal-bearing discharges.

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining in Area A, statutory reviews will be conducted in accordance with section 121 of CERCLA to ensure that the remedy remains protective of human health and the environment.

1.6 Data Certification Checklist

The following information is included in the Decision Summary section of this Record of Decision. Additional information can be found in the Administrative Record file for this site.

- Chemicals of concern and their respective concentrations (Section 2.2);
- A description of risk represented by the chemicals of concern (Section 2.2);
- Cleanup levels established for chemicals of concern and the basis for these levels (Section 2.3);
- A determination that source materials do not constitute principal threat wastes as defined by CERCLA (Section 2.6);
- Current and reasonably anticipated future land and resource use assumptions (Section 2.1.6);
- Potential land and water use that will be available at the site as a result of the Selected Remedy (Section 2.1.6);
- Estimated capital, annual operation and maintenance (O&M), and total present worth costs, discount rate, and the number of years over which the remedy cost estimates are projected (Section 2.8.1).
- Key factor(s) that led to selecting the remedy (i.e., a description of how the Selected Remedy provides the best balance of tradeoffs with respect to the balancing and modifying criteria, highlighting criteria key to the decision) (Section 2.8).

1.7 Lead Agency and Supporting Agency Signatures

Approved by: Date:

2/13/12

Colleen Cripps, Ph.D.
Administrator
Nevada Division of Environmental Protection

Approved by: Date:

Mike Montgomery
Assistant Director
Superfund Division
US Environmental Protection Agency, Region 9

1.7 Lead Agency and Supporting Agency Signatures

Approved by: **Date:**

2/13/12

Colleen Cripps, Ph.D.
Administrator
Nevada Division of Environmental Protection

Approved by: **Date:**

2/14/12

Mike Montgomery
Assistant Director
Superfund Division
US Environmental Protection Agency, Region 9

2. The Decision Summary

2.1 Project Background

2.1.1 Site Name, Location and Brief Description

The Site is a located approximately 2.5 miles south of Mountain City, in Northern Elko County, Nevada (Figure 1) at 41° 48′ 58.5″ north latitude, 115° 58′ 24.0″ west longitude. The Site is identified in the NDEP "Project Tracking" database with the ID number of F-001027. The site is listed in CERCLIS under the name Rio Tinto Copper Mine with a US EPA ID of NV3141190030.

The Site is not on the National Priorities List (NPL) but is being addressed under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA), also known as Superfund, under US EPA's Superfund Alternative Site Guidance. The NDEP is the lead agency for the implementation of the Selected Remedy. The US EPA is a support agency and concurs with the Selected Remedy. In addition to being a support agency, the US EPA retains certain authorities to ensure that any imminent threats to human health and the environment are addressed by the implementation of the Selected Remedy.

The Selected Remedy will be undertaken by certain alleged prior owners or operators ("Settling Defendants") through a voluntary Consent Decree with the NDEP and US EPA. The Consent Decree will contain financial assurances and performance guarantees sufficient for the lead agency to complete the remedy in the event of failure by the Settling Defendants to satisfy elements of this Record of Decision. Several years ago the Settling Defendants formed the Rio Tinto Working Group (RTWG), consisting of the Atlantic Richfield Company, the Cleveland-Cliffs Iron Company, E.I. du Pont de Nemours and Company, and Teck Cominco American Incorporated.

Area A of the Site (Figure 2) includes a number of features resulting from historic copper mining operations involving an underground, copper sulfide ore body. In addition to the main ore body which was mined from 1932 and 1947 and an additional lower grade ore body that was identified but never mined. Area A retains a number of surface features associated with mining activities: an abandoned town and mill sites; a waste rock pile at the former mine site; Hillside Tailings Piles No.1 and No. 2, which are located immediately north of the town site; a heap leach pad located immediately south of the town site; and the historic Mill Creek channel and associated Fresh Water Pond (Pond 1), Sludge Pond (Pond 2) and two ponds containing mine waste materials known as Ponds Nos. 3 and 4, which were placed in and along Mill Creek approximately 2,000 feet north of the town site (Figure 3).

2.1.2 Site History and Enforcement Activities

Underground mining occurred between 1932 and 1947. Starting in approximately 1965, there were a number of operations at Area A that involved the re-working of the tailings material in the upper Mill Creek Valley, leaching stockpiles of ore, leaching the underground workings, and exploration for additional mineral deposits. No mining related activities have occurred at the site since the late 1970s.

Site investigations, regulatory actions, and remedial construction activities have been ongoing for some time. In 1986, the Nevada Mining Association, on behalf of NDEP, developed several suggestions to reduce discharges from the former mine. Subsequently, the NDEP entered into an agreement with two of the RTWG companies for the construction of the "S-curve" in the Mill Creek diversion along Pond 3 to reduce flow velocities, control erosion, minimize potential flow onto the tailings piles, and protect the stability of tailings piles in the Mill Creek valley.

Under a 1996 Administrative Order on Consent (1996 AOC) entered into between the RTWG and NDEP, the Heap Leach Pad and Hillside Tailings Piles 1 and 2, located on the slope south of the Mill Creek Diversion Channel, were regraded, covered with clean borrow soil and reseeded. Run-on structures and water bars were also constructed around the Waste Rock Pile, the Heap Leach Pad, and Hillside Tailings Piles 1 and 2. Run-off and intermittent seepage from the Heap Leach Pad were collected by an intercept ditch that conveyed flow towards Lower Dry Creek.

Other interim remedial measures performed include:

- Constructed the 3/4 trench to drain surface runoff from Ponds 3 and 4 to the Mill Creek Diversion Channel. This was constructed at the boundary between Ponds 3 and 4.
- Regraded mine-related materials and installed soil covers on Ponds 3 and 4.
- Resloped and armored Pond 4 dam.
- Constructed Mill Creek groundwater cut-off wall west of Pond 1.
- Installed partial lining of the Mill Creek Diversion Channel.
- Backfilled and covered Pond 2.
- Routed Pond 1 discharge water past Ponds 2, 3 and 4.
- Installed French Drain along north side of Pond 4 and routed water to Lower Mill Creek.
- Closed mine openings and wells into mine workings.

The RTWG also performed plant site clean-up, and installed a downgradient groundwater monitoring well. In addition, the RTWG undertook an aggressive water monitoring program involving monthly field parameter testing and quarterly water quality sampling.

As a part of a 2001 Administrative Order on Consent (2001 AOC), additional field data was collected in 2002 to conduct studies on remedial options to develop a Remedial Alternatives Study. The primary activities performed include:

- Investigation of applicability of a low-maintenance, pilot scale water treatment system using lime to precipitate metals from water collected in the former Hydraulic Control Pond (HCP).
- Investigation of applicability of a pilot-scale biological treatment system using sulfate reducing bacteria for treating water collected in the HCP.
- Investigation of applicability of a spray-enhanced evaporative system for eliminating water collected in the HCP.
- Installation of two alluvial groundwater monitoring wells at fixed intervals down gradient of the HCP in the Mill Creek Valley.
- Characterization of the geochemistry of waste rock material located along the western margin of the collar area of the former mine shaft.
- Investigation of applicability of diverting seasonal low flow in Mill Creek (i.e., seeps from the south side of Pond 4) to the HCP.
- Evaluation of the applicability of using a passive evaporation system to treat seepage emanating from the Heap Leach Pad.
- Characterize soil conditions in lower Mill Creek Valley between Pond 4 and the confluence with the Owyhee River and initiate test plots to determine potential soil amendment strategies to improve the soil productivity for agricultural use.
- Evaluation of the physical and chemical characteristics of solids generated during the 2001 HCP lime-mixing experiment, and solids produced by the proposed 2002 pilot-scale treatment systems.

- Identification of an appropriate solids management strategy.
- Continuation of evaluations of the physical and chemical characteristics of surface water and groundwater in the vicinity of the Rio Tinto Mine as part of the water monitoring program.

In 2004, the RTWG conducted a soil survey of the lower Mill Creek Valley between Pond 4 and historic Patsville, near the confluence of the Owyhee River and Mill Creek, to characterize soil chemistry and determine what reclamation strategies might be applicable to improve soil productivity for agricultural use.

In 2007, after consultation with the US EPA, the NDEP and RTWG companies entered into a Administrative Order on Consent to implement a final remedy for the hillside mining features. These cleanup actions were determined to be appropriate for implementation independent of the other decisions to be made for the final remedy in the Mill Creek Valley. Consistent with State of Nevada requirements for the reclamation of mine sites, the remedy for these features included:

- Added cover materials (18-inch minimum total thickness) and revegetated the covers of the Heap Leach Pad, Hillside Tailings Pile 1, and Hillside Tailings Pile 2.
- Regraded the Waste Rock Pile to a maximum slope of 2.5 horizontal to 1 vertical (2.5:1) and installed an 18-inch thick cover and revegetated the cover.
- Completed improvements to drainages around the Heap Leach Pad, and Hillside Tailings Piles 1 and 2. Installed new diversion drainages around the regraded Waste Rock Pile.

The NDEP approved the constructed remedy for the hillside features in January 2009.

2.1.3 Community Participation

One of the RTWG's commitments under the 2001 AOC was to develop and implement a plan for public involvement. In accordance with the plan, beginning in 2002, the NDEP and RTWG periodically circulated newsletters to interested community members describing activities at the Site in order to keep the public informed of remedial actions completed and planned for the future. The newsletters also listed key reports and plans prepared during the relevant timeframe, and provided contact information for individuals interested in additional information. NDEP and the RTWG also held public meetings to discuss the progress of the remediation in June, 2002, June, 2003 and June, 2005, and developed fact sheets for circulation at the public meetings.

In October 2010, the NDEP published the *Proposed Plan for Rio Tinto Mine Site*. The *Proposed Plan* described the cleanup alternatives that the NDEP was considering and also identified a preferred alternative. The *Proposed Plan* provided information to the public on site conditions, the remedial alternatives, and the remedy selection process including a ranking of the remedial alternatives using the nine-criteria contained in the National Contingency Plan. Details on the public comment period and public meeting to facilitate collection of comment were also included in the *Proposed Plan*.

The *Proposed Plan* was distributed through direct mailing to local property owners and residents, local governments, tribal representatives, and interested parties that have expressed interest based on prior community outreach efforts. Copies were also provided for distribution at community centers in Elko, Mountain City, and Owyhee. The *Proposed Plan* and public comment period were announced in the Elko Daily News.

Comments on the Proposed Plan were accepted for a 30-day period. During the comment period, a public meeting was held in Elko on November 9, 2010. At the request of the Tribes, a presentation to the tribal members of the cleanup alternatives was made during their General Meeting on December 14, 2010. Written comments were received from a local landowner and from the Tribes. These comments are addressed in Section 3 of this Record of Decision.

The US EPA provided a Superfund Support Agency Cooperative Agreement to the Tribes in support of their participation in technical discussions at the site. Throughout the development of remedial alternatives, and upon remedy selection, the US EPA has undertaken consultation with the Tribes consistent with US EPA policies. On July 15, 2009, US EPA and the Tribes held a consultation meeting at the Duck Valley Reservation. On November 9, 2010, US EPA visited the reservation to brief the Business Council on the Proposed Plan. On November 22, 2010, Chairman Robert Bear issued a letter in support of the Proposed Plan.

2.1.4 Scope and Role of the Response Action

The 2001 Administrative Order on Consent and its attached Scope of Work subdivided the Rio Tinto Site into two areas: Area A and Area B. (Figure_2_). Area A includes the former mine site proper including all areas of historic operation and mine related materials placement. Area A also includes areas of suspected impact where mine-related materials are known to have been dispersed over time. This area includes the lower Mill Creek Valley from the Pond 4 embankment to the confluence with the East Fork Owyhee River where surface water flows over time mobilized and dispersed some mine-related materials downstream.

Area B includes the East Fork Owyhee River upstream and downstream of the confluence with Mill Creek (Figure 2). There was no record of waste disposal or tailings deposition in Area B; however, the RTWG undertook studies to determine whether mining related activities had produced conditions in the area that would require remediation. Results of the Area B characterization were submitted in the Area B Report and Area B Screening Level Assessment Report in 2002 and 2003. In addition, in April 2006, technical representatives from various regulatory agencies, the Tribes and the RTWG reviewed additional data at a 2-day "Area B Data Summit". Additional Owyhee River sediment data was collected later in 2006. No areas of concern requiring remediation were identified in the East Fork of the Owyhee River or Area B more generally. Following construction of the remedy selected in this ROD, implementation of the Ambient Monitoring Protocol (Appendix B) will generate and analyze specific surface water quality data in the East Fork Owyhee River drainage to determine if any persistent water quality anomalies in the river exist, and if so, whether they may be attributable to releases from the underground mine workings at the Site.

Only Area A has been identified as requiring remedial action. The Selected Remedy addresses the release of contaminants of concern from mine-related materials that are located entirely within the boundary of Area A. The only work elements anticipated at this time for Area B consist of monitoring of the East Fork Owyhee River identified in the Water Quality Compliance Protocol (Appendix 1) and the Ambient Monitoring Protocol (Appendix 2)

2.1.5 Site Characteristics

The Contaminants of Concern (COCs) at the Site have been identified through an intensive monitoring and screening process implemented by the RTWG over the past decade. The final COC list was published in the 2010 Proposed Plan and includes copper, zinc, iron and manganese, with copper being the most significant COC. These metals continue to be released from mine-related materials in Pond

Nos. 3 and 4 to surface water and alluvial groundwater in Mill Creek, which contributes to surface water loading in the East Fork Owyhee River. The concentrations of COCs in surface waters downstream of Area A do not exceed standards established for the protection of human health. However, concentrations of certain COCs do still occasionally exceed standards protective of aquatic life or agricultural uses due to releases from Area A.

Surface Water

Mill Creek is the principal hydrologic feature in Area A. It flows in an easterly direction and drains an area of approximately 15 square miles. Mill Creek is a tributary to the Owyhee River in north central Elko County, Nevada. The Owyhee River flows northwestward and, after passing through southwestern Idaho, joins the Snake River in eastern Oregon.

Mill Creek displays typical cold-zone hydrography. Peak flows, which typically range between 30 and 60 cubic feet per second (cfs), occur during early spring as a result of snowmelt runoff. Low flow conditions (less than 3 cfs) are typical by early June. By mid- to late-summer, Mill Creek near the Rio Tinto Mine generally has very low flow (less than 0.5 cfs) to no flow.

In the 1930s, the Mill Creek Diversion Channel was constructed south and parallel from the original Mill Creek bed at a higher elevation than the original creek bed. The Mill Creek Diversion Channel is a losing stream from approximately the eastern side of Pond 1, also known as the Fresh Water Pond (FWP), to approximately the 3/4 Trench. Seepage from the diversion channel flows northward toward the valley center. Pond 1 is a pond of spring-fed fresh water located to the west of Ponds 2, 3, and 4. Also known as the Sludge Pond, Pond 2 is an engineered impoundment constructed in the early 1970s that contains approximately 285,000 cubic yards (cy) of wastewater treatment sludge and native borrow soil. The native borrow soil was placed in 1996 to stabilize the wastewater treatment plant sludge when Pond 2 was backfilled and reclaimed. The backfill was performed under the direction of NDEP as part of the 1996 Administrative Order on Consent. The sludge in Pond 2 is not a source of metal contamination because the metals are not in a readily soluble form. Mill Creek generally stops flowing from July through October in the vicinity of Pond 1 to downstream of where the 3/4 Trench joins Mill Creek. The reach of Mill Creek adjacent to and downstream of Pond 4 (i.e., Lower Mill Creek) generally has at least some flow throughout the year. The FWP Pipe, 3/4 Trench, and the Pond 4 French Drain are sources of small summer season flow. However, during summer season monitoring performed since 2001, lower Mill Creek has frequently been observed to be totally dry at the confluence with the Owyhee River.

During high-intensity storm events and the spring snowmelt season, intermittent surface runoff from the now reclaimed facilities on the hillside (e.g., Waste Rock Pile, Hillside Tailings, the Plant area, and the Heap Leach Pad) flows to either the Mill Creek Diversion Channel or Lower Dry Creek drainages. The Dry Creek drainage is otherwise dry most of the year and demonstrates ephemeral stream characteristics.

Groundwater

Two separate and distinct groundwater systems exist at the Site: a near surface alluvial groundwater system and a deeper bedrock groundwater system. Underlying the alluvium is a low permeability clay-rich weathered bedrock layer. Below the weathered bedrock is unweathered bedrock. The weathered bedrock was typically dry when drilled, suggesting that the clay-rich zone may act as a confining layer below the alluvial groundwater system.

The alluvial groundwater system extends from the headwaters of Mill Creek to its confluence with the Owyhee River. The interstitial water in the mine-related materials in upper Mill Creek Valley between

the FWP and the eastern end of Pond 4 is also part of this alluvial groundwater system. Water level observations from piezometers in Ponds 2 and 3 indicate that the groundwater levels vary significantly on a seasonal basis. When flows are high in Mill Creek Diversion Channel, the groundwater level rises in Ponds 2 and 3. As flow and water level in Mill Creek Diversion Channel decrease, the groundwater level in Ponds 2 and 3 decreases. The groundwater level in Pond 4 appears to be less variable seasonally than in Ponds 2 and 3, and past measurements indicate the groundwater level in Pond 4 has been decreasing slowly over time. Lower Mill Creek east of the mining material impoundments has gaining and losing stretches that vary seasonally with surface water flows. Alluvial groundwater ultimately discharges downgradient to the Owyhee River.

Alluvial groundwater from the north and south sides of upper Mill Creek Valley flows toward the valley center. Groundwater flow from the hillside to the north of Pond 4 is intercepted by a french drain and routed east around Pond 4.

The deeper bedrock groundwater likely exists in secondary porosity (fractures and faults). There are no readily visible surface expressions (e.g., seeps, springs or mine adit discharge) of the bedrock groundwater at or downgradient of Area A. The bedrock groundwater elevation has shown limited variation over time. An analysis and investigation was performed to assess the potential for bedrock groundwater to convey COCs originating from the underground mine workings to the surface. That analysis found no conclusive evidence to indicate bedrock discharges contribute to COCs in Mill Creek; therefore no remedial actions are specified in this Record of Decision to address groundwater. This is consistent with the Site conceptual model, which delineates loading to Mill Creek as principally due to impacted alluvial groundwater seeping from Pond 4. However, the Selected Remedy includes an Ambient Monitoring Protocol (Appendix 2) to determine whether the underground mine workings are a source of COCs to the East Fork Owyhee River downstream of the confluence of Mill Creek. At the present time, the potential for these discharges could be masked by continuing contributions of COCs to the East Fork Owyhee River from Mill Creek.

Mine-Related Materials

Mine-related materials are located in the upper Mill Creek Valley and on the hillside south of the Mill Creek Diversion Channel. As previously discussed, surface reclamation, drainage improvements, and other remedial activities have been implemented in both areas. Pond 3 and Pond 4 materials exhibit elevated metal concentrations and have the potential to generate acidic fluids. As part of the 1996 AOC and 2007 AOC remedial efforts, the Waste Rock Pile, Heap Leach Pad, and Hillside Tailings Piles 1 and 2 were regraded and covered with soil material, and materials from the former Hillside Tailings Piles 3 and 4 were excavated, placed within the existing Pond 4, and covered. Seepage chemistry test results indicate that Pond 4 is a primary source area for COCs in surface water in Mill Creek.

Mining-related waste materials have been sampled by several parties, starting in 1989 by the regulatory agencies. The most extensive sampling has been conducted by the RTWG. In August 2000, samples of mine waste material were collected from the Heap Leach Pad and from Pond 4. One composite sample was collected from a test-pit excavation at the Heap Leach Pad. Three boreholes were drilled at Pond 4 and two composite samples were collected from each borehole for a total of six Pond 4 samples. One sample was collected from a near surface zone (generally 5 to 9 feet below the ground surface) and the second sample was collected from a deeper zone (generally 15 to 30 feet below the ground surface). These samples were analyzed for select total metals constituents and acid-base accounting to evaluate the potential of the materials as source areas. Sampling results confirmed the acid generating potential

of the Pond 4 tailings materials and the presence of metal constituents in the tailings that were also found in leachate and surface water samples.

More extensive waste material sampling was conducted in August and September 2007 to further characterize in-place tailings and underlying alluvium, and tailings/alluvial pore water. Soil samples were collected of tailings and underlying alluvium from a total of twenty-five (25) boreholes located at Ponds 2, 3, and 4 (13 boreholes); Hillside Tailings Pile 1 (6 boreholes); and the Heap Leach Pad (6 boreholes). Soil samples were analyzed for sulfur speciation, major and trace elements, a full or partial list of total metals and metalloids, and leachability. Pore water samples were analyzed for sulfur speciation and total metals/metalloids. Sampling results were consistent with the Site conceptual model for the formation of acidic, metal-bearing leachate as water comes in contact with the tailings materials deposited in Pond 3 and 4. Acid-generating potential and metal constituents are also present in the hillside tailings and heap leach pad. The underlying alluvium contained fewer metal constituents and had less, if any, acid generating potential.

The potential mechanisms by which contaminants may be released from Ponds 3 and 4 include erosion and leaching. Contaminants leached from the mine waste materials in Ponds 3 or 4 may impact Mill Creek surface water or enter the shallow alluvial groundwater system beneath the ponds which may express itself in Mill Creek further downstream. Potential receptors for contaminants released from Ponds 3 and 4 include aquatic biota, terrestrial biota, and humans via contact or ingestion routes.

2.1.6 Current and potential Future Land and Resource Uses

Land Uses

Mining operations at the Rio Tinto Mine ceased in the 1970s. Since that time there has been no active use of the property other than assessment and construction activities associated with environmental remediation of in Area A beginning in 1986. Land in the immediate vicinity of the former Rio Tinto Mine is privately owned. Grazing does not occur on these lands, but some open grazing occurs in the area and livestock may pass through or near the Site on the United States Forest Service (USFS) access road.

Structures associated with the historic mine operations remain in Area A, including remnants of industrial and residential types of buildings, none of which are currently functional. Infrastructure improvements also remain in Area A, including live electrical lines, but at this time Area A does not support any residential use or presence. Only one actively occupied residence is located in the vicinity of the former mine site, which is located to the west and upstream of the former mine on Mill Creek; access to the residence is via a USFS road which passes through the Rio Tinto Mine site.

Large-scale mining operations have ceased throughout the immediate region. The former Rio Tinto Mine is located in a sparsely populated region. The reasonably anticipated future land uses consistent with use in the surrounding areas would include the potential for low-density residential occupation, grazing, recreation, hunting, fishing, and other low-impact resource uses.

Land-use controls will prevent the disturbance of the constructed elements of the remedy, including the covers of the repository, heap leach pad, waste rock pile, and hillside tailings ponds; run-on and run-off channels; the Mill Creek channel realignment; potential evaporation basins; or any other element intended to prevent the release of hazardous substances to the environment. The land use controls will potentially be enforced through a voluntary covenant with private landowners of the Rio Tinto Site. The voluntary covenant would comply with Nevada legislation for environmental covenants (Nevada Revised

Statute 445D) to ensure durability and the binding of future landowners. If a voluntary covenant cannot be negotiated, the State and Federal government will seek to enforce land-use controls through other means such as site inspection and enforcement authorities with landowners.

Groundwater and Surface Water Uses

No extractive use of either of the groundwater systems identified at Area A is currently made. However, because of the connection between the alluvial groundwater system and Mill Creek, the shallow groundwater in the alluvial system can be considered a supporting element of the beneficial uses associated with the Site's surface water.

The Rio Tinto Mine is sited on Mill Creek which is a tributary of the East Fork Owyhee River. The uses of the surface water in the vicinity of the Site include recreation, fishing, and irrigation for cropland and livestock. Surface water is not currently withdrawn for either industrial or residential purposes.

State Law designates beneficial uses for the East Fork Owyhee River as irrigation, watering of livestock, recreation involving contact with the water, recreation not involving contact with the water, industrial supply, municipal or domestic supply, propagation of wildlife, and propagation of aquatic life. These beneficial uses apply to tributaries of the East Fork Owyhee River, including Mill Creek.

2.2 Summary of Site Risks

Previous remedial efforts at the Rio Tinto Mine have resulted in the reduction or elimination of many Site risks. Physical risks such as open mine shafts, unstable structures, debris, and steep grades were addressed under the 1996 AOC.

In addition, mine-related materials have been reclaimed in accordance with State of Nevada regulations and guidance through grading, the placement of soil covers and revegetation with native plants and grasses. Through these and other activities over the years, many of the Site risks associated with the mine-related materials have been controlled. However, previous remedial efforts have not eliminated the infiltration of water into waste materials within the upper Mill Creek Valley and the generation of acidic discharges to Mill Creek.

Some of the mine-related materials at the Rio Tinto Mine site have acid generating potential. Contact of these materials with air and water can cause a chemical reaction resulting in the water's acidification, as well as increased concentrations of metals and other parameters in the affected water. The acidified water can adversely affect ecosystems, including some terrestrial plants, wildlife and aquatic organisms. The primary metal of concern associated with the Rio Tinto wastes is copper, although iron, manganese and zinc are also identified as contaminants of concern (COCs). These metals have been found in tailings ponds at Area A and at concentrations sometimes exceeding water quality standards in Mill Creek and occasionally in the Owyhee River. The identification of the COCs followed the process detailed below.

Monitoring for contaminants of potential concern has taken place at surface water and groundwater locations at the Site on a regular basis since 1996 and periodically prior to that (Figure 5). Constituents that were not detected in surface water or groundwater samples generally were not retained in future sampling events unless there was a reason to retain them based on knowledge of site conditions. Constituents were determined to be of potential concern if 1) concentrations exceeded benchmark values that were taken from State and Federal water quality standards for all beneficial uses (Table 1) or 2) concentrations of samples downstream of mine waste materials was elevated above concentrations from upstream samples.

All contaminants of potential concern were monitored at the site as part of the site-wide monitoring program at all sampling locations and at all sampling events. The list of COCs was determined to be those contaminants that exceeded benchmark levels and were significantly higher than background concentrations through statistical testing. These constituents were copper, iron, manganese, and zinc.

TABLE 1
Water Quality Standards Based on Use
(mg/L)

COC	Municipal/Domestic Water Supply[1]		Aquatic Life[2,3]		Agricultural[2]	
	SMCL	MCL	Chronic	Acute	Irrigation	Livestock Watering
Copper	1	1.3	$(0.96)*e^{0.8545(\ln \text{hardness}) - 1.702}$ **[0.008]**	$(0.96)*e^{0.9422(\ln \text{hardness}) - 1.700}$ **[0.012]**	0.2	0.5
Iron	0.3	--	1	--	5	--
Manganese	0.05	--	--	--	0.2	--
Zinc	5	--	$(0.986)*e^{0.8473(\ln \text{hardness}) + 0.884}$ **[0.108]**	$(0.978)*e^{0.8473(\ln \text{hardness}) + 0.884}$ **[0.107]**	2	25

Notes:
[1] National Primary Drinking Water Standards, 40 CFR §141, (MCLs) and National Secondary Drinking Water Regulations, 40 CFR §143, (SMCLs)
[2]Nevada Administrative Code (NAC) 445A.144; iron is expressed as total recoverable concentration, copper and zinc are expressed as dissolved concentration.
[3]For hardness-based standards **[bolded]** values were calculated assuming a hardness of 90 mg/L as $CaCO_3$
-- indicates that no standard is applied

The primary metal of concern associated with the wastes is copper. Elevated levels of copper may be toxic to aquatic biota and may adversely affect fish, invertebrates, plants, and amphibians. Acute toxic effects may include mortality of organisms; chronic toxicity can result in reductions in survival, reproduction, and growth. Copper standards are based on an empirical hardness-based relationship and, in waters with low hardness levels, acute and chronic standards can be quite low. For example, at a hardness level of 90 mg/L as $CaCO_3$, the chronic and acute copper concentrations are 0.008 mg/L and 0.012 mg/L, respectively.

The copper criteria for agricultural uses are higher than the aquatic life standards (NAC 445A.144). Water diverted for irrigation purposes has a copper standard 0.2 mg/L, while water used for livestock watering has a copper standard on 0.5 mg/L. In humans, small amounts of copper are necessary to maintain good health; however, higher concentrations of copper may cause health effects such as irritation of the nose, mouth, and eyes; nausea; and diarrhea. Drinking water standards for humans are higher than the aquatic life and agricultural standards, with the US EPA's action level set at 1.3 mg/L.

Historic concentrations of copper measured in Mill Creek at surface water monitoring station SW-2 and in the Owyhee River below the confluence with Mill Creek at surface water monitoring station SW-4 are provided in Table 2.

TABLE 2
Summary of Contaminants of Concern in Surface Water
(1995-2009)

Surface Water Monitoring Station	Contaminant of Concern[1]	Number of Samples	Concentration Range (mg/L)		Screening Value[2](mg/L)
			Minimum	Maximum	
SW-2 (lower Mill Creek)	Copper	95	0.009	8.1	0.008
	Iron	102	0.12	81.4	5
	Manganese	87	0.054	5.2	0.02
	Zinc	91	0.01	3.48	0.108
SW-4 (Owyhee River)	Copper	101	0.001	0.086	0.008
	Iron	111	0.2	18	5
	Manganese	105	0.037	0.58	0.02
	Zinc	64	0.009	0.14	0.108

Notes:
[1]Copper and zinc concentrations in the dissolved form; iron and manganese concentrations are in the total form.
[2]The screening values for copper and zinc represents the lowest of the chronic and acute aquatic life standards from Table 1. The screening values for iron and manganese represents the irrigation standards from the same table.

The historic concentration of copper in the alluvial groundwater downgradient of Pond 4 is illustrated by monitoring data collected from well GW-1A (Table 3 and Figure 6).

TABLE 3
Summary of Contaminants of Concern in Alluvial Groundwater
(1995-2009)

Well No.	Contaminant of Concern[1]	Number of Samples	Concentration Range (mg/L)	
			Minimum	Maximum
GW-1A	Copper	127	0.001	0.15
	Iron	130	0.01	5.38
	Manganese	134	0.23	3.66
	Zinc	130	0.01	0.27

Notes:
[1] All metals concentrations in the dissolved form

Under US EPA's Ecological Risk Assessment Guidance for Superfund (US EPA 540-R-97-006) the phrase "ecological risk assessment," refers to a qualitative and/or quantitative appraisal of the actual or potential impacts of contaminants from a hazardous waste site on plants and animals other than humans and domesticated species. A risk does not exist unless: (1) the stressor has the ability to cause one or more adverse effects, and (2) it co-occurs with or contacts an ecological component long enough and at a sufficient intensity to elicit the identified adverse effect.

At the Site, measures of exposure of potential ecological receptors (i.e., metals data collected in Mill Creek and the East Fork of the Owyhee River) were used to make inferences about the risk assessment endpoint. The data set was compared to chronic water quality criteria established under the Clean Water Act. Chronic criteria are considered appropriate due to the presence of a sensitive receptor, the redband trout in the East Fork of the Owyhee River. The redband trout is also considered native to Mill Creek, although passage up Mill Creek is currently inhibited by several mine-related features which are designated for removal under the selected remedy.

The data set collected at the Site meets the goal of providing the risk information necessary to assist risk managers in making informed decisions regarding substances designated as hazardous under CERCLA (see 40 CFR 302.4). Specifically, the data set shows that in Mill Creek, between 1995 and 2009, 100% of the collected water samples exceeded the chronic water quality criteria for copper. In terms used in US EPA guidance for determining ecological risk (see above): (1) levels of dissolved copper in Mill Creek (the stressor), have the ability to cause chronic adverse health effects in aquatic life; and (2) these levels of copper, being present at all times, co-occur with ecological receptors, including sensitive receptors such as the redband trout.

The selected remedy will address actual or potential ecological threats in the form of dissolved copper detected at levels exceeding the chronic water quality criteria for copper in 100% of samples collected in Mill Creek, and due to the potential for future release of contaminants from mine-related tailings currently located in Pond 3 and Pond 4.

Site risks in Area B have been investigated as part of prior assessment work. Copper concentrations in the East Fork Owyhee River do not exceed standards established for the protection of human health but do occasionally exceed aquatic life standards (Table 2 and Figure 7). As previously discussed, it is likely that any potential future impacts to Area B can be addressed by eliminating discharges from the former mine site through the implementation of the Selected Remedy for Area A. Under the Ambient Monitoring Protocol (Appendix 2), additional data will be collected after Performance Standards are achieved in the East Fork of the Owyhee River to determine whether water quality anomalies in the East Fork of the Owyhee River mainstream exist, and if so, are likely attributable to releases from the underground mine workings in Area A.

2.3 Remedial Action Objectives

The overall goal of the Remedial Action is to protect human health and the environment by minimizing exposure of human, terrestrial, and aquatic receptors to affected media through the development and implementation of a final site remedy. To accomplish this, the following two specific goals, also known as Remedial Action Objectives (RAOs), have been established:

- Minimize any significant loading of contaminants of concern from the Mill Creek Valley mining material impoundments to Mill Creek and the Owyhee River.

- Minimize potential human, terrestrial biota, and aquatic biota exposures to low-pH, metal-bearing surface water at the Rio Tinto Mine, as well as in downstream receiving waters.

Achievement of RAOs will be evaluated by comparing surface water quality to the water quality Performance Standards. The Water Quality Compliance Protocol (Appendix 1) establishes a process to monitor water quality both during implementation of the Selected Remedy and after completion of

construction. Specific Applicable, or Relevant and Appropriate Requirements (ARARs) and their relation to the Water Quality Compliance Protocol are discussed in the Statutory Determinations Section (2.8.3.2). A summary table of the relevant Performance Standard Analytes is included here (Table 4), but the table should be understood within the greater detail provided by the Water Quality Compliance Protocol (Appendix 1).

The Water Quality Compliance Protocol includes a variety of parameters for specified project monitoring purposes. The monitoring parameters include three Performance Standard Analytes as well as supplemental analytes and field parameters. The three Performance Standard Analytes - copper, zinc and cadmium - were selected through a statistical analysis of surface water data downstream of the former mine. Copper, zinc and cadmium were generally found to be statistically associated with those parameters whose source is, to some degree, Area A related mine-related materials (e.g., iron, aluminum and TDS) and, in the case of copper and zinc, are also COCs. The Water Quality Compliance Protocol identifies specific concentration/compliance thresholds, or Performance Standards, for the performance analytes. By tracking the response of copper, zinc and cadmium in waters downstream of the former mine, the agencies can make a determination of the effectiveness of the Selected Remedy relative to compliance with ARARs and achievement of RAOs.

TABLE 4
Summary Table of Performance Analytes and Standards

Thresholds	Dissolved Cd (mg/L)	Dissolved Cu (mg/L)	Dissolved Zn (mg/L)
Calculated 95% Upper Confidence Limit (UCL)[1]	0.00024	0.028	0.030
AcutePerformance Standard	1.136672 – (ln hardness) [0.041838] X $e^{1.0166(\ln \text{hardness}) - 3.924}$ **[0.0018]**	0.960 X $e^{0.9422(\ln \text{hardness}) - 1.700}$ **[0.012]**	0.978 X $e^{0.8473(\ln \text{hardness}) + 0.884}$ **[0.107]**
Chronic Performance Standard	1.101672 – (ln hardness) [0.041838] X $e^{0.7409(\ln \text{hardness}) - 4.719}$ **[0.00023]**	0.960 X $e^{0.8545(\ln \text{hardness}) - 1.702}$ **[0.008]**	0.986 X $e^{0.8473(\ln \text{hardness}) + 0.884}$ **[0.108]**

[1] 95% UCLs calculated from SW-4 water quality monitoring database for January, 2005 to March, 2010.

If compliance with Performance Standards is not achieved within the time periods specified in the Water Quality Compliance Protocol (Appendix 1), then additional actions may be undertaken, as specified in the protocol. Additional actions may include site-specific studies which could result in different numeric standards that are equally protective for the site and are consistent with the processes for establishment of standards in the federal Clean Water Act and the Nevada Water Pollution Control Law.

2.4 Description of Alternatives

The following sections describe the four remedial alternatives that were considered by the lead agency in the process of selecting the remedy identified in this Record of Decision as the Selected Remedy. The remedial alternatives were developed under the 2001 AOC and were presented along with the data necessary to evaluate them in the Area A Remedial Alternatives Study in 2006. The alternatives were

further refined through continued data collection and evaluation and then were presented in the Proposed Plan. All four alternatives include the ongoing maintenance of the completed Hillside Remediation work.

2.4.1 Remedy Components

Alternative 1 – No Further Action Alternative

The No Further Action Alternative provides the baseline for comparing other alternatives. This alternative includes the installation of fencing and signage and long-term monitoring and maintenance. Fencing would total approximately 13,800 feet at the private property perimeter and consist of steel post and barbed wire. The purpose of fencing is to control livestock grazing, particularly along Mill Creek within Area A and at areas with vegetated covers. Deed restrictions or other land use controls would limit the future use of the property. In addition, requirements related to maintaining the completed remedial actions would be implemented. Although the No Further Action Alternative is not precisely the same as the No Action Alternative specified under CERCLA, for the purpose of alternatives evaluation and remedy selection at this site, the difference in this instance was not deemed significant by the US EPA.

Alternative 2—Improve Existing Source Control and Long-term Water Treatment

Alternative 2 includes all of the remedial components included in Alternative 2 in the Remedial Alternatives Study, plus certain enhancements. Alternative 2, as presented in the Remedial Alternatives Study, would improve the existing containment components and provide for water collection, conveyance, and long-term treatment. Mine-related materials would remain in their current location within the Mill Creek Valley. An enhanced soil cover would be installed at Pond 3 to achieve revegetation success like that at Ponds 2 and 4. Mill Creek would continue to be diverted out of its native channel, and diversion ditches would be upgraded to prevent surface water run-on and minimize potential infiltration into the reclaimed mining material areas. Water would be captured for treatment below Pond 4 through the installation of a groundwater cutoff wall. Any surface water seeps from Pond 4 would be captured before they enter Mill Creek and would be treated along with the captured groundwater. Water treatment would be conducted for the period of the analysis, which is 30 years. Treated water would be required to meet water standards and will be discharged to either Mill Creek or the Owyhee River. Conventional water treatment to address metals would likely consist of mixing in lime to adjust the water's pH and promote the precipitation of metals. The resulting treatment sludge would be disposed of on-site away from Mill Creek.

Alternative 2 as presented in this Record of Decision improves on Alternative 2 from the Remedial Alternatives Study by adding additional containment and control. Alternative 2 in this Record of Decision includes enhanced covers on Ponds 2 and 4 and improves on the originally proposed Pond 3 cover enhancement. This alternative would also include relocation of the Mill Creek Diversion Channel to the south of the existing channel below the S-Curve. The Diversion Channel would be widened and lined from upgradient of Pond 1 to below Pond 4.

Alternative 3—Full Removal of Mine-Related Materials from Mill Creek Valley to On-site Repository and Long-term Water Treatment

Alternative 3 would remove mining materials from Mill Creek Valley by excavating Ponds 2, 3, and 4 and some amount of underlying material and depositing them in an on-site repository on the hillside above Mill Creek to the south. The repository would be located on the ridge to the east and south of the former town site and would include an evapotranspiration cover to prevent or reduce infiltration of meteoric water and snowmelt. A cut-off wall would be installed east of Pond 4 to capture groundwater

in the Mill Creek Valley that had been impacted historically by the mining materials. Water treatment of alluvial groundwater and active management of associated treatment sludge would occur over a period of time, estimated at the period of analysis, which is 30 years. This is based on conservative assumptions about the quality of groundwater that will remain after removal of the tailing.

Alternative 3A (Selected Remedy)—Partial Removal of Mine-Related Materials from Mill Creek Valley to On-site Repository and Seasonal Water Treatment or Management During Remedy Construction
Alternative 3A will remove mining materials from Ponds 3 and 4 and some amount of underlying materials to the hillside repository to the east and south of the former town site. Pond 2 (Sludge Pond) will remain in place, behind an engineered berm to ensure the pond's long-term stability. During construction activities a temporary, seasonal water treatment system or other appropriate practices will be utilized to manage water associated with the removal of Ponds 3 and 4 and underlying materials. The water treatment technology to be applied will be determined during design of the selected remedy. Conventional water treatment to address metals would likely consist of mixing in lime to adjust the water's pH and promote the precipitation of metals. Following the removal, an average three-foot-thick layer of clean, on-site soils will be placed within the footprints of Ponds 3 and 4. Mill Creek will then be realigned to the center of Mill Creek Valley east of Pond 2. Attenuation of metals in the Mill Creek alluvium will be achieved through the removal of Ponds 3 and 4 and the placement of a liner in Mill Creek post-removal to isolate alluvial groundwater from surface water and allow for neutralization in alluvial soils. Water quality in Mill Creek and the Owyhee River will be monitored for several years after completion of the remedy to measure progress toward meeting water quality standards.

2.4.2 Common Elements and Distinguishing Features of Each Alternative

All the alternatives, with the exception of Alternative 1 (No Further Action Alternative), address the release of acidic, metal-bearing discharges from mine-related wastes to site surface waters. Each alternative identifies this discharge as the primary mechanism for the release of pollutants and contaminants to surface waters. The objective of all alternatives is to achieve water quality standards in surface waters consistent with all beneficial uses. Two conceptual remedial elements have been identified to address the discharges and achieve water quality standards: a) capture and treatment of water discharges and b) reduction of discharges through source removal or control. The three alternatives evaluated by the NDEP represent different combinations of these two conceptual remedial elements. Alternative 2 relies primarily on water capture and treatment. Alternative 3 employs a combination of both capture and treatment and reduction of discharges through source removal. Alternative 3A relies primarily on reduction of discharges through source removal. All of the alternatives contain maintenance of the completed Hillside Remediation work as a common element.

Capture and treatment of discharges, as a conceptual remedial element at the Site, involves the interception of alluvial groundwater that has been impacted by contact with tailings material prior to its release to Mill Creek. The captured water would be sent through a treatment plant where the poor quality water would be mixed with lime to raise the pH of the water and cause precipitation and removal of dissolved metals. The treated water may then be discharged back to the environment without impacting the quality of the Mill Creek or East Fork Owyhee River. The construction of the Alternative 2 and 3 capture and treatment system can be accomplished in a single year with minimal capital investment, but the operation of the treatment system at the remote site would require long-term access, including chemical transport, and result in long-term operating costs to meet water quality standards for as long as alluvial groundwater is in contact with tailings material. Water treatment will generate a waste product, sludge, which will require disposal.

The reduction of discharges, as a remedial element for the Site, involves the separation of tailings from contact with alluvial groundwater to prevent the formation of acid mine drainage. This reduces the loading of metals to surface water. The reduction of discharges would require construction involving the source materials that might take several years to complete. The construction would also require higher capital costs but would require only long-term maintenance as opposed to long-term operation.

For remedial alternatives 1 and 2, the mine-related materials will remain in the Mill Creek Valley. Remedial alternatives 3 and 3A entail removal of all or a portion of these mine-related materials to a new repository constructed in Area A. Alternative 3 would remove mining materials from Mill Creek Valley by excavating Ponds 2, 3, and 4 and some amount of underlying alluvial material, while Alternative 3A includes the removal of only Ponds 3 and 4, and the same amount of underlying alluvial material, plus some alluvium downstream of Pond 4 in the vicinity of the former HCP. The expected volumes of mine-related materials associated with each of these alternatives are listed below:

- Alternative 3 (Ponds 2, 3 & 4) = 687,200 cy
- Alternative 3A (Ponds 3 & 4) = 653,180 cy

2.4.3 Expected Outcomes of Each Alternative

Alternative 1, No Further Action, will not result in a significant decrease in the concentrations of COCs in alluvial groundwater downgradient of Pond 4. It also does not address the seepage along the Pond 4 embankments. Consequently, there would be minimal to no change in the concentrations of the COCs in lower Mill Creek or the Owyhee River downstream of the confluence with Mill Creek. Although the water quality in Mill Creek and the Owyhee River has improved since 1996, it is likely that water quality standards would continue to be exceeded. Therefore, implementation of Alternative 1 would not result in any increased protection of human health or the environment.

Implementation of Alternative 2, Improve Existing Source Control and Long-term Water Treatment, would substantially decrease loading of COCs from Area A. This decrease in loads would result in an improvement in water quality in both lower Mill Creek and the Owyhee River, thereby increasing protection of human health and the environment. However, the mine wastes in Ponds 3 and 4 would remain in place under Alternative 2. Consequently, the improvements to riparian and aquatic habitat realized under Alternatives 3 and 3A are absent under Alternative 2. Alternative 2 includes long-term water treatment, which would require active operations at this remote site and sludge management, perhaps in perpetuity.

Alternatives 3 and 3A would result in similar improvements to protection of human health and the environment. Water quality will improve in downstream areas (lower Mill Creek and the Owyhee River). Removal of mine wastes from the Mill Creek valley bottom will increase riparian habitat. Relocation of Mill Creek back to the majority of its original channel and improvements to stream geomorphology will enhance aquatic habitat and support seasonal fish passage. However, Alternative 3 includes long-term water treatment, which would require active operations at the site and sludge management. Alternative 3A will not require the long-term operation of a water treatment plant.

2.5 Comparative Analysis of Alternatives

The National Contingency Plan (NCP) requires that the ROD explain how the Selected Remedy was determined to be the most appropriate remedy for implementation by comparing all alternatives against a standard set of nine criteria. Because the Site has been a State-lead project under a series of

Administrative Orders on Consent, the comparison criteria have slightly different names than the nine-criteria employed by the US EPA. However, the criteria as defined in the AOCs are substantially equivalent, and the US EPA concurs that the analysis performed and the remedy selected in this ROD are NCP compliant.

The following sections briefly describe each criterion. Two criteria are not included in the comparison at this point; these are the NCP criteria for State Acceptance and Public Acceptance. State Acceptance is not discussed in this ROD because this is a State-lead project. Public Acceptance is addressed in the Responsiveness Summary (Part 3 of the ROD); no comments opposing the Selected Remedy were received from the public during the public comment period on the Proposed Plan.

2.5.1 Water Quality Objectives and Requirements

Section 121(d) of CERCLA and NCP §300.430(f)(1)(ii)(B) require that remedial actions at CERCLA or Superfund Alternative sites at least attain legally applicable or relevant and appropriate Federal and State requirements, standards, criteria, and limitations which are collectively referred to as "ARARs," unless such ARARs are waived under CERCLA section 121(d)(4).

Applicable requirements are those cleanup standards, standards of control and other substantive requirements, criteria or limitations promulgated under Federal environmental or State environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance found at a CERCLA site. Relevant and appropriate requirements are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under Federal environmental or State environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well-suited to the particular site.

Compliance with ARARs addresses whether a remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes or provides a basis for invoking a waiver.

All the alternatives have common ARARs regarding the reclamation of mining features (NAC 445A.424 to 445A.447) and compliance with surface water quality standards (NAC 445A.11074 to 445A.225). The reclamation of mining features in each of the alternatives conforms to reclamation guidelines for active mine sites in the State. Although the State's reclamation requirements and guidelines apply only to currently active, permitted mine sites, the requirements are felt to be relevant and appropriate for use at the Rio Tinto Mine as a guideline for the long-term stability and protectiveness of mine-related wastes remaining in Area A.

The no further action alternative (Alternative 1) would not meet water quality standards in the East Fork Owyhee River or its tributary, Mill Creek. Alternative 2 and 3 would meet water quality standards through the establishment of a permanent water treatment plant that would operate to meet discharge requirements; water quality standards in the East Fork Owyhee River and its tributary, Mill Creek, could be met in the near-term under these Alternatives depending on the placement and effectiveness of a capture system for the acidic, metal bearing waters from the mine materials in the Mill Creek Valley. Water quality standards under Alternative 3A will eventually be met but will require a longer timeframe; this is because Alternative 3A allows for a gradual return to natural conditions after removal of source material. The compliance of Alternative 3A with surface water ARARs will be measured and evaluated

against a program of attainment, over time, of a series of water quality benchmarks and standards as described in the Water Quality Compliance Protocol (Appendix 1).

2.5.2 Overall Protection of Human Health and the Environment

Overall protection of human health and the environment addresses whether each alternative provides adequate protection of human health and the environment and describes how risks posed through each exposure pathway are eliminated, reduced, or controlled, through treatment, engineering controls, and/or institutional controls.

All of the alternatives, except the no-action alternative (Alternative 1), are protective of human health and the environment by eliminating, reducing, or controlling risks posed by discharges of acidic, metal bearing waters from mine related wastes. Alternative 2 would provide protection through the capture and treatment of discharges that can be identified given current Site configurations; available treatment technologies are sufficient to bring discharges to conditions that are protective of designated uses. Alternative 3 and Alternative 3A would provide additional protection through the removal of mine related materials from their current location in the Mill Creek drainage to an engineered repository on the Site that is designed to limit infiltration and eliminate discharges.

All of the alternatives reduce or eliminate direct exposure of receptors to the mine-related materials through capping and reclamation of mining features. Proper reclamation of mining features is intended to secure materials and prevent their exposure or migration through grading, capping, and engineered features for the control of run on and run off by storm water. These features are common to all the alternatives and would be protected through institutional controls such as deed restrictions and fencing.

2.5.3 Long-term Effectiveness and Permanence

Long-term effectiveness and permanence refers to expected residual risk and the ability of a remedy to maintain reliable protection of human health and the environment over time, once clean-up levels have been met. This criterion includes the consideration of residual risk that will remain following remediation and the adequacy and reliability of controls.

Since each of the cleanup alternatives leave all mining related materials in Area A, the long-term effectiveness of the remedies is distinguished by the on-site management of the material, the reliance on long-term water treatment, and the performance of the remedy under extreme conditions. Since the No Action Alternative did not meet the threshold criteria, its performance against the other alternatives was not further considered.

Alternative 2 includes some elements that would possibly reduce the volume of acidic leachate produced by the Mill Creek tailings, but it is assumed that this alternative would not eliminate these discharges or reduce them to a level that would eliminate the need for long-term operation of a water treatment plant. Alternatives 3 and 3A address the discharges by removing materials from the Mill Creek Valley and placing them in an engineered repository. Pond Nos. 2, 3 and 4 would be removed under Alternative 3. Pond 2, which contains stabilized water treatment plant sludges from prior operations, remains in place in Alternative 3A.

Alternative 3 includes long-term water treatment as a remedial component to address alluvial groundwater that has already been impacted by the Mill Creek tailings. Alternative 3A achieves the same long-term effectiveness and permanence through a gradual flushing of the alluvium; a detailed monitoring program (Appendix 1) will ensure and demonstrate that natural conditions improve water

quality over time. Alternative 3A does not rely on the operation of a water treatment plant making it less likely to fail because of mechanical issues, operator error, or unexpected conditions. Alternative 3A also does not require the long-term transport of chemicals to a remote site, the long-term management of solid wastes produced as a byproduct of the water treatment process or the energy use required for the long-term operation of a permanent water treatment plant envisioned for the Site under Alternative 3. For these reasons, Alternative 3A is superior to Alternative 3 in regard to long-term effectiveness and permanence.

Alternative 3 and 3A also have greater long-term effectiveness than Alternative 2 by removing mine-related materials from areas that are subject to flooding. Although Alternative 2 includes elements that were previously constructed to protect against flooding damage and additional elements that would strengthen that protectiveness, Alternative 3 and 3A are not dependent on these constructed elements, which would still be subject to potential failure during extreme conditions.

As described in Section 2.8.3.6., under all the alternatives, the selected remedy will be reviewed at least every five years to evaluate its effectiveness because mine-related materials would remain in Area A.

2.5.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Reduction of toxicity, mobility, or volume through treatment refers to the anticipated performance of the treatment technologies employed on source materials that may be included as part of a remedy. Since the No Action Alternative did not meet the threshold criteria, its performance against the other alternatives under this criterion was not further considered.

While Alternative 2, 3, and 3A all include water treatment as a remedial component to varying degrees, this treatment is targeted at discharges from the mine-related wastes and not at the source materials themselves. No direct treatment of mine-related wastes is included in any of the alternatives because of the high-volume, low-concentration nature of these materials, which would make treatment infeasible or impractical. However, the movement of mine-related materials from the areas that are subject to flooding under Alternative 3 and 3A to a repository outside of the Mill Creek Valley would dry the materials and isolate the metal constituents.

2.5.5 Short-Term Effectiveness

Short-term effectiveness addresses the period of time needed to implement the remedy and any adverse impacts that may be posed to workers, the community and the environment during construction and operation of the remedy until cleanup levels are achieved. Since the No Action Alternative did not meet the threshold criteria, its performance against the other alternatives under this criterion was not further considered.

Alternatives 2 and 3 include the construction of a long-term or permanent water treatment plant that is intended to address both the discharges from tailings and alluvial groundwater that is captured prior to discharge into Mill Creek. It is expected that this water treatment approach would result in compliance with water quality standards in Mill Creek and East Fork Owyhee River at completion of the construction of the water treatment system or shortly thereafter. Alternative 3A employs water treatment only on a temporary basis to address water drained from tailings material during construction and relies on a gradual return of natural conditions to address residual alluvial impacts; therefore, it is anticipated that Alternative 3A will take the longest time to meet surface water standards and remedial action objectives.

During remedy construction, Alternative 2 presents the least risk to workers and surrounding residents and communities because it involves a minimal handling of mine related wastes and the least amount of intrusive construction work. Alternative 3 and 3A both involve the excavation, on-site transport, and management of a large volume of mining-related wastes. Best Management Practices will be employed during construction to limit exposures by workers and minimize risks of releases that could affect surrounding communities.

2.5.6 Implementability

Implementability addresses the technical and administrative feasibility of a remedy from design through construction and operation. Factors such as availability of services and materials, administrative feasibility, and coordination with other governmental entities are also considered. Since the No Action Alternative did not meet the threshold criteria, its performance against the other alternatives under this criterion was not further considered.

All the alternatives employ common remedial techniques that are frequently used at active and historic mine sites in the area. The alternatives involve both earth moving and/or water treatment which can be done with local resources and are easily administered. Earth moving at the Area A (which is the main component of Alternative 3 and 3A and involves the removal of mine-related wastes from the Mill Creek Valley to an on-site repository) is complicated by the topography of the Site and the nature of mining-related wastes. Area A is constrained by some steep grades between the hillside and the Mill Creek Valley in addition to the lack of flat land for equipment movement and materials staging, though these issues can be addressed by site preparation and proper design consideration. A majority of the mining-related wastes will be too wet to be placed directly in a repository and will require staging and drying prior to disposal. Wet materials may also pose excavation concerns.

Construction of the water treatment plant will also require proper design consideration, but the principles behind treatment of acidic, metal-rich waters are well understood. Difficulties in implementation may be encountered in the design and construction of adequate water capture under Alternative 2 and 3 to immediately meet water quality standards in the Mill Creek and East Fork Owyhee River; however, due to the less intensive nature of these elements, design and construction alterations can more readily account for encountered field conditions to ensure success of the remedy.

Overall it is felt that earth moving presents more challenges in implementability than establishment of water treatment. Therefore, Alternative 2 is felt to be more easily implemented than Alternative 3 or 3A, while Alternative 3A is more easily implemented than Alternative 3, which relies on both water treatment and the most excavation. However, Alternative 3A does not rely on the operation of a long-term or permanent water treatment plant at a remote location.

TABLE 5
COST ESTIMATE SUMMARY FOR ALTERNATIVES

	Alternative 2	Alternative 3	Alternative 3A
	Cost[1]	Cost[1]	Cost[1]
Construction Cost	$13,400,000	$29,000,000	$17,980,000
O&M Costs	$11,400,000	$11,400,000	$3,600,000
Total	$24,800,000	$40,400,000	$21,580,000
Time to complete construction	2 years	3 years	4 years

[1] Rounded to nearest $10,000 from original cost estimate.

2.5.7 Cost

The estimated capital, annual operations and maintenance, and total costs for each remedial alternative are given in the Table 5. The costs presented in Table 5 represent current dollars; present value costs for the Selected Remedy are presented in Section 2.8.1.

2.6 Principal Threat Wastes

Federal law establishes an expectation for the use of treatment to address the principal threats posed by a site wherever practicable. Principal threat wastes refers to those source materials at a site that are considered to be highly toxic or highly mobile and that generally cannot be reliably contained or would present a significant risk to human health or the environment should exposure occur. These types of wastes include liquid sources, surface or subsurface soil containing high concentrations of chemicals, or buried drummed non-liquid wastes containing significant concentrations of highly toxic materials.

No principal threat wastes are present at the Site. The source wastes at Area A are the result of mining operations that generated high volumes of low toxicity materials. The threats to the environment are a result of the high volume of waste material which can generate acidic, metal rich discharges when in contact with water over long periods of time.

2.7 Selected Remedy

The selected remedy will remove mine-related materials and underlying impacted alluvial materials in Ponds 3 and 4 and east of Pond 4 in the area of the HCP to an on-site repository. Pond 2 (Sludge Pond) will remain in place, and Pond 1 (FWP) will be integrated into the realigned upper Mill Creek. A repository will be located on the hillside to the east and south of the former town site and will include an ET cover. During construction activities, a temporary water treatment system will seasonally treat water associated with the excavation work in the upper Mill Creek Valley. Following the removal, an average three foot- thick layer of clean, on-site soils will be placed and graded within the footprint of the excavation to facilitate the flow of alluvial groundwater through the area, minimize interaction with surface water, and direct surface flow towards the new creek channel. Mill Creek will subsequently be realigned to the approximate center of upper Mill Creek Valley east of Pond 2 (Figure 4).

2.7.1 On-Site Repository

The on-site repository will be located in Area A at the east end of the former town site and will be excavated in native soil. Soil and rock will be excavated from the repository site to develop the site in accordance with the final design documents. The excavated material will be used to produce the fine-grained soil required for the repository berm construction, repository interim berm construction, repository ET cover construction, upper Mill Creek liner system construction and other general uses. Best Management Practices (BMPs) will be utilized for all stockpiles to prevent or minimize erosion and dust.

The repository will be of sufficient capacity to accommodate placement of all of the excavated materials from the upper Mill Creek Valley and other sources, and all treatment solids generated during water treatment operations. The internal and outer slopes of the repository will be constructed at a maximum slope of 2.5:1 (horizontal:vertical), and the footprint of the repository will be approximately 15 acres. The expected capacity of the repository is approximately 750,000 cy.

The repository will be closed following the placement of all excavated materials and treatment solids. Closure operations will include the construction of the ET cover, final grading, stormwater interceptor ditch construction and revegetation. The ET cover will be designed to minimize infiltration and to promote vegetation growth. It will be constructed to an 18-inch minimum thickness. The ET cover and adjacent soils disturbed by repository operations will be planted with a seed mixture similar to that used in previous site remedial activities. An interim cover will be placed over the deposited materials between construction seasons until the final cover is constructed.

A series of channels and berms will be constructed on the ET cover to direct storm drainage off of the cover and minimize surface erosion. In addition, run-on controls such as diversion channels, interceptor trenches or berms will be constructed to isolate the repository from upgradient stormwater flow. Diversion channels will be designed to safely convey the design event, and be armored, as necessary. The interim cover, placed between construction seasons, will be designed to shed flow and not allow water to accumulate within the repository.

2.7.2 Removal of Mining Material from Upper Mill Creek Valley

Excavation and Removal

The volume of mine-related materials removed under the Selected Remedy totals 653,180 cy. Mining materials and impacted alluvial materials in Ponds 3 and 4 will be excavated to their full depth. The expected volume of mining material (soil and rock), which includes the existing soil covers and embankment materials, from Ponds 3 and 4 is 608,145 cy. An additional 39,300 cy of underlying alluvial soil is expected to be removed based on an average over-excavation thickness of one foot. Tailings excavated from Ponds 3 and 4 in a wet condition will be dried prior to transport to the on-site repository. In addition, the HCP will be removed and all material placed in the repository. It is expected that the volume of material associated with the HCP, along with 3' of overexcavation, is 5,735 cy.

When excavation is complete, a minimum one foot thick lift of alluvium will be overexcavated from the base of the ponds and transported to the repository. If the alluvium excavation operation encounters competent bedrock the overexcavation will be terminated. The depth of excavation into the alluvium will depend on the geology encountered and the extent of observable impacts.

After the removal of mining-related materials and impacted alluvium, any seeps present along the north or south sides of the valley in the exposed slopes will be addressed. Post-excavation backfilling and contouring of the valley floor is intended to minimize the likelihood that lateral seeps will occur. If seeps are observed, drains will be constructed to manage them and direct their flow into the realigned Mill Creek channel or disperse the flow into the alluvium.

Dewatering and Drying of Tailings

Tailings dewatering will commence by pumping tailings water from existing wells in Pond 4 and, if feasible, by excavating slot drains in the tailings. Collected water will be transferred to the temporary water treatment plant for treatment. Tailings dewatering will also be accomplished by excavating wet tailings material and spreading the wet tailings over a portion of Ponds 3 and 4 to allow air-drying. If water drains from these wet tailings it will be collected in a sump at a low area and transferred to the temporary water treatment plant. Some tailings may be dry enough for direct excavation and placement in the repository.

Periodic inspections will be performed during the winter break, between November and April, of each construction season. It is expected that at least two to three inspections will be scheduled, and one after every significant storm event. If unacceptable conditions are observed, a corrective action plan specifying appropriate off-season best management practices will be developed and implemented.

Transport and Placement of Excavated Materials
Excavated materials that have dried sufficiently will be transported to the repository for disposal. Materials will be dumped and spread in lifts, and compacted. The compacted materials will be sloped to prevent stormwater from flowing out of the repository. All accumulated stormwater and drained liquids will be pumped or transported to the temporary water treatment plant.

If excavation and placement of upper Mill Creek Valley materials cannot be completed during one construction season (May-October), an interim soil cover will be placed over the repository. At the completion of the excavation, the upper 6 inches of the haul roads used to transport excavated material will be removed and placed in the repository. These areas will then be graded to facilitate proper drainage.

Backfill of Upper Mill Creek Valley Excavation
After the over-excavation of the ponds area is complete, and the final contours of the post-excavation upper Mill Creek Valley are determined, an optimum alignment for the reconstructed upper Mill Creek channel will be selected and the remainder of the tailings ponds area will be backfilled to an average depth of 3 feet. Coarse-grained soil from the borrow area screening operations will be incorporated into the backfill. The final layer of backfill will be amended with coarse-grained soil to prevent erosion during extreme precipitation events. The backfilled area will be graded to gently direct drainage towards the reconstructed upper Mill Creek channel.

2.7.3 Temporary Water Treatment Plant
Water drained/collected from tailings dewatering, the upper Mill Creek Valley excavation area, and the active repository will be collected and treated at a temporary water treatment plant that will operate seasonally for the duration of the construction activities. This temporary water treatment system will consist of a metal precipitation/aeration plant that uses lime, aeration and settling ponds. A lined holding pond may be constructed to receive and store water prior to treatment. Unlined settling ponds will be constructed to accept treated water prior to discharge into Mill Creek. Sludge generated as a part of the treatment process will be dried, as necessary, and disposed in the on-site repository. This temporary water treatment plant may be located on the hillside southeast of Pond 4 and Mill Creek.

Road access to the temporary water treatment plant will be developed and connected to the haul road between Ponds 3 and 4 and the on-site repository. Power to the site will be provided by an existing overhead powerline, and supplemented with an auxiliary power generator, if necessary. The treated water from the settling ponds will be piped to Mill Creek downstream of the active construction areas.

2.7.4 Heap Leach Pad Evaporation Basin
Because the heap leach pad was previously remediated with an ET soil cover only minimal infiltration is expected into the mining material at this location. However, two seeps have been identified along the north side of the facility. If these seeps remain active, a collection piping system will be constructed to convey this seepage to an evaporation basin. This evaporation basin will be lined and sized to contain the expected seepage considering precipitation and evaporation at Area A.

2.7.5 Mill Creek Remediation

Upper Mill Creek Channel

A new Mill Creek channel will be constructed through the excavation area and realigned to the approximate center of upper Mill Creek Valley. The reconstructed channel will begin at a point east of Pond 2 and connect to Mill Creek at a point downstream of the former HCP. Backfill material will be placed in the excavated channel to restore the alluvium to the proposed final grade. The channel will be lined with a geosynthetic clay liner (GCL) which will be covered with protective soil and rock riprap. Additional rock armoring maybe placed at select locations to increase the durability of the channel.

The rock armored channel will encompass the "low flow channel" width. This low flow channel will contain the 10-year flood event. A "high flow channel" width will encompass this low flow channel. The high flow channel will contain the 100-year flood event. The width of the high flow channel will be minimized, as possible, and tie into the surrounding final grade. The high flow channel will not be rock armored, but will be vegetated to minimize erosion. The need for soft armoring of the high flow channel banks will be determined during the draft design stage.

The Mill Creek diversion channel will be directed through the FWP, around the north side of Pond 2 and through the realigned upper Mill Creek channel located roughly in the center of the valley. Appropriately sized culverts will be installed west of the FWP to convey the realigned upper Mill Creek beneath the USFS road. An armored earthen berm will be constructed along the north side of Pond 2 to keep upper Mill Creek high flow events within the realigned channel. Filling/grading will be performed in the area forming the transition between the east side of Pond 2 and the west end of the excavated /reconstructed upper Mill Creek channel to allow for appropriately sized drop structures and pools, and to achieve the slope requirements for the channel bed.

Fish Passage

The reconstruction of the upper Mill Creek channel will include installation of features to facilitate opportunistic, seasonal passage of non-resident redband trout through Mill Creek during optimal flow conditions. A study of the existing Mill Creek and the conceptual design of the realigned channel was performed to determine enhancements that could aid in the passage of redband trout. The upper Mill Creek channel design will incorporate the majority of the recommendations made by the study. Specific, key design components are presented below.

The steepest-sloped portion of the realigned creek will be located just east of Pond 2. This portion of the realigned upper Mill Creek channel will be constructed using drop structures (creating adequate downstream leaping and upstream landing pools) with elevation changes that do not exceed the redband trout leaping ability. Large riprap will also be used to create eddy pools and prevent erosion.

Because the seasonal flow characteristics of upper Mill Creek would likely cause accelerated decomposition of submerged logs, the design will consider more durable materials that serve a similar purpose (e.g., boulder groupings). This portion of the creek will be constructed with isolated boulders, or groups of boulders, spaced to provide eddies and small pools for resting places for redband trout during their transition through the reach of reconstructed upper Mill Creek.

Riparian vegetation along the banks of the reconstructed upper Mill Creek channel will be actively managed (removed) during, and following, the completion of construction of the channel to prevent deep-rooting riparian vegetation from potentially impacting the buried GCL liner. Active riparian

vegetation management will continue for a minimum of five years following the receipt of the Certification of Completion of Remedial Action. Following this five-year period, the decision to discontinue active riparian vegetation management will be made based on the water quality in Mill Creek. When active riparian vegetation management is discontinued, deep rooting vegetation will be allowed to voluntarily establish in, and on the banks of, the reconstructed channel.

Additional features intended to enhance the probability of redband trout passage through the reconstructed channel may be considered in the final design consistent with this feasibility analysis and the recommendations made in the study of redband trout passage.

Revegetation of upper Mill Creek Valley
Upon completion of all earthwork within the valley, the area of the upper Mill Creek overbank channel disturbed during remedy construction will be scarified and revegetated using the test plot seed mix. An inorganic fertilizer amendment will be applied based on agronomic testing of samples of borrow material collected during construction activities. Re-vegetated areas will be evaluated during subsequent field seasons and re-seeded or otherwise managed as necessary until vegetative cover has been established.

Revegetation of Lower Mill Creek Valley
Those areas delineated in Figure 8 will be reclaimed to establish vegetation in the lower Mill Creek Valley, east of the Pond 4 embankment and downstream of the Rio Tinto Mine. The seed mix and lime and fertilizer application rates used are based, in part, on vegetation test plots constructed by MWH Corporation and Arrowhead Reclamation in 2002.

2.7.6 Institutional Controls

Additional perimeter fencing and signs will be installed where needed to control site access. Fencing will consist of steel posts and barbed wire and will be installed around the private property boundaries at the beginning of site remedial activities. The fencing will prevent unauthorized livestock grazing, which will reduce the potential for erosion of new and existing vegetated covers. Gates will be installed, as needed, to allow continued public use of the USFS road.

Environmental covenants or other land use controls will be used to limit the future use of the property. In addition, related notice requirements or requirements related to maintenance of the completed remedial actions will be addressed.

2.7.7 Operation and Maintenance

Operation and Maintenance will include monitoring and maintenance of the reclaimed mining material areas, existing ET covers, and the repository. This will consist primarily of monitoring and maintenance of the vegetated ET covers and water quality monitoring. Periodic inspections will be performed by field personnel to assess vegetative performance and any erosion on ET covers. Diversion channels will be inspected when covers are monitored.

Additional Operation and Maintenance activities will include:

- Maintenance of the Heap Leach Pad evaporation basin.
- Monitoring for erosion of the reconstructed upper Mill Creek Channel and any subsequent repairs.

- Inspection and maintenance of the perimeter fencing and signage.
- Maintenance of the upper Mill Creek GCL.
- Maintenance of the Pond 2 berm and soil cover.

Maintenance activities will include performing necessary repairs to covers and diversion channels.

Surface water quality monitoring will be conducted during active construction periods in Mill Creek and the Owyhee River in accordance with the Water Quality Compliance Protocol. Long term surface water quality monitoring will be performed on a prescribed schedule in accordance with the Water Quality Compliance Protocol and the Ambient Monitoring Protocol (Section 2.7.8).

2.7.8 Protocols

The Water Quality Compliance Protocol (WQCP) for the Site establishes the performance standards for the remedy as derived from the remedial action objectives. The WQCP establishes methods for monitoring water quality to demonstrate achievement of these performance standards and State and Federal requirements. The WQCP contains provisions that apply during and after remedy construction for the East Fork Owyhee River and for Mill Creek. The WQCP provides for achievement of performance standards along a timeline determined to be appropriate by the NDEP and US EPA. The WQCP also provides for consideration of specified additional actions at certain times if sufficient progress has not been made.

The Ambient Monitoring Protocol (Appendix 2) will generate and analyze specific surface water quality data in the East Fork Owyhee River drainage. These data will be evaluated to determine if persistent water quality anomalies in the river exist, and if so, may be attributable to releases from the underground mine workings in Area A. If findings based on data collected pursuant to the Ambient Monitoring Protocol indicate that water quality standards are being exceeded, and that these exceedances may be attributed to mine-related groundwater releases, then additional actions, as determined by NDEP and/or US EPA, may be considered.

2.8 Summary of the Rationale for the Selected Remedy

Of the Remedial Alternatives investigated, a remedy that included the removal of tailings from the Mill Creek Valley was selected because it most directly addresses the formation of acidic discharges and is the least likely to require permanent and ongoing management of discharges. It is believed that were the large volume of tailings to remain in the Mill Creek Valley it would not be possible to reduce infiltration sufficient to eliminate discharges and meet water quality standards without water treatment in perpetuity. By removing mine-related wastes and placing them on the hillside, potential infiltration is minimized and discharges can be reduced or eliminated through the construction of an evapo-transpirative cap sufficient to handle rain and snow volumes.

By placing the mine-related materials in a constructed repository on the hillside, then Remedial Action Objectives can likely be met in the future with limited ongoing operation and maintenance requirements and limited requirement for a continuing remedial presence at the site. The Selected Remedy will be less reliant on the proper mechanical functioning of water treatment to meet water quality standards and will be less prone to disruption from extreme weather events. The hillside repository will be less susceptible than the current tailings location to catastrophic failure during extreme flooding which could result in the release of tailings to surface waters, though this likelihood is minimal under all alternatives and can be effectively managed through design considerations.

Alternative 3A was selected because it removes those mining-related wastes from Mill Creek Valley that are likely to generate acidic discharges (i.e., Ponds 3 and 4). Pond 2, which contains primarily water treatment sludge, is not acid generating and does not contain leachable constituents of concern. Leaving Pond 2 in-place under Alternative 3A results in lower costs and less intrusive construction requirements than Alternative 3, while still being equally protective. The Selected Remedy does not employ long-term water treatment to address residual groundwater concentrations of contaminants of concern. While this will result in a potentially longer timeframe to meet water quality standards once the source of contaminants of concern are removed, this is offset by the benefits of a shorter active remedial presence at the Site. Alternative 3A will result in the establishment of a natural regime in a quicker timeframe in Mill Creek Valley without the presence of elements for the capture and treatment of residual groundwater and the need for a long-term operator presence at the site. Flooding and extreme weather events would be less likely to disrupt the Selected Remedy or require reconstruction of the remedial elements.

2.8.1 Cost Estimate for the Selected Remedy

The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial alternative. Changes in the cost elements are likely to occur as a result of new information and data collected during the engineering design of the remedial alternative. Major changes may be documented in the form of a memorandum in the Administrative Record file, an Explanation of Significant Difference (ESD), or a ROD amendment. Table 6 presents an order-of-magnitude engineering cost estimate that is expected to be within +50 to -30 percent of the actual project cost.

TABLE 6
Cost Estimate for Selected Remedy

Capital Costs

	Description	Quantity	Unit	Unit Cost	Cost
1	Mobilization / Field Management / Demobilization	1	LS	$2,006,834	$2,006,834
2	Design Engineering	1	LS	$516,510	$516,510
3	Site Preparation	1	LS	$164,916	$164,916
4	Repository Construction & Run off Controls				
	Clear & Grub Repository	1	LS	$58,193	$58,193
	Repository Excavation/Berm Embankment	186,300	CY	$7	$1,290,011
	Run On Controls	1,500	LF	$47	$70,095
5	Mining Materials Removal	620,000	CY	$9	$5,779,471
6	Construction Related Water Management & Treatment	1	LS	$1,584,636	$1,584,636
7	Repository Cover Construction & Run On Controls	1	LS	$1,100,317	$1,100,317
8	Heap Leach Pad Evaporation Pond Construction	1	LS	$5,235	$5,235
9	Mill Creek Realignment & Restoration				
	Mill Creek Realignment Fill	118,000	CY	$6	$657,850
	Berm Construction Pond #2	800	LF	$9	$7,167
	Lined Mill Creek Channel	1	LS	$405,742	$405,742
	Mill Creek Reclamation	24	AC	$2,309	$55,404
	Fish Passage Culvert	1	LS	$265,360	$265,360
10	Site Reclamation				
	Reclamation	1	LS	$113,120	$113,120
	Fences & Signs	3,450	LF	$8	$27,597
11	Survey	1	LS	$275,543	$275,543
	Subtotal				$14,384,000
	Contingency Allowances (15%)				$2,157,600
	Project Management and Support (10%)				$1,438,400
	Total Capital Cost				**$17,980,000**

O&M Costs

	Description	Quantity	Unit	Unit Cost	Cost
1	Owyhee Water Monitoring	10	Year	$92,198	$921,984
2	Mill Creek Water Monitoring	15	Year	$7,165	$107,472
3	Inspections/Reporting	30	Year	$27,460	$823,799
4	Field Construction	30	Year	$32,390	$971,690
	Subtotal				$2,824,946
	Contingency Allowances (17%)				$479,386
	Project Management and Support (10%)				$282,495
	Total O&M Cost				**$3,600,000**

	Capital Cost	Annual O&M Cost	Total Cost
TOTALS	$17,980,000.00	$3,600,000.00	$21,580,000.00

2.8.2 Estimated Outcomes of the Selected Remedy

Under the Selected Remedy, the mine wastes present in Ponds 3 and 4 will be removed from the Mill Creek Valley and isolated from the environment in an on-site repository. Prior remedial actions will be enhanced to improved their long-term effectiveness and permanence. The net result of these remedial actions will be a decrease in the concentrations of COCs in the affected media; alluvial groundwater and surface water, and the achievement of the Performance Standards specified in the Water Quality Compliance Protocol.

The decrease in concentrations of copper, iron, manganese and zinc in the downstream areas (lower Mill Creek and the Owyhee River) will improve the quality of water for aquatic life and agricultural uses. Additionally, removal of Ponds 3 and 4 from the Mill Creek valley bottom will increase both the area and quality of riparian habitat. Relocation of Mill Creek back to its original channel and improvements to stream geomorphology will enhance aquatic habitat and also support seasonal fish passage.

2.8.3 Statutory Determinations

Under CERCLA §121 and the NCP, the lead agency must select remedies that are protective of human health and the environment, comply with applicable or relevant and appropriate requirements (unless a statutory waiver is justified), are cost-effective, and utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable. In addition, CERCLA includes a preference for remedies that employ treatment that permanently and significantly reduces the volume, toxicity, or mobility of hazardous wastes as a principal element and a bias against off-site disposal of untreated wastes. The following sections discuss how the Selected Remedy meets these statutory requirements.

2.8.3.1 Protection of Human Health and the Environment

The Selected Remedy, Alternative 3A, will protect human health and the environment by removing tailings from the Mill Creek Valley where interaction with water in the alluvial system creates acidic, metal-rich discharges. The tailings will be placed in a repository located in Area A but outside the alluvial system. The construction of the repository and the use of an evapo-transpirative cap will reduce infiltration by meteoric waters and prevent the mobilization of metal constituents.

The metal constituents of concern and other water quality impacts caused by the discharge from tailings in the Mill Creek Valley are deleterious to aquatic life in Mill Creek. These effects impair the growth of aquatic communities that serve as the foundation for higher level organisms, such as trout and other fish, which are resources designated as beneficial uses of the surface water. The concentrations of contaminants, particularly in Mill Creek, may also represent a direct stress to the higher level organisms and impair the establishment of a healthy fishery along the affected surface water system. The Selected Remedy addresses these impacts by removing the source of the COC's from the Mill Creek Valley, thereby facilitating a return to conditions supportive of aquatic populations. The Mill Creek and East Fork Owyhee River will be monitored subsequent to the removal of tailings material to demonstrate attainment of remedial goals over time.

Short term impacts associated with the Selected Remedy can be effectively managed through the use of Best Management Practices during construction. Monitoring of conditions during construction will be employed to ensure non-degradation of conditions and will determine the necessity for additional protective actions.

2.8.3.2 Compliance with Applicable or Relevant and Appropriate Requirements

Section 121(d) of CERCLA, 42 U.S.C. §9621(d) requires that remedial actions at CERCLA sites attain (or justify the waiver of) any federal or state environmental standards, requirements, criteria, or limitations that are determined to be legally applicable or relevant and appropriate. These applicable or relevant and appropriate requirements are referred to as ARARs. Federal ARARs may include requirements under any federal environmental laws. State ARARs include promulgated, enforceable environmental or facility-siting laws of general application that are more stringent or broader in scope than federal requirements.

An ARAR may be either "applicable," or "relevant and appropriate," but not both. If there is no specific federal or state ARAR for a particular chemical or remedial action, or if the existing ARARs are not considered sufficiently protective, then other guidance or criteria to be considered (TBCs) may be identified and used to ensure the protection of public health and the environment. The NCP, 40 C.F.R. Part 300, defines "applicable," "relevant and appropriate," and "to be considered" as follows:

- **Applicable requirements** are those cleanup standards, standards of control, or other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstances found at a CERCLA site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be applicable.

- **Relevant and appropriate requirements** are those cleanup standards, standards of control, and other substantive requirements, criteria, or limitations promulgated under federal environmental or state environmental or facility siting laws that, while not "applicable" to a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at the CERCLA site that their use is well suited to the particular site. Only those state standards that are identified in a timely manner and that are more stringent than federal requirements may be relevant and appropriate.

- **TBCs** consist of advisories, criteria, or guidance that US EPA, other federal agencies, or states developed that may be useful in developing CERCLA remedies. The TBC values and guidelines may be used as US EPA deems appropriate. Once a TBC is adopted, it becomes an enforceable requirement.

ARARs are identified on a site-specific basis from information about the chemicals at the site, the remedial actions contemplated, the physical characteristics of the site, and other appropriate factors. ARARs include only substantive, not administrative, requirements, and pertain only to onsite activities. Section 121(e) of CERCLA, U.S.C. 9621(e), states that no federal, state or local permit is required for remedial actions conducted entirely onsite. Offsite activities, however, must comply with all applicable federal, state, and local laws, including both substantive and administrative requirements that are in effect when the activity takes place. There are three general categories of ARARs:

- **Chemical-specific** ARARs are health- or risk-based concentration limits, numerical values, or methodologies for various environmental media (i.e., groundwater, surface water, air, and soil) that are established for a specific chemical that may be present in a specific media at the site, or that may be discharged to the site during remedial activities. These ARARs set limits on concentrations of specific hazardous substances, pollutants, and contaminants in the environment. Examples of this type of ARAR include state and federal drinking water standards.

- **Location-specific** ARARs set restrictions on certain types of activities based on site characteristics. Federal and state location-specific ARARs are restrictions placed on the concentration of a contaminant or the activities to be conducted because they are in a specific location. Examples of special locations possibly requiring ARARs may include flood plains, wetlands, historic places, and sensitive ecosystems or habitats.

- **Action-specific** ARARs are technology- or activity-based requirements that are triggered by the specific type of remedial activities selected. Examples of this type of ARAR are RCRA regulations for waste treatment, storage, or disposal.

The NDEP and US EPA have evaluated and identified the ARARs for the selected remedy in accordance with CERCLA, the NCP, and US EPA guidance, including the CERCLA Compliance with Other Laws Manual, Part I (Interim Final), OSWER Directive 9234.1-01 (US EPA, 1988a) and CERCLA Compliance with Other Laws Manual, Part II, OSWER Directive 9234.1-02 (US EPA, 1989). All the Applicable or Relevant and Appropriate Regulations are summarized in Table 7; however, State of Nevada requirements for water quality protection and mining design criteria have been identified as the key ARARs requiring additional discussion.

Water Quality ARARs

The State of Nevada regulates water quality through the Nevada Water Pollution Control Law (Nevada Revised Statute 445A.300 to 445A.73) and regulations adopted under those enabling authorities (Nevada Administrative Code 445A). State laws and regulations have been determined to be consistent with the federal Clean Water Act (33 U.S.C. § 1251 et. seq.), as such the State of Nevada operates a delegated program with responsibility for the enforcement of federal provisions. The Nevada Water Pollution Control Law and accompanying regulations are the source for the Performance Standards detailed in the Water Quality Compliance Protocol (Appendix 1), which has been developed to demonstrate compliance with ARARs and achievement of Remedial Action Objectives.

The critical elements of the Nevada Water Pollution Control Law in the development of the Water Quality Compliance Protocol are the provisions that prohibit the discharge of any pollutant to waters of the State from a point source without a permit (NRS 445A.465), authorize the establishment of water quality standards (NRS 445A.520), and the authority of the State to enforce federal regulations regarding non-point source discharges. Discharge permits, water quality standards, and non-point sources are handled in more detail in agency regulations (Nevada Administrative Code).

The Water Quality Compliance Protocol contains provisions that protect water quality during implementation of the remedy and provisions for the measurement of compliance after remedy implementation. The relation of these provisions to the ARARs is briefly discussed here.

Table 7: Description of ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis	Action
Chemical-Specific ARARs					
Federal	Surface water	33 U.S.C. § 1251 et. seq. Clean Water Act	Applicable	The federal Clean Water Act provides the basis for State water quality programs by establishing nationwide standards that State programs must meet.	Compliance with ARARs that are based on the Clean Water Act are described in detail below. The State of Nevada operates a delegated clean water program that meets requirements and nationwide standards established by the Federal government. Compliance with State ARARs will demonstrate compliance with Federal clean water ARARs.
State	Surface water and groundwater	NRS 445A.300 to NRS 445A.730 Nevada Water Pollution Control Law	Applicable	The Nevada Water Pollution Control Law is the statutory authority for all regulations regarding water quality and protection of waters of the State. It establishes the fundamentals of antidegradation and standards for water quality.	As described below in greater detail in relation to specific regulations adopted as part of the Nevada Water Control Law, the remedy is intended to meet water quality standards through the Water Quality Compliance Protocol and to address discharges in such a manner as to minimize degradation.

Table 7: Description of ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis	Action
State	Surface Water	NAC 445A.121 Standards applicable to all surface waters	Applicable	This section provides narrative water quality standards for all surface waters in the State of Nevada for general conditions of appearance, odor, and toxicity. Controllable sources of metals that are reasonably amenable to treatment must not be discharged without treatment or control. Standards do not apply to receiving waters when they are outside of established limits, including periods of extreme high or low flow conditions.	The removal of mining waste materials to a controlled repository is expected to eliminate or reduce discharges sufficient to meet narrative standards. Water that is removed from waste materials during construction will be managed and treated as necessary.
State	Surface Water	NAC 445A.122 Standards applicable to beneficial uses	Applicable	This section provides narrative standards for existing and designated beneficial uses of surface waters. Water quality must be supportive of beneficial uses.	The remedy is intended to protect all existing and designated beneficial uses of surface water through the achievement of numerical standards.
State	Surface Water	NAC 445A.144 Standards for toxic materials applicable to designated waters	Applicable	This section provides numeric standards for toxic inorganic and organic materials for particular beneficial uses.	The remedy is intended to meet numeric standards for Performance Standard analytes through a compliance monitoring protocol included as Appendix A to this Record of Decision. Establishment of site specific standards may be considered as specified in the Water Quality Compliance Protocol.

Table 7: Description of ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis	Action
State	Surface Water	NAC 445A.145 Control Points: Prescription and applicability of numerical standards for water quality; designation of beneficial uses	Applicable	This section of the Nevada Water Quality Control law establishes the reaches of water where specific standards and beneficial uses are applied through the establishment of control points. All waters in the watershed upstream of a control point are to be included in the application, including tributaries.	Control points on the East Fork Owyhee River are at Mill Creek and at Owyhee. The remedy is expected to comply with the standards established for the reach upstream of the Owyhee control point, including the tributary of Mill Creek, through the Water Quality Compliance Protocol.
State	Surface Water	NAC 445A.214 Beneficial uses for areas in Snake River Basin	Applicable	This section designates beneficial uses for the East Fork Owyhee River.	The remedy is intended to protect all existing and designated beneficial uses of surface water through the achievement of numerical standards as presented in the Water Quality Compliance Protocol in Appendix A.
State	Surface Water	NAC 445A.223 Owyhee River: East Fork south of Owyhee	Applicable	This section provides numeric standards for the stretch of East Fork Owyhee River upstream of the Owyhee control point to the confluence of Mill Creek, including Mill Creek.	The remedy is intended to meet numeric standards for Performance Standard analytes through a compliance monitoring protocol included as Appendix A to this Record of Decision. Establishment of site specific standards may be considered as specified in the Water Quality Compliance Protocol.

Table 7: Description of ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis	Action
State	Surface water and groundwater	NAC 445A.228 to NAC 445A.263 Discharge Permits	Relevant and Appropriate	A permit is required for the discharge of pollutants from a point source to surface waters or groundwater in the State of Nevada. The permit places requirements for treatment, monitoring, and reporting on the discharger.	Permits are not required for CERCLA remedial actions, but substantive requirements must be met. Water will be monitored and treated, as necessary, prior to discharge in a manner consistent with and equivalent to what would be required under a permit.
State/Federal	Surface Water	40 C.F.R. §122.26(b)(14)(x) and 122.26(b)(15) Non-point source	Applicable	Federal regulations enforced by the State of Nevada require storm water discharge permit coverage for non-point source discharges from construction activities that disturb 1 or more acres. The permit requires the implementation of best management practices to control discharges.	Permits are not required for CERCLA remedial actions, but substantive requirements must be met. Construction activities at the site will employ best management practices to minimize the release of construction-related pollutants to surface waters. After remedy construction, best management practices may also be considered as set forth in the Water Quality Compliance Protocol.
State	Surface water, groundwater, and soil	NAC 445A.345 to NAC 445A.348 Notification of Release of Hazardous Substance	Relevant and Appropriate	This regulation places requirements on facility owners and operators to report releases to the Nevada Division of Environmental Protection. Certain releases that present an imminent threat to human health and the environment require reporting to the Division as soon as practicable.	Emergency response requirements will be placed on the parties implementing the remedy. Those requirements will include notification requirements to the State project manager in the event of an emergency release.

Table 7: Description of ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis	Action
Federal	Surface water and groundwater	Safe Drinking Water Act	Relevant and Appropriate	The Safe Drinking Water Act establishes national primary drinking water standards (MCLs) to protect the quality of water in public water systems. The Safe Drinking Water Act is delegated to States who can demonstrate the establishment of a program that meets national standards.	The State of Nevada operates a delegated safe drinking water program that meets requirements and nationwide standards established by the Federal government. Compliance with State ARARs will demonstrate compliance with Federal safe drinking water ARARs.
State	Surface water and groundwater	NAC 445A.450 to NAC 445A.492 Public Water Systems—Water Quality	Relevant and Appropriate	The State of Nevada has adopted federal requirements under the Safe Drinking Water Act which establishes drinking water standards known as Maximum Contaminant Limits (MCLs) for public water systems. MCLs are enforceable standards for water systems that deliver water to the public but are only considered relevant and appropriate for consideration for waters that are a potential source of drinking water.	MCLs are considered in the establishment of water quality standards under the Nevada Water Pollution Control Law where the beneficial use of municipal or domestic supply is designated for a surface water body. This beneficial use applies at the East Fork Owyhee River and Mill Creek; however, standards for other beneficial uses are generally lower than MCLs, and the most protective standard is used.

Table 7: Description of ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis	Action
Location Specific ARARs					
Federal	Fisheries	16 U.S.C. §1531, et seq. Fish and Wildlife Conservation Act and Fish and Wildlife Coordination Act	Relevant and Appropriate	The Fish and Wildlife Coordination Act requires federal agencies involved in the control or structural modification of any natural stream or body of water to take action to protect fish and wildlife resources that may be affected by the selected remedial action	The Selected Remedy incorporates fish passage and riparian vegetation restoration components. Best Management Practices will be employed during remedy implementation to minimize impacts to Mill Creek and the Owyhee River.
Federal	Surface Water	33 U.S.C. §1344 Clean Water Act Section 404	Applicable	The substantive requirements of this Section of the Act pertain to the discharge of dredged or fill material into waters of the United States, which might be triggered during road construction, sediment removal, and surface water diversion.	The Implementation of Best Management Practices will limit or confine the discharge of sediments effecting aquatic biota, avoiding disruptions of periodic water inundation patterns, and minimizing or preventing standing pools of water.
Federal	Floodplains	Executive Order No. 11,988 Floodplain Management	Applicable and Relevant	This Executive Order requires that federal agencies evaluate the potential effects of actions that may take place in a floodplain to avoid, to the extent possible, adverse effects associated with direct and indirect development of a floodplain.	The Selected Remedy removes mining-related wastes from the Mill Creek Valley floodplain. The site will be less prone to release of materials during floods.
Federal	Wetlands	Executive Order No. 11,990 Protection of Wetlands	Relevant and appropriate	This Executive Order requires that federal agencies avoid, to the extent possible, adverse impacts associated with the destruction or loss of wetlands and to avoid support of new construction in wetlands if a practicable alternative exists.	The Selected Remedy removes mining-related materials from a riparian area and also includes restoration activities to support revegetation in impacted riparian areas.

Table 7: Description of ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis	Action
Action-Specific ARARs					
Federal	Wastes	40 C.F.R. §261.4(b)(7) Bevill Amendment	Applicable	The Bevill exclusion provides that solid waste from the extraction, beneficiation and processing or ores and minerals are not hazardous wastes. In addition, any residues generated from treatment of Bevill excluded materials are also exempt because the residue is the direct result of extraction.	The handling and disposal of mine tailings, treatment residues, or other wastes that are a result of mineral extraction or beneficiation at the site are not subject to RCRA Subtitle C regulations or hazardous waste regulations under State law. This waste is instead treated under relevant and appropriate laws and regulations governing solid waste and mining wastes in State law.
State	Wastes	NAC 445A.424 to NAC 445A.447 Operation and Design of Mining Facilities	Relevant and Appropriate	These sections of Nevada regulations place minimum design criteria on the construction of various mining impoundments, ponds and containers, including those for tailings, waste ore, and fluids. The minimum design criteria are guided by the overarching principle of protecting surface water and groundwater from degradation. These sections also contain requirements for permanent closure of mining facilities.	The minimum design criteria are applicable for operating mining facilities that must obtain a permit for operation from the State of Nevada. Since the Rio Tinto mine site is an inactive mine site and not an operating site, the minimum design criteria are used as a guide for construction of remediation facilities, while ultimately ensuring that degradation is adequately addressed..

Table 7: Description of ARARs for Selected Remedy

Authority	Medium	Requirement	Status	Synopsis	Action
State	Air	NAC 445B.22037 Emissions of particulate matter: Fugitive dust	Applicable	This regulation prohibits the handling or storing of any material in a manner which allows controllable particulate matter to become airborne. It requires that best practical methods be taken to prevent particulate matter from becoming airborne and requires a surface area disturbance permit for disturbances greater than 5 acres.	Construction and handling of tailings during remedy implementation will use best practical methods as relevant and appropriate. Post-remedial stabilization of particulate matter will be handled through the appropriate reclamation and revegetation of areas disturbed during construction.

During remedy construction, of the Water Quality Compliance Protocol requires the maintenance of existing water quality in Mill Creek and in the East Fork Owyhee River. Construction activities have the potential to release additional hazardous substances to surface waters through erosion or accidents, particularly as a result of excavation and earth-moving work in and around an alluvial system. US EPA regulations (40 C.F.R. §122.26(b)(14)(x) and 122.26(b)(15)) require storm water discharge permit coverage for discharges from construction activities that disturb 1 or more acres. These nationwide regulations are implemented by authorized State agencies such as the NDEP. The NDEP Stormwater General Permit (NVR100000—the General Construction Permit) was developed to satisfy federal storm water permitting requirements. The General Construction Permit requires the implementation of Best Management Practices (BMPs) to control erosion and prevent accidental discharges. The Water Quality Compliance Protocol contains provisions for the regular monitoring and assessment of surface water conditions to determine the adequacy of BMPs and assess whether additional BMPs are necessary to protect water quality in Mill Creek and the Owyhee River.

The State of Nevada's Pollution Control Law (NRS 445A.565) prohibits discharges which will result in lowering the quality of waters whose quality is higher than the applicable standards unless it is justifiable because of economic or social considerations. This is addressed through the determination of the baseline concentrations observable at the present time in the East Fork Owyhee River. Exceedances of the of baseline concentrations in the East Fork Owyhee River may indicate worsening conditions and may prompt further assessment or corrective action. Additionally, any site waters collected during remedy implementation, such as water pumped from the tailings ponds to allow for excavation, would be required to be treated prior to discharge consistent with State discharge permit requirements (NAC 445A.228 to 445A.263) such that the existing quality of East Fork Owyhee River would not be degraded.

After completion of remedy construction, the Water Quality Compliance Protocol focuses on measuring compliance with water quality benchmarks and, ultimately, the water quality standards or "ARARs" established by the State of Nevada. Timeframes are established for meeting standards in the East Fork Owyhee River and Mill Creek, with the East Fork Owyhee River being on a quicker timeline for compliance. The timeframe for compliance has been determined to be necessary and appropriate by the NDEP and US EPA because the alluvial system will require time to return to natural or near-natural conditions after removal of the mine-related wastes from the Mill Creek Valley. Numeric and narrative standards for all beneficial uses of the East Fork Owyhee River and Mill Creek were identified from NAC 445A.11704 to 445A.225 (Table 1); some of these standards are already being met at and downstream of Area A, others can be met on a shorter timeframe, while others will require a longer timeframe for compliance. The final milestone established in the Water Quality Compliance Protocol for compliance on East Fork Owyhee River and Mill Creek are the strictest standards applicable for all beneficial uses identified for these surface waters.

Mining Design Criteria

Under the authorities of the Nevada Water Pollution Control Law (NRS 445A.300 to 445A.730) the State of Nevada developed regulations for the operation of mining facilities to be protective of waters of the State. The mining regulations (NAC 445A.350 to 445A.447) contain a requirement for facilities to obtain an operating permit from the NDEP, and they also establish minimum design criteria for process components and operating requirements for mining facilities. The regulations apply to facilities that are actively involved in the extraction and beneficiation of metals as of September 1, 1989.

The Rio Tinto Mine is not currently active, and the remediation efforts being planned for the Site do not constitute extraction or beneficiation of metals. Therefore, the mining regulations are determined not

to be "applicable"; however, because the regulations deal generally with the appropriate operations and design for the handling of mining materials and mining wastes to prevent degradation of waters of the State, the regulations are determined to be "relevant and appropriate" and were considered in the development of remedial alternatives.

The Operation and Design of Facilities section of the mining regulations begins with NAC 445A.424, which contains the general principle that mining facilities shall not degrade waters of the State (either groundwater or surface water) below those standards established in State law. NAC 445A.433 to 445A.438 define the minimum design criteria required of each process component and the site and operating conditions. These provisions establish minimum design requirements and define the site and operating conditions which must be evaluated; however, NAC 445A.432 allows that based on site characterization, best engineering judgment will be applied to determine the degree to which designs must provide more or less protection through engineered containment.

Universal design requirements are listed in NAC 445A.433. The key design criteria in this section are NAC 445A.433(1)(a) "In areas where annual evaporation exceeds annual precipitation, a process component must achieve zero discharge," and NAC 445A.433(1)(c) "All process components must be designed to withstand the runoff from a 24-hour storm event with a 100-year recurrence interval." These requirements were considered in the design of the on-site repository and evapo-transpirative covers for all mining wastes at the Site. The evapo-transpirative covers were designed to limit infiltration by 95% so as not to allow for the generation of leachate and the discharge of pollutants to groundwater or surface water. Remedial elements were also designed to meet runoff criteria.

A key remedial element of the Selected Remedy is the construction of an on-site repository in Area A located where it will not promote discharges. NAC 445A.437 contains the minimum design criteria for tailings impoundments. This section requires that a tailings impoundment utilize a system of containment equivalent to "twelve inches of recompacted native, imported, or amended soils which have an in place recompacted coefficient of permeability of no more that $1X10^{-6}$ cm/sec" or some other geologic formation that can be demonstrated to provide equivalent containment. However, the Department may require an alternate level of containment after considering several site factors.

The NDEP has determined that a lined tailings repository is not necessary to prevent degradation of waters of the State, because the mining materials to be disposed of at the Rio Tinto Site would be dried materials **rather** than tailings being disposed as a slurry as would most often occur at active mine sites. The repository cover has been designed to limit infiltration by 95% to prevent vertical migration of meteoric water.

2.8.3.3 Cost Effectiveness

The NDEP has determined that the Selected Remedy is cost-effective and consistent with the NCP. In making this determination, the following definition was used: "A remedy shall be cost-effective if its costs are proportional to its overall effectiveness." (40 C.F.R. §300.430(f)(1)(ii)(D)). This was accomplished by evaluating the "overall effectiveness" of those alternatives that satisfied the threshold criteria (i.e., were both protective of human health and the environment and ARAR-compliant). Overall effectiveness was evaluated by assessing three of the five balancing criteria in combination (long-term effectiveness and permanence; reduction in toxicity, mobility, and volume through treatment; and short-term effectiveness). Overall effectiveness was then compared to costs to determine cost-effectiveness. The relationship of the overall effectiveness of this remedial alternative was determined

to be proportional to its costs and hence this alternative represents a reasonable value for the money to be spent.

2.8.3.4 Utilization of Permanent Solutions and Alternative Treatment Technologies (or Resource Recovery Technologies) to the Maximum Extent Practicable

The NDEP has determined that the Selected Remedy represents the maximum extent to which permanent solutions can be utilized in a practicable manner at the Site. Of those alternatives that are protective of human health and the environment and comply with ARARs, the NDEP has determined that the Selected Remedy provides the best balance of trade-offs in terms of the five balancing criteria, while also considering the statutory preference for treatment as a principal element and bias against off-site treatment and disposal and considering community acceptance.

The Selected Remedy results in the protection of human health and the environment and compliance with ARARs with the removal of tailings from the Mill Creek Valley and placement in an on-site repository outside of the alluvial system. The repository is designed for long-term stability and the reduction or elimination of discharges, which eliminates the need for a long-term remedial presence at the Site to manage discharges. The repository therefore represents the remedial action which meets the statutory preference for permanent solutions.

2.8.3.5 Preference for Treatment as a Principal Element

The wastes at the Site are not considered Principal Threat Elements due to their low toxicity. Due to the large volume of mining-related wastes and the isolated location, treatment and chemical stabilization of the tailings materials was not considered to be practicable. However, the removal of the tailings from the alluvial system, where the presence of interstitial water can continuously mobilize constituents, is the most reasonable alternative to treatment and is the alternative that best satisfies the preference for permanent solutions.

2.8.3.6 Five-Year Review Requirements

Because this remedy will result in hazardous substances, pollutants, or contaminants remaining on-site, a statutory review will be conducted within five years after the initiation of remedial action construction to ensure that the remedy is, or will be protective of human health and the environment. The five-year reviews will continue until it is demonstrated that water quality standards can be met on a continuing basis without any active remedial presence at the site.

Benchmarks for achievement of performance standards in the Water Quality Compliance Protocol have been established using a 5-year schedule as a model. To ensure that the benchmarks in the WQCP coincide with the five-year remedy protectiveness review, the NDEP will perform the first review of remedy protectiveness at the completion of the construction of the remedy, which is anticipated to occur several years after initiation of the remedy; if remedy construction lasts for a period greater than five years, the NDEP will conduct a remedy review at Year 5 of construction and an additional remedy review will be conducted at completion of construction.

2.9 Documentation of Significant Changes from Preferred Remedy of Proposed Plan

No significant changes have been made in this ROD to the Preferred Alternative presented in the Proposed Plan.

3. Responsiveness Summary

3.1 Stakeholder Issues and Lead Agency Responses

During the public comment period (October 22 to November 22, 2010) following the release of the Proposed Plan, the Nevada Division of Environmental Protection received written comments from three parties: the Shoshone-Paiute Tribes of the Duck Valley Indian Reservation; Dennis and Marcia Bieroth, adjacent landowners; and Jennifer Unekis on behalf of Doris Weiderberg, current landowner of the majority of the Rio Tinto Mine. No formal comments were received during the public presentation of the Proposed Plan on November 9, 2010.

Because only three sets of comments were received, the Responsiveness Summary will directly respond to comments on a point-by-point basis. Comments specific to the Selected Remedy will be presented in their entirety followed by a response from the NDEP as the lead agency. The comment correspondence is included as Appendix 3.

3.1.1 Comments by the Shoshone-Paiute Tribes of the Duck Valley Indian Reservation

In written correspondence dated November 22, 2010, the Tribes present their support of the Rio Tinto Mine Proposed Plan. However, they express the following concerns.

Comment 1:
"The plan must ensure that all material identified as tailings are removed during implementation and that only non-toxic sludge materials are left in place. Materials left in place must be protected from future mobilization as a result of flood events or similar circumstances. Consideration should be given by the RTWG and NDEP/US EPA to removal of the sludge as a modification to the plan during implementation."

NDEP Response:
Pond 2 (the sludge pond) has been determined to be at most a minor source of loading to Mill Creek and the underlying alluvium based on the acid-base accounting undertaken during site assessment. The deposition history is known to a reasonable extent to consistent primarily of water treatment sludges with a basic pH that is not conducive to metal leaching. The Mill Creek Channel around Pond 2 will be designed to proper engineering standards to reduce or eliminate the risk of damage or mobilization during flooding events.

Comment 2:
"The plan must result in the design and implementation of changes to Mill Creek to accomplish fish passage during critical high flow periods and to ensure geomorphologic integrity during flood events and other similar circumstances."

NDEP Response:
Fish passage is a critical goal of the restoration component of the Selected Remedy; however, fish passage is not a compliance criterion that can be applied to determinations that the Remedy has met Remedial Action Objectives. The design and implementation of Mill Creek Restoration upon removal of Tailings Ponds 3 and 4 has been and will continue to be informed by best professional judgment regarding stream geomorphology, flow patterns, and channel structures that should be supportive of fish passage. The design process relies on input from the restoration Trustees including the Nevada Department of Wildlife, US Fish and Wildlife Service, Tribes, and NDEP.

Comment 3:
"Monitoring of the potential mine pool impacts on the East Fork Owyhee River must continue for as longs as there is a realistic possibility that the mine pool contains significant contamination and might impact the river (e.g. until mine pool sampling is performed indicating no impacts to groundwater)."

NDEP Response:
The Ambient Monitoring Protocol was developed to address whether a connection between the underground workings at the former mine site might have a hydrologic connection to the East Fork Owyhee River and whether that connection could have an impact on water quality. Independent consultants were selected to make informed decisions regarding the potential location of a possible connection and provided advice on the development of a monitoring program to look for impacts. At the present time, any potential inputs may be masked by the known loading of mining-related contaminants from the wastes deposited in Mill Creek.

Additionally, water quality monitoring at several sampling stations on the East Fork Owyhee River is routinely conducted by the State of Nevada to assess water quality. Monitoring is done to ensure that water quality is consistent with designated beneficial uses, and that information is made available to the public.

Comment 4:
"The RTWG and agencies must agree to provide adequate funding and opportunity for the Tribes to participate in the implementation of the plan and post-remedy monitoring."

NDEP Response:
The Nevada Division of Environmental Protection is committed to extending opportunities for Tribal participation during remedy implementation and post-remedial monitoring. Funding mechanisms are currently being discussed.

3.1.2 Comments by Dennis and Marcia Bieroth, adjacent landowners
Mr. and Mrs. Bieroth express their pleasure to learn that a plan will be implemented to clean up the Rio Tinto tailings in an e-mailed correspondence dated November 17, 2010. They expressed the following concerns regarding the Selected Remedy.

Comment 1:
"One of our concerns is that it appears that there may be some work planned on our deeded land. In the past, a test well was drilled on our land without our knowledge or consent. We don't want to see the mistake repeated! We need to be involved in any plans that pertain to our land."

NDEP Response:
All work in this Record of Decision on private property would require authorized access. It is not clear whether work required in the Record of Decision will be required on property owned by Dennis and Marcia Bieroth; however, efforts are being made to verify property ownership prior to initiation of work. More specifically, prior to conducting any of the work, the site will be surveyed, and the Bieroth property boundary will be clearly delineated. Also, efforts will be made to keep neighboring property owners aware of work being undertaken in the area and to maintain a strong working relationship with property owners and local stakeholders.

Comment 2:
"We also have a concern about water for our livestock. We are not sure where the boundary line starts on our deeded property and we are not sure if the fresh water pond lies within our deeded property. Over the years our livestock have used the fresh water pond as a source of stock water late in the year when the stream bed above the pond dries up. If the pond is removed and the channel realigned to its original creek bed, and the creek is then lined with rock as it is above the pond now, our livestock won't be able to access it."

NDEP Response:
To implement the preferred alternative, the current Mill Creek channel will be realigned and will pass through the Pond 1 area. Eventually, the Pond 1 area is likely to fill with sediment. With the potential exception of certain intervals during the construction of the realigned channel, it is our understanding that the Bieroths will, as needed, be assured continued access to the Pond 1 area.

Comment 3:
"Another concern is a corridor for our livestock to travel through the mine site. When we now move our livestock out of our forest allotment we travel on the road through the mine. Will we still be allowed to use this corridor or will we have to move the livestock around the mine perimeter?"

NDEP Response:
The road which traverses the site is a United States Forest Service Road, and access to the road for the purpose of moving livestock should not be interrupted. NDEP will ensure that the parties conducting the remedial action coordinate with local property owners as needed in the event that site activities temporarily limit access.

3.1.3 Comments from Jennifer Unekis on behalf of Doris Weiderberg
The NDEP received an electronic correspondence on November 22, 2010 from Jennifer Unekis, who is the daughter of one of the current owners of property within Area A. The electronic correspondence was not provided as a formal support or opposition to the Proposed Plan. However, since it did contain a statement of concern regarding the remediation at the site as discussed in the Proposed Plan, the NDEP determined that it should be included in the Responsiveness Summary. Only one statement of concern was included; therefore, the entire correspondence has not been included in Appendix 3.

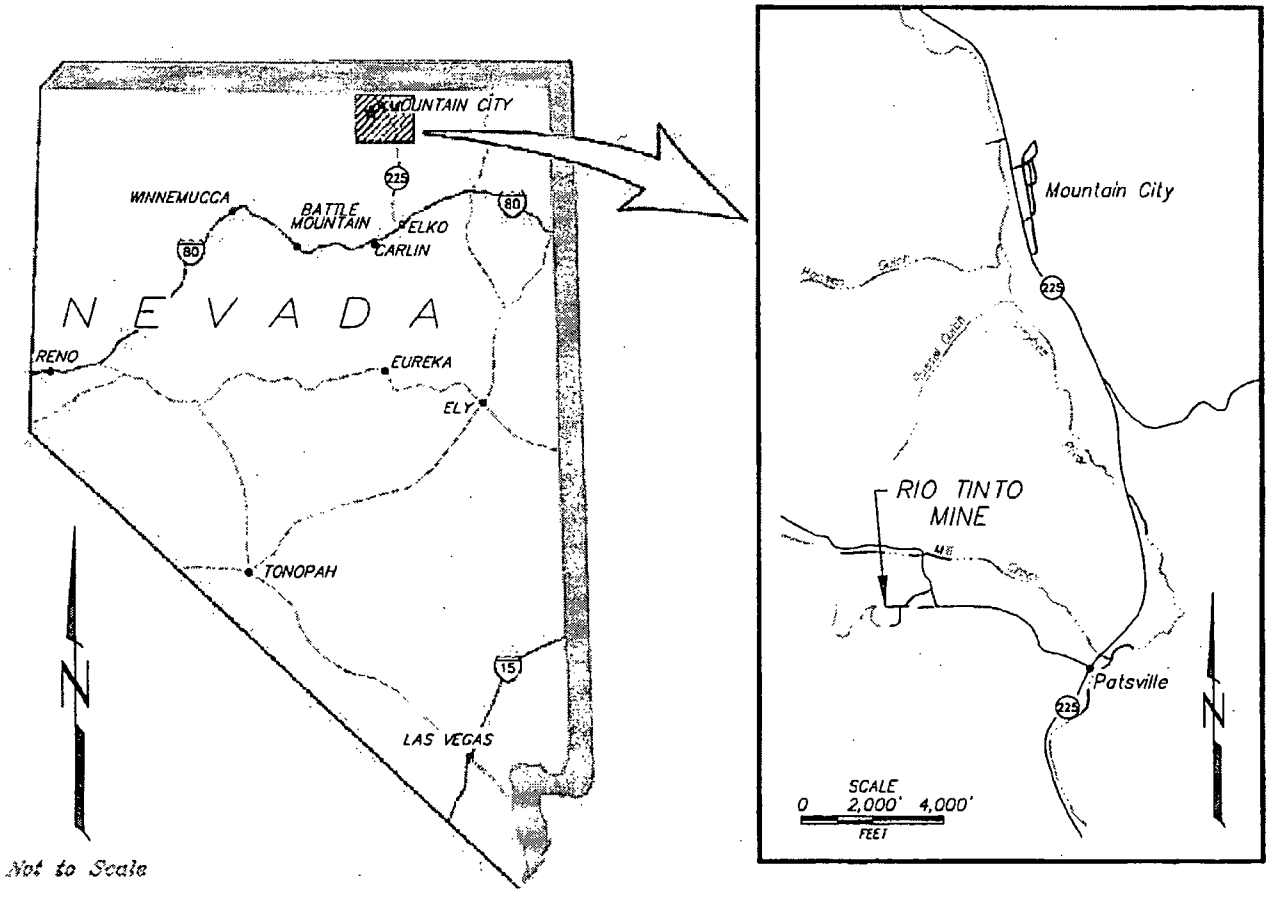
Comment 1:
"Alternative 3-A may impact the landowner in many ways and we are concerned that the remediation may tie up the property for current and future uses and possible devalue it."

NDEP Response:
Releases of contaminants through contact of alluvial water with tailings historically deposited in the Mill Creek Valley represent the primary concern associated with the Site and represent a continuing environmental liability for any current landowner. The NDEP considered an alternative that would not substantially alter the present locations of mine-related wastes (Alternative 2), but that alternative did not perform as well as the Selected Remedy in the comparative analysis and would have been subject to the same or similar land use controls to protect mine-related wastes that remain in-place. In addition to the same or similar land use controls, Alternative 2 and Alternative 3 would have necessitated an on-going remedial presence to operate a permanent water treatment plant, which would represent an additional burden to any land owner.

3.2 Technical and Legal Issues

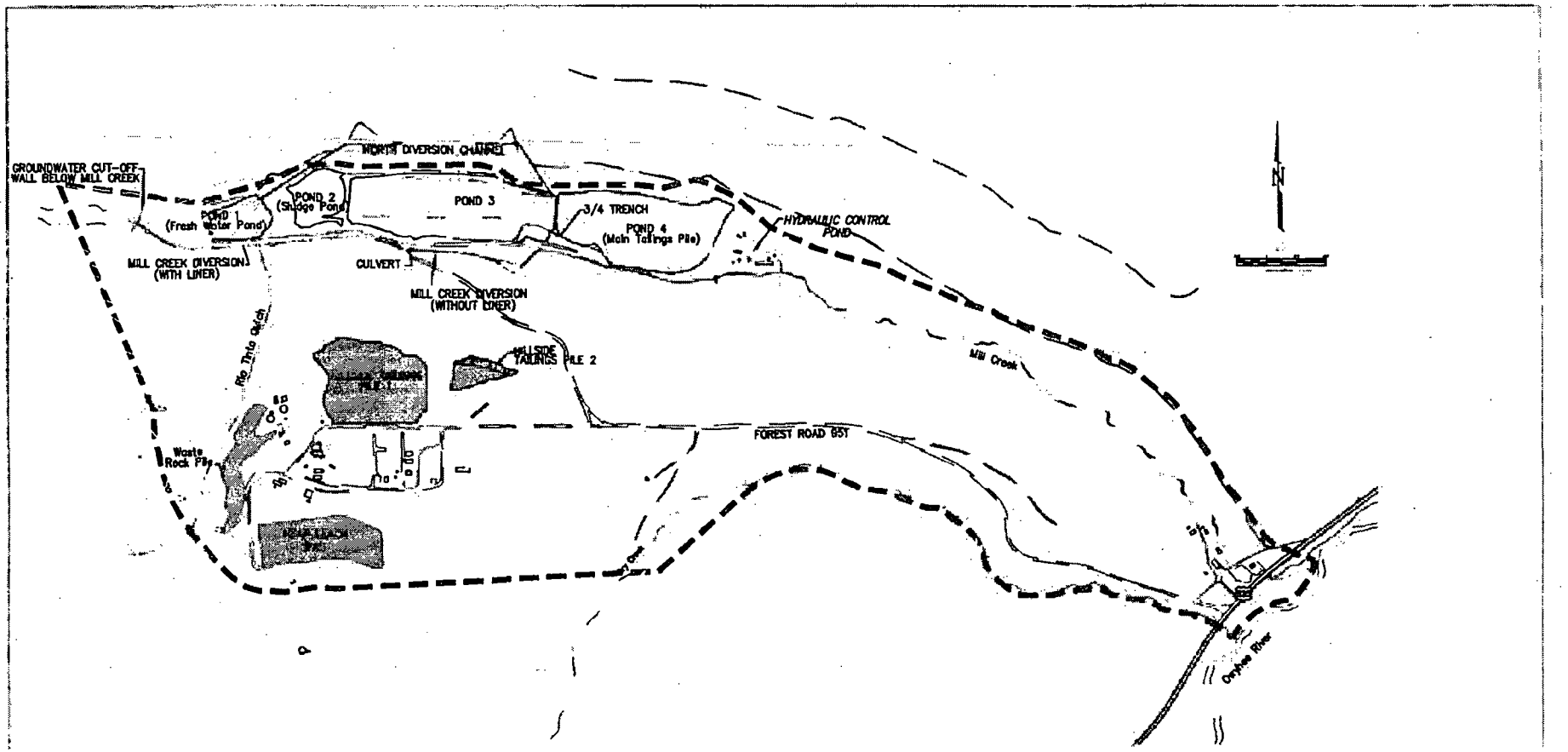
No technical or legal issues were identified during the public comment period.

FIGURES



PROJECT NAME		
RIO TINTO MINE SITE		
TITLE		
SITE LOCATION MAP		
CAD FILE:	DATE	FIGURE
110830_FIGURE 1.DWG	08.30.2011	1

P:\RIO TINTO\ENGINEERING\ROD\FIGURES



LEGEND

- AREA A BOUNDARY
- CREEK/RIVER
- EXISTING COVERS

Original drawing from MWH (February 2004)

PROJECT NAME		
RIO TINTO MINE SITE		
TITLE		
AREA A BOUNDARY		
CAD FILE:	DATE	FIGURE
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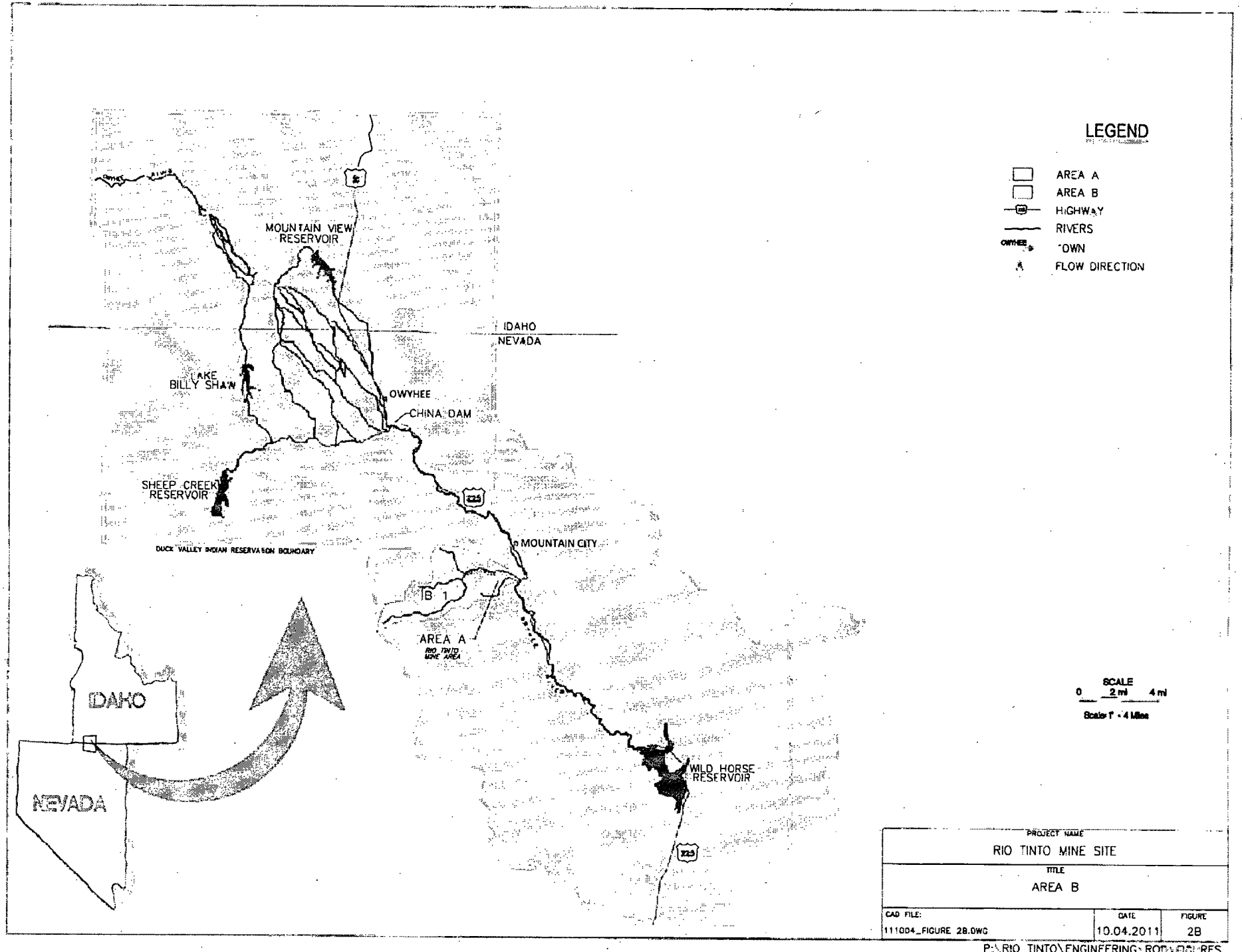

PROJECT NAME		
RIO TINTO MINE SITE		
TITLE		
AREA B		
CAD FILE:	DATE	FIGURE
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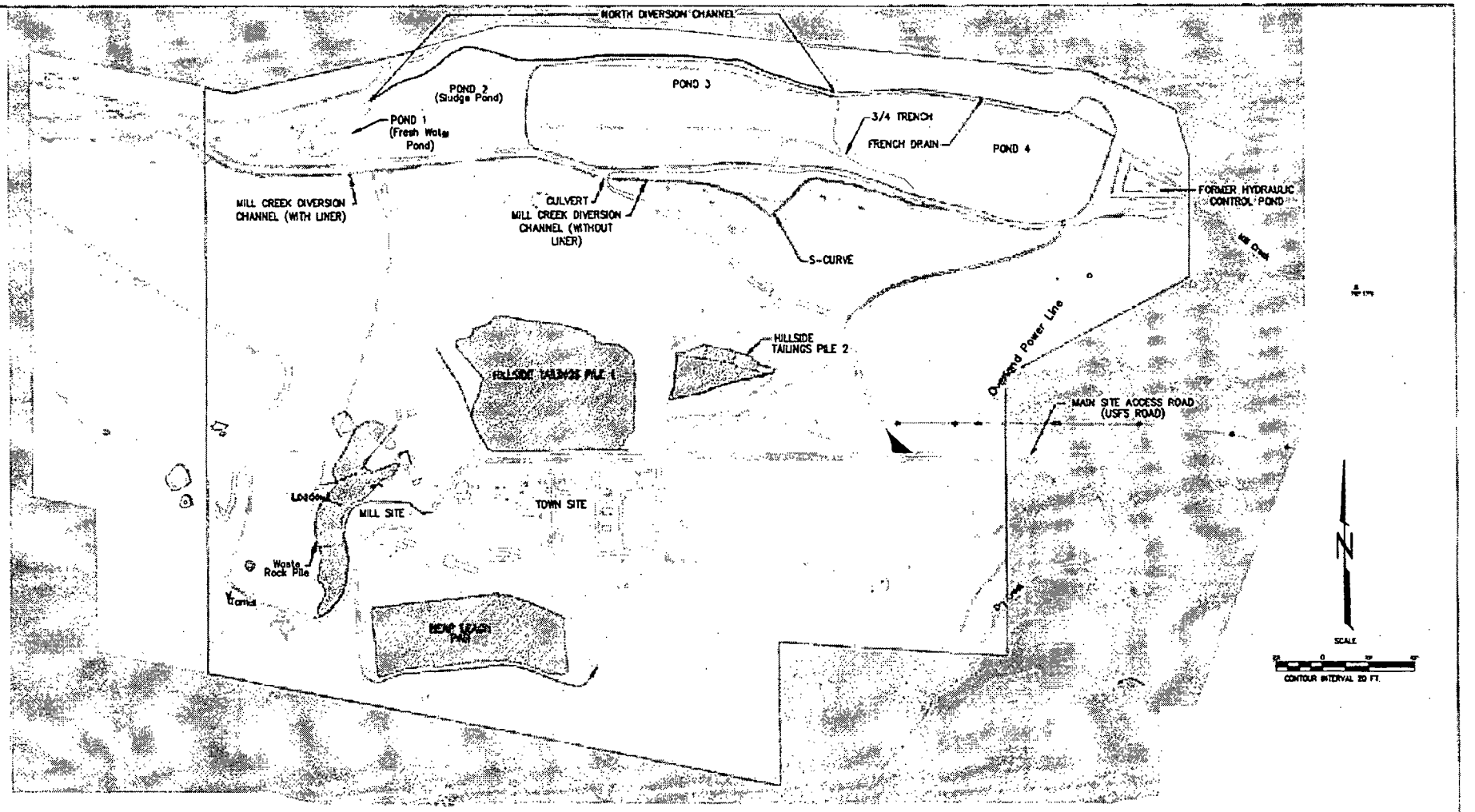


LEGEND

- USFS LANDS OR OTHER PRIVATE LANDS (AFTER LAND TRANSFER TO WIDERBURG)
- PRIVATE OWNERSHIP WITH RIO TINTO WORKING GROUP ACCESS AGREEMENTS
- EXISTING MILL CREEK DIVERSION CHANNEL
- EXISTING DIVERSION CHANNELS
- FENCING AND SIGNAGE
- PONDS 3, AND 4 (APPROXIMATE LIMITS OF MINE-RELATED WASTE)
- EXISTING COVERS
- EXISTING FRENCH DRAIN

NOTES:

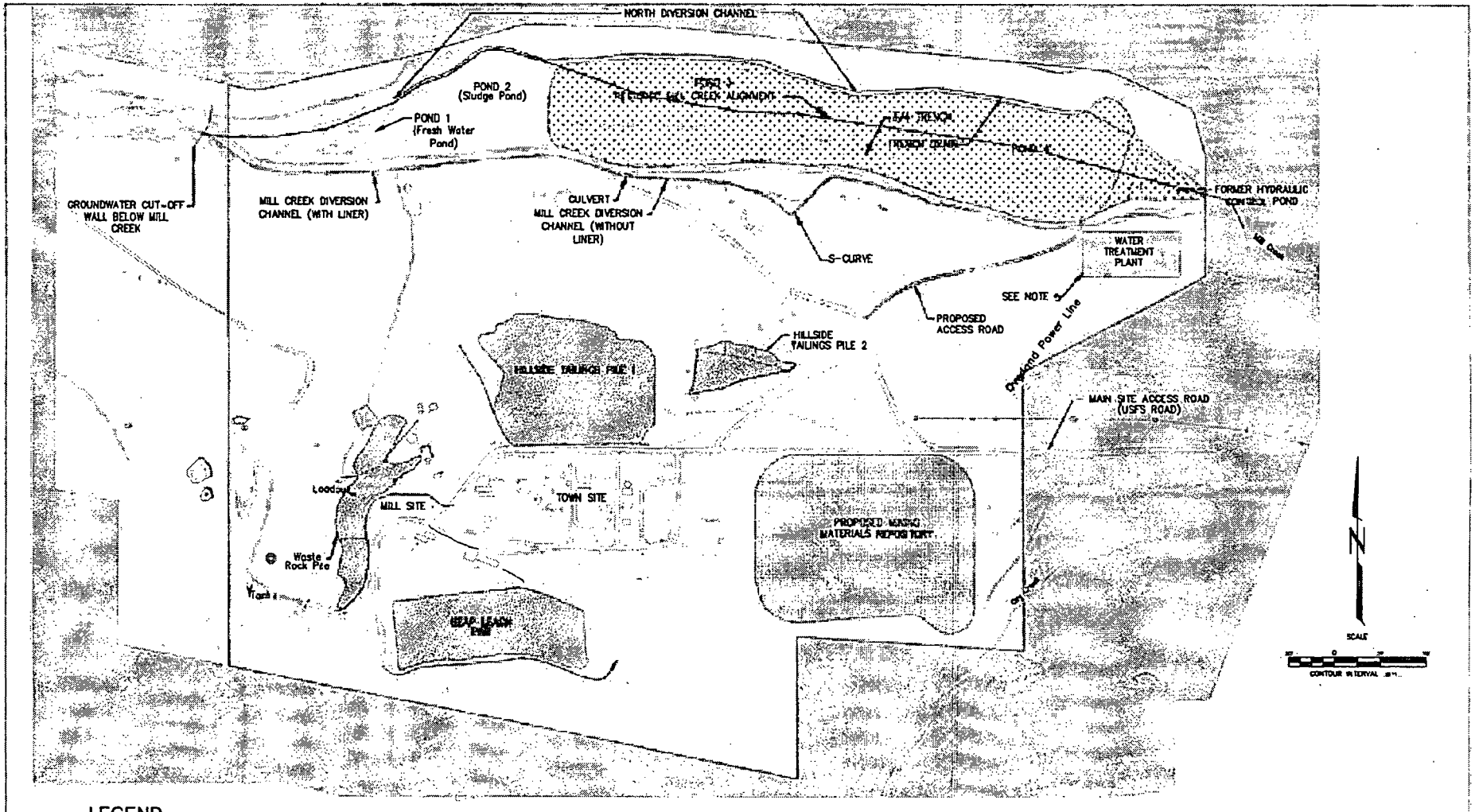
1.) TOPOGRAPHY BASED ON 2002 AERIAL PHOTOGRAPHY (1:4800) PREPARED BY OLYMPUS AERIAL SURVEYS INC.

2.) PRIVATE LAND BOUNDARIES DIGITIZED FROM (1"=200') FOREST SERVICE MAP "Record Of Survey Historical Forest Boundary Township 43 North, Range 53 East MES No.93 - MS No. 4736 MOUNT DIABLO MERIDIAN ELKO COUNTY, NEVADA, March 1991" BY TERRAMATRIX ENGINEERING MAY 1998.

3.) LIMITS OF TAILINGS, WASTE ROCK & HEAP LEACH PILES ARE APPROXIMATE AND BASED ON FIELD MAPPING PERFORMED BY TERRAMATRIX 1993 & 1995.

PROJECT TITLE		
RIO TINTO MINE SITE		
TITLE		
FORMER MINE FEATURES		
DWG FILE	DATE	FIGURE
111004_FIGURE 3.DWG	10.04.2011	3

P:\RIO TINTO\ENGINEERING\ROD\FIGURES



LEGEND

- USFS LANDS OR OTHER PRIVATE LANDS (AFTER LAND TRANSFER TO WIDERBURG)
- PRIVATE OWNERSHIP WITH RIO TINTO WORKING GROUP ACCESS AGREEMENTS
- EXISTING MILL CREEK DIVERSION CHANNEL
- EXISTING DIVERSION CHANNELS (25% WILL BE UPGRADED)
- FENCING AND SIGNAGE
- PONDS 3, AND 4 AND UNDERLYING MATERIALS REMOVED TO ON-SITE REPOSITORY
- EXISTING COVERS
- EXISTING FRENCH DRAIN
- PROPOSED MINING MATERIALS REPOSITORY
- PROPOSED TEMPORARY WATER TREATMENT PLANT

NOTES:

1.) TOPOGRAPHY BASED ON 2002 AERIAL PHOTOGRAPHY (1:4800) PREPARED BY OLYMPUS AERIAL SURVEYS INC.

2.) PRIVATE LAND BOUNDARIES DIGITIZED FROM (1"=200') FOREST SERVICE MAP "Record Of Survey National Forest Boundary Township 45 North, Range 53 East MDB No.93 – MS No. 4726 MOUNT DIABLO MERIDIAN ELKO COUNTY, NEVADA, March 1991" BY TERRAMATRIX ENGINEERING MAY 1996.

3.) LIMITS OF TAILINGS, WASTE ROCK & HEAP LEACH PILES ARE APPROXIMATE AND BASED ON FIELD MAPPING PERFORMED BY TERRAMATRIX 1993 & 1995.

PROJECT TITLE		
RIO TINTO MINE SITE		
TITLE		
SELECTED REMEDY CONCEPTUAL LAYOUT		
CAD FILE: 110030_FIGURE 4.DWG	DATE: 08.30.2011	FIGURE: 4

P:\RIO TINTO\ENGINEERING\ROD\FIGURES

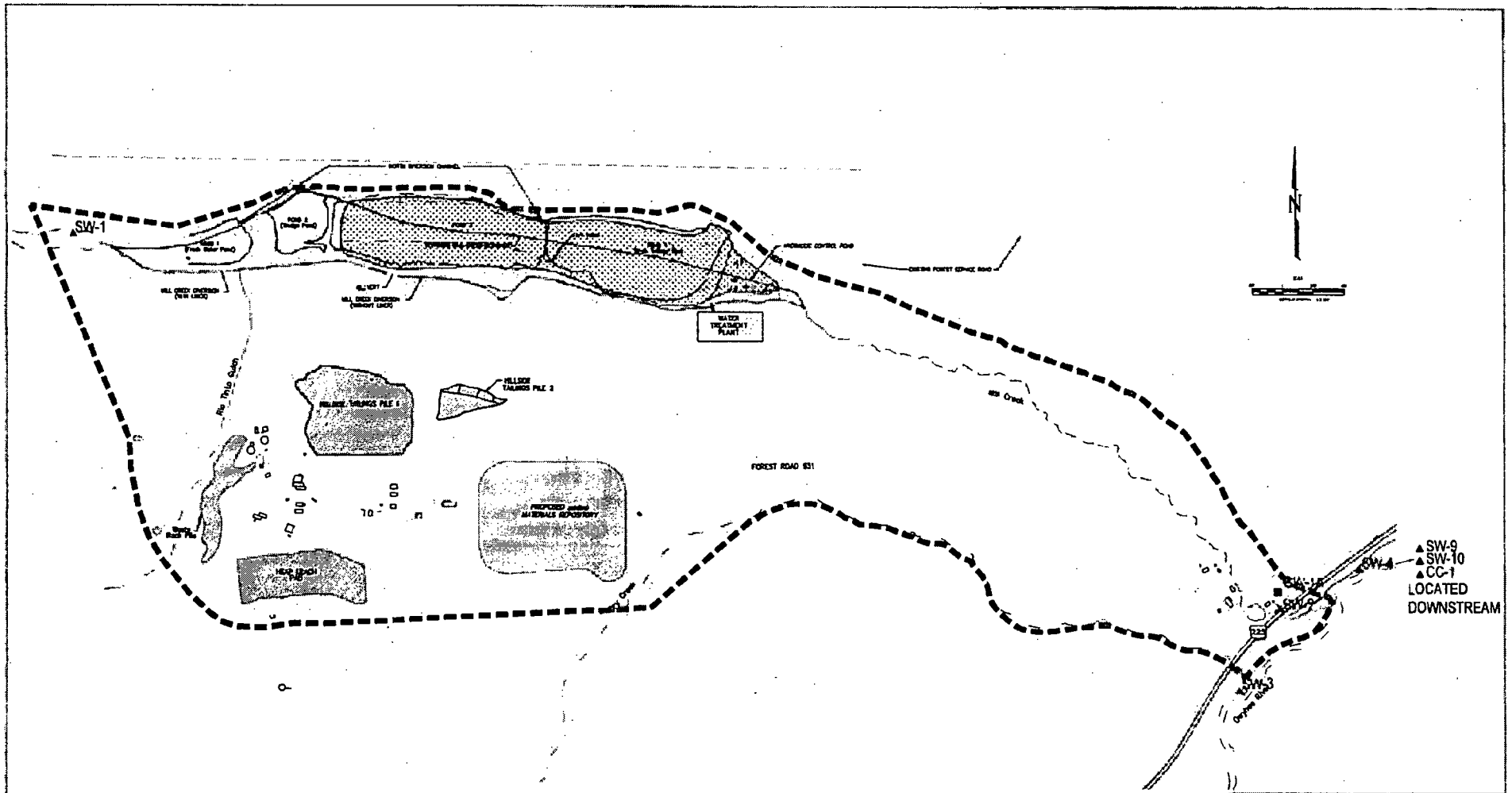

SW-1
NORTH DIVERSION CHANNEL
POND 2
(Inner Pond)
POND 1
(Outer Pond)
POND 3
HILL CREEK DIVERSION
(NEW LINER)
HILL CREEK DIVERSION
(WRIGHT LINER)
HILLSIDE CONTROL POND
CHEVRON FOREST SERVICE ROAD
WATER TREATMENT PLANT
Rio Tinto Gulch
HILLSIDE TAILINGS PILE 1
HILLSIDE TAILINGS PILE 2
Creek
FOREST ROAD 631
PROPOSED graded MATERIALS REPOSITORY
HEAP LEACH PAD
N
SW-9
SW-10
CC-1
LOCATED
DOWNSTREAM
SW-4
SW-3
225
Original drawing from MWH (February 2004)
LEGEND
AREA A
CREEK/RIVER
SW-8 RTWG SURFACE WATER SAMPLE LOCATION
PONDS 3, AND 4 AND UNDERLYING MATERIALS REMOVED TO ON-SITE REPOSITORY
EXISTING COVERS
EXISTING FRENCH DRAIN
PROPOSED MOVING MATERIALS REPOSITORY
PROPOSED TEMPORARY WATER TREATMENT PLANT
PROJECT NAME
RIO TINTO MINE SITE
TITLE
ROD WATER QUALITY MONITORING LOCATIONS
CAD FILE:
111129_FIGURE 5.DWG
DATE
11.29.2011
FIGURE
5
P:\RIO TINTO\ENGINEERING\ROD\FIGURES

Figure 6 - Historic Concentrations of Dissolved Copper at Alluvial Groundwater Well GW-1A

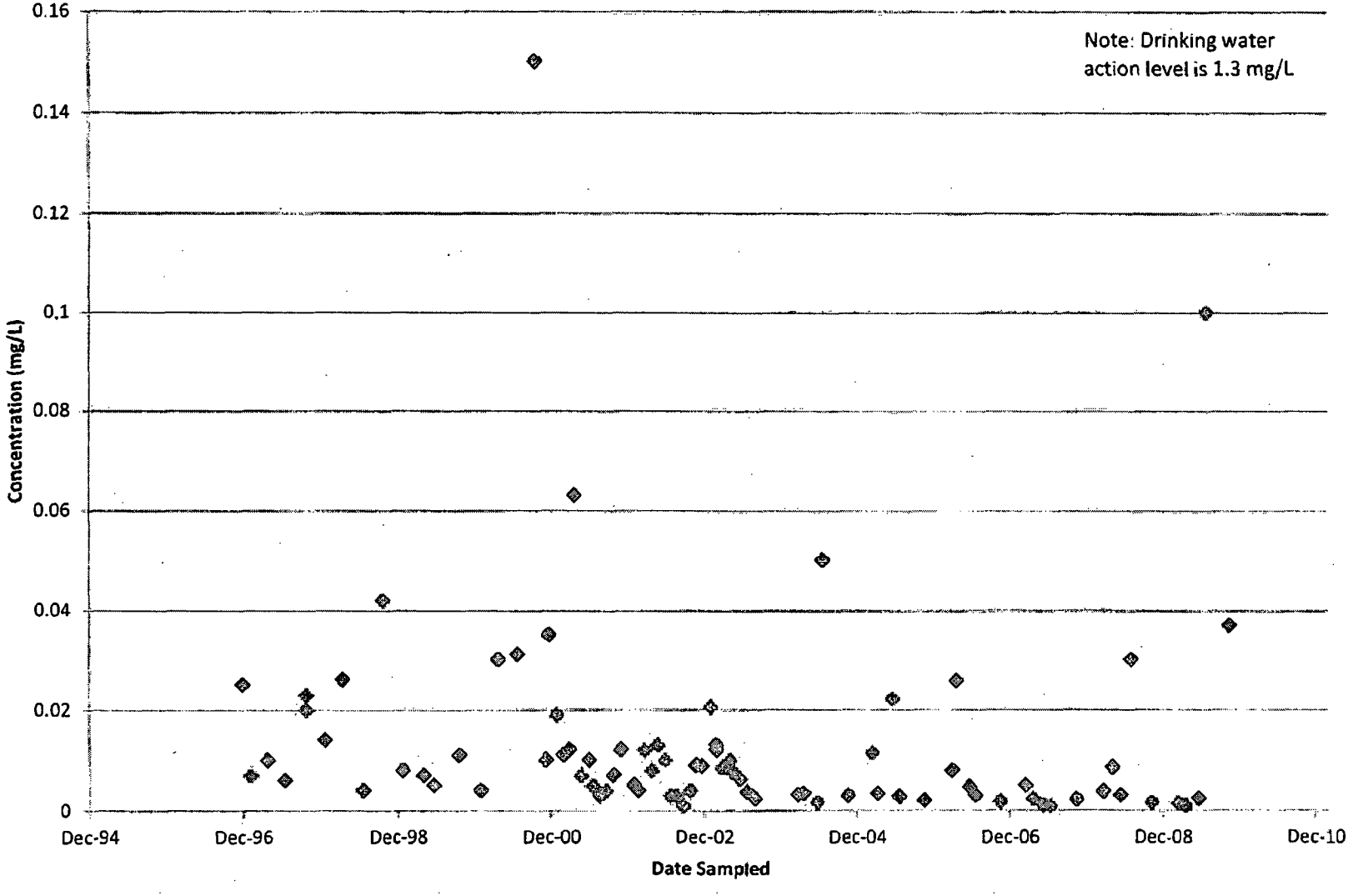
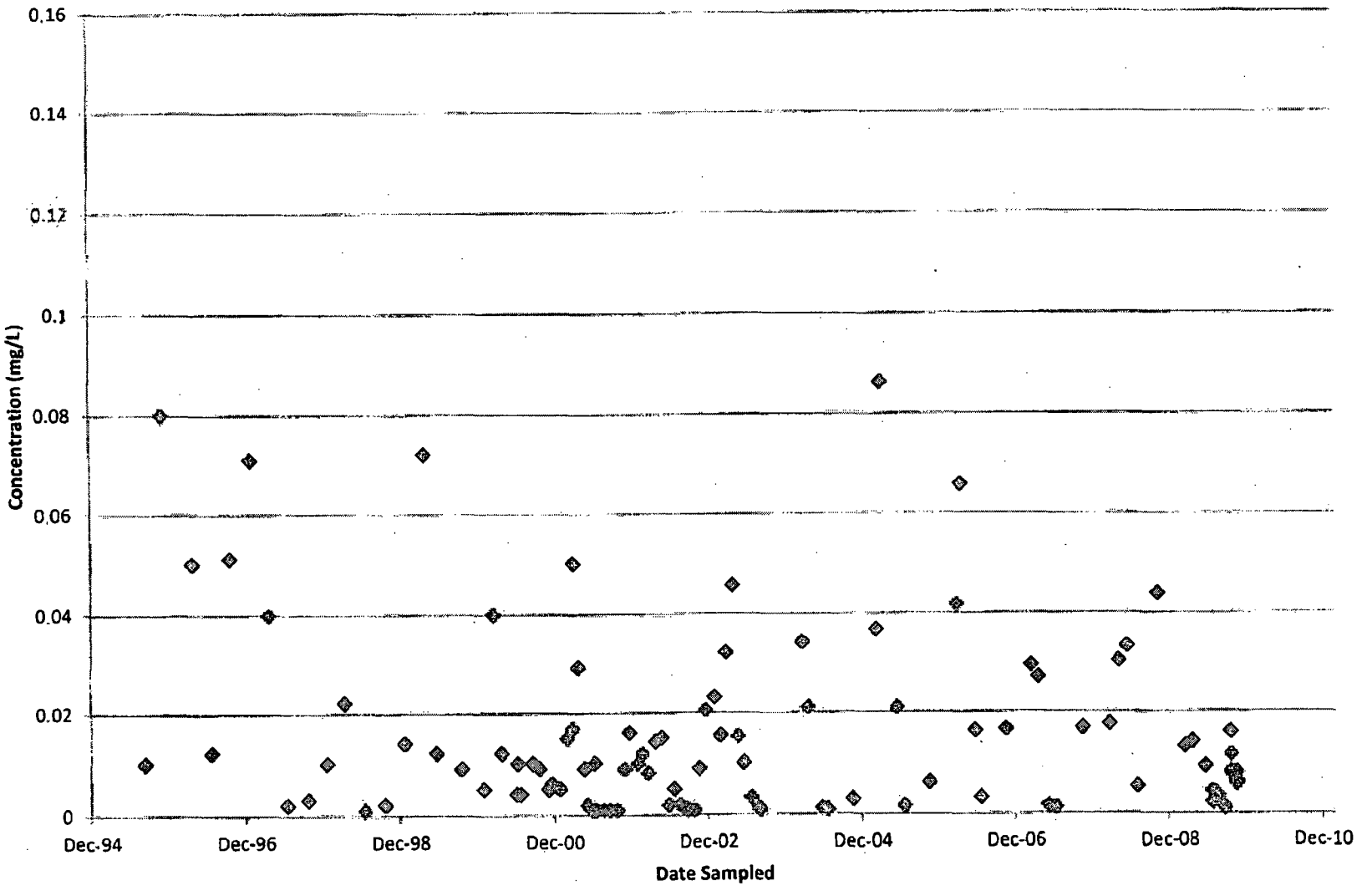
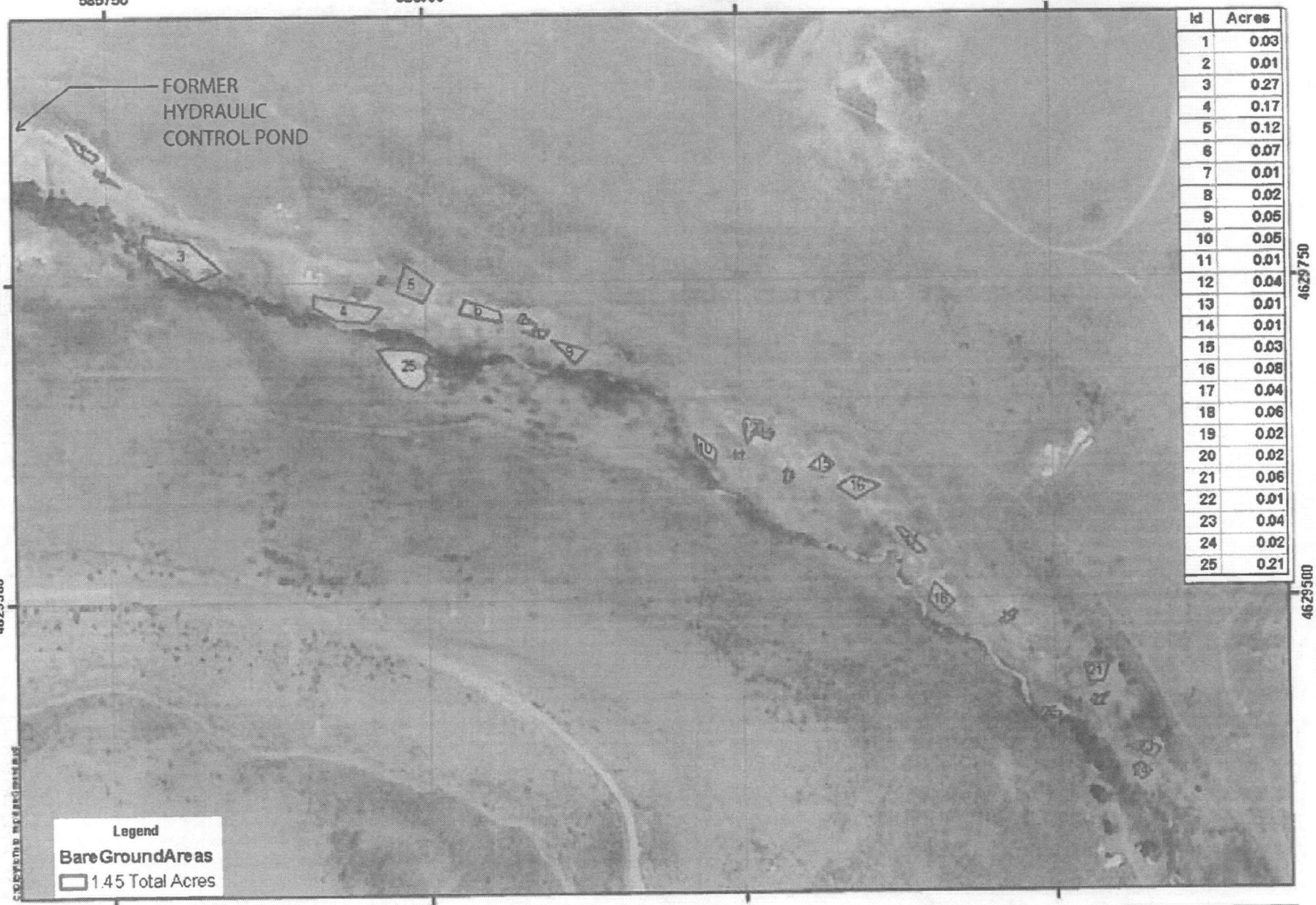


Figure 7 - Historic Concentrations of Dissolved Copper at Owyhee River Surface Water Monitoring Station SW-4





Id	Acres
1	0.03
2	0.01
3	0.27
4	0.17
5	0.12
6	0.07
7	0.01
8	0.02
9	0.05
10	0.05
11	0.01
12	0.04
13	0.01
14	0.01
15	0.03
16	0.08
17	0.04
18	0.06
19	0.02
20	0.02
21	0.06
22	0.01
23	0.04
24	0.02
25	0.21

LOWER MILL CREEK VALLEY
RESTORATION AREAS

FIGURE 8

0 125 250 500 Feet
SCALE = 1:4,000

N

NOTES
Data compiled using GPS points converted to polygons in ArcGIS software. Accuracy is relative to area and may vary slightly.
Projection UTM NAD83 ZONE11

PROJECT NO:	300599X
DATE:	7/13/2010
DRAWN BY:	SYR
APPROVED BY:	MBD
TT OFFICE	ELKO, NV

APPENDICES

Record of Decision—Appendix 1

Rio Tinto Mine Site
Water Quality Compliance Protocol
Final

December, 2011

I. Introduction

A. Purpose

This Water Quality Compliance Protocol (Protocol) for the Rio Tinto Mine Site (Site) establishes the Performance Standards for the Remedial Action for the Site as selected in the Record of Decision (ROD) for the Site. The Protocol establishes methods for monitoring water quality to demonstrate achievement of these Performance Standards and State and Federal requirements. The Protocol contains provisions that apply during and after Remedy Construction for the East Fork Owyhee River and for Mill Creek. The Protocol provides for achievement of Performance Standards along a timeline determined to be appropriate by the Nevada Division of Environmental Protection (NDEP) and the US Environmental Protection Agency (EPA). The Protocol also provides for consideration of specified additional actions at certain times if sufficient progress has not been made.

B. Definitions

This Protocol is an Appendix to the ROD. All terms presented in capital letters or acronyms, unless they are defined herein, shall have the meaning provided in the ROD. All references to sampling locations (SW stations) are to the sampling locations identified on the map attached as Figure 1.

II. Reporting

Monitoring conducted under this Protocol shall be reported according to the following schedule and to the extent possible shall be consolidated with any other reporting requirements for the Site. During remedy construction, all then available data from biweekly (every other week) monitoring activities will be reported monthly in a periodic progress report, by the 10th of each month. Activities conducted between construction periods will be summarized in a progress report preceding the commencement of the next construction period. After certification of completion of Remedy Construction, quarterly monitoring activities will be reported yearly in a periodic progress report, by a date determined to be appropriate by the NDEP at the time of certification.

Benchmarks for achievement of Performance Standards in this Protocol have been established using a 5-year remedy review schedule as a framework. To ensure that the benchmarks in this Protocol coincide with the five-year remedy protectiveness reviews conducted by the NDEP, the NDEP will perform the first review of remedy protectiveness at the certification of completion of Remedy Construction, which is anticipated to occur several years after initiation of the remedy; if Remedy Construction lasts for a period greater than five years, the NDEP will conduct a remedy review at Year 5 of construction and an additional remedy review will be conducted at certification of completion.

III. Analytes

The analyte list provided in Table 1 consists of Performance Standard Analytes, Supplemental Analytes and Field Parameters. Three Performance Standard Analytes (dissolved cadmium, dissolved copper, and dissolved zinc) were selected as representative parameters for the purpose of monitoring downstream water quality both in Mill Creek and the East Fork Owyhee River. These analytes were selected because they are the most significant in terms of risk to ecological receptors, and because statistical analysis shows they are predictive of mine site constituent concentrations in the East Fork Owyhee River. Supplemental Analytes (total iron, total aluminum, hardness, total dissolved solids, and total suspended solids) and Field Parameters (pH, temperature, specific conductance, dissolved oxygen, turbidity, stream discharge) will also be measured to assist in evaluating the Selected Remedy as set forth in the ROD. See Table 1 for the list of Performance Standard Analytes, Supplemental Analytes, and Field Parameters. All samples will be collected and all laboratory analysis of the analytes will be conducted in accordance with an approved Quality Assurance Project Plan or any approved revisions to the Plan.

IV. Performance Standards

Compliance shall be determined by comparing measured concentrations of the Performance Analytes at the specified sampling location (either SW-2 or SW-4 as specifically identified in this Protocol) with the appropriate acute and chronic Performance Standard concentrations identified in Table 2 (base upon Nevada Administrative Code (NAC) 445A.144), and additionally in the case of monitoring conducted during Remedy Construction with the calculated 95% Upper Confidence Limit (UCL) concentrations derived from the historical data set for water quality downstream of the Site. See Table 2.

The Performance Standards for the Performance Standard Analytes have the specific numeric values established for compliance purposes for each stage of the Remedy as shown in Table 2. The Federal Clean Water Act, the implementing authorities of the Nevada Water Pollution Control Law, and other authorities, provide various mechanisms for accommodating site-specific conditions in protecting water quality and designating water quality criteria, water quality standards, beneficial uses, and mixing zones. Depending on site conditions over time, these authorities may also be appropriately applied to evaluate and insure the protectiveness of the mine site remedy. The existing numeric values and Performance Standards that have been established at this time are summarized below:

A. During Remedy Construction: the Performance Standards for the Performance Standard Analytes in the East Fork Owyhee River at station SW-4 are the greater of either

(1) the prevailing upstream water quality condition at Station SW-3;

(2) the 95% Upper Confidence Limit ("UCLs") calculated from SW-4 water quality monitoring database for January, 2005 to March, 2010, as set forth in Table 2; or

(3) the applicable Chronic Performance Standard, as set forth in Table 2.

B. Following Certification of Completion of Remedy Construction, the Performance Standards for the East Fork Owyhee River at station SW-4 are the greater of either

(1) the prevailing upstream water quality condition at Station SW-3; or

(2) the applicable Chronic Performance Standard, as set forth in Table 2.

C. Ten years following Certification of Completion of Remedy Construction, the Performance Standards for Mill Creek at station SW-2 are:

(1) the applicable Acute Performance Standard as set forth in Table 2; or

(2) no acute toxicity observed for relevant organisms at Station SW-2.

D. Fifteen years following Certification of Completion of Remedy Construction, the Performance Standards for Mill Creek at Station SW-2 are the applicable Chronic Performance Standards, as set forth in Table 2.

Details of how compliance is to be measured and achieved during Remedy Construction and after Remedy Construction in both the East Fork Owyhee River and in Mill Creek are described in their respective sections below.

V. Monitoring During Remedy Construction

1. During Remedy Construction, monitoring will be conducted biweekly (every other week) during active construction periods at SW-1, SW-2, SW-3 and SW-4 locations, to the extent measurable flow is present. Construction is anticipated to occur between May and October. No monitoring will be conducted between construction periods, although Site inspections will be performed to verify the adequacy of best management practices (BMPs). Upon certification of completion of Remedy Construction, sampling will be conducted quarterly as described in subsequent sections of this protocol.

2. During Remedy Construction, including Mill Creek channel realignment, Baseline Water Quality will be maintained at SW-4 as described, below.

3. Baseline Water Quality is defined based upon the historical mine site data for specified analytes at station SW-4 during the period of January 2005 to March 2010. During Remedy Construction, antidegradation compliance shall be determined by comparing the monthly mean concentrations measured during construction compared to the greater of: a) the prevailing upstream water quality condition at Station SW-3; b) the applicable Chronic Performance Standard in Table 2; or c) the calculated 95% Upper Confidence Limit (UCL) concentrations in Table 2. Antidegradation compliance shall be achieved through implementation of relevant BMPs in construction areas near Mill Creek as necessary.

4. If compliance with Baseline Water Quality is not maintained during Remedy Construction, additional actions may be required, including:

    - implementation of additional BMPs if monitoring identifies a controllable Site-related source; and/or

    - additional monitoring to evaluate the protectiveness of the stream for designated uses.

VI. Long Term Monitoring / East Fork Owyhee River

1. Quarterly compliance monitoring will continue for a minimum of five years following certification of completion of Remedy Construction. East Fork Owyhee River (EFOR) compliance monitoring of stations SW-3 and SW-4 will be terminated following three consecutive years of compliance with Performance Standards at SW-4 with no more than one exceedance in the three consecutive year period, but not prior to the fifth year following certification of completion of Remedy Construction. Monitoring for individual analytes will be terminated following three years of compliance with the Performance Standard for that analyte, even if monitoring for other analytes continues. The basis for termination of compliance monitoring or termination of monitoring of individual analytes shall be documented in the yearly progress report for the year in which compliance with the Performance Standard was achieved. Applicable water quality exceedance thresholds for Performance Standard Analytes will be the greater of the prevailing upstream water quality condition at Station SW-3 or the applicable Performance Standard concentration in Table 2.

2. Quarterly monitoring results at Station SW-4 will be compared to the greater of the prevailing upstream water quality conditions at Station SW-3 or the Chronic Performance Standard in Table 2. If compliance with Performance Standards is not achieved within five years after certification of completion of Remedy Construction as specified above, additional actions may be required, including the following:

    - implementation of additional BMPs, if monitoring identifies a controllable Site-related source;

    - examination of factors necessary to determine whether the Biotic Ligand Model results in a more appropriate determination of protectiveness of copper concentrations than the existing hardness-based standard; and/or

    - additional monitoring to evaluate the protectiveness of the stream for designated uses.

3. If compliance with Performance Standards is not achieved within 10 years after certification of the completion of Remedy Construction as specified above, additional actions may be required, including but not limited to the following:

- evaluation of water quality data to determine whether data indicated promising trends toward meeting standards (in which case additional time may be granted to achieve compliance);

- additional monitoring to evaluate the protectiveness of the stream for designated uses;

- implementation of additional BMPs, if monitoring identifies a controllable Site-related source;

- examination of factors necessary to determine whether the Biotic Ligand Model or other methodologies for development of site-specific criteria results in a more appropriate determination of protectiveness;

- a site-specific, quantitative risk analysis; and/or

- implementation of additional remedial measures, including groundwater capture/treatment, if technically feasible, but only after other options have been evaluated for feasibility and effectiveness and, if appropriate, implemented. Selection and implementation of additional remedial measures may require an explanation of significant difference or amendment to the Record of Decision.

VII. Long Term Monitoring / Mill Creek

1. The analyte list (Table 1) shall be the same as developed for the EFOR monitoring described above.

2. Water quality monitoring will only be conducted during periods of measurable flow at Station SW-2. Upon certification of completion of Remedy Construction, monitoring will be conducted on a quarterly basis.

3. During Remedy Construction, BMPs will be implemented in order to comply with antidegradation requirements in Mill Creek.

4. Mill Creek compliance monitoring of stations SW-1 and SW-2 will continue for a minimum of five years following certification of completion of Remedy Construction. After this period, Mill Creek compliance monitoring will be terminated following three consecutive years of compliance with the Chronic Performance Standards (Table 2) at SW-2 with no more than one exceedance in the three consecutive year period. Monitoring for individual analytes will be terminated following three years of compliance for that analyte, even if monitoring for other analytes continues. Termination of monitoring of individual analytes shall be presented in the yearly progress report for the year in which compliance with the Performance Standard was achieved.

5. During the five-year period following certification of completion of Remedy Construction, concentrations of Performance Standard Analytes are expected to be improving at SW-2. If after five years, available monitoring data do not indicate these trends, further monitoring may be required to evaluate instream biological conditions.

6. By Year 10 after certification of completion of Remedy Construction, the Acute Performance Standards shall be met at SW-2 as outlined in Table 2, or no acute toxicity shall be observed for relevant organisms at SW-2. In addition and consistent with Mill Creek's intermittent flow patterns and geomorphological characteristics, benthic macroinvertebrate community metrics at SW-2 are expected to indicate improved conditions for intermittent stream fauna during late spring/early summer flowing water periods. If the above described conditions are not achieved by Year 10, additional actions may be required, including the following:

    - more detailed monitoring of benthic macroinvertebrate community metrics and/or evaluation of toxicological conditions;

    - examination of factors necessary to determine whether the Biotic Ligand Model results in a more appropriate determination of protectiveness of copper concentrations than the existing hardness-based standard; and/or

    - additional monitoring to evaluate the protectiveness of the stream for designated uses.

7. By Year 15 after certification of completion of Remedy Construction, compliance with the Chronic Performance Standards, as outlined in Table 2, shall be demonstrated at SW-2 (no more than one exceedance in a 3-year monitoring period). If compliance is not demonstrated at this time, additional actions may be required, including the following:

    - implementation of additional BMPs, if monitoring identifies a controllable site-related source;

    - examination of factors necessary to determine whether the Biotic Ligand Model or other methodologies for development of site-specific criteria results in a more appropriate determination of protectiveness; and/or

    - additional monitoring to evaluate the protectiveness of the stream for designated uses.

8. By Year 20 after certification of completion of Remedy Construction, compliance with Chronic Performance Standards, as outlined in Table 2, shall be demonstrated at SW-2 (no more than one exceedance in a 3-year monitoring period). If compliance is not demonstrated at this time, additional actions may be required, including but not limited to the following:

- evaluation of water quality data to determine whether data indicated promising trends toward meeting standards (in which case additional time may be granted to achieve compliance);

- additional monitoring to evaluate the protectiveness of the stream for designated uses;

- implementation of additional BMPs, if monitoring identifies a controllable site-related source;

- examination of factors necessary to determine whether the Biotic Ligand Model or other methodologies for development of site-specific criteria results in a more appropriate determination of protectiveness;

- a site-specific, quantitative risk analysis be conducted; and/or

- implementation of additional remedial measures, including groundwater capture/treatment, if technically feasible, but only after other options have been evaluated for feasibility and effectiveness and, if appropriate, implemented. Selection and implementation of additional remedial measures may require an explanation of significant differences or an amendment to the Record of Decision.

9. If at any point following five years after certification of completion of Remedy Construction, a statistically significant trend indicating an increase in contaminant concentrations or a decrease in pH is detected that may be attributable to the Site and that impairs water quality, additional investigation or analysis may be required to identify possible sources or causes for the worsening of water quality in order to supplement the information available for evaluation at the benchmarks established in this Protocol.

Table 1. *Performance Standard Analytes*, *Supplemental Analytes* and *Field Parameters* for the Rio Tinto compliance monitoring program.

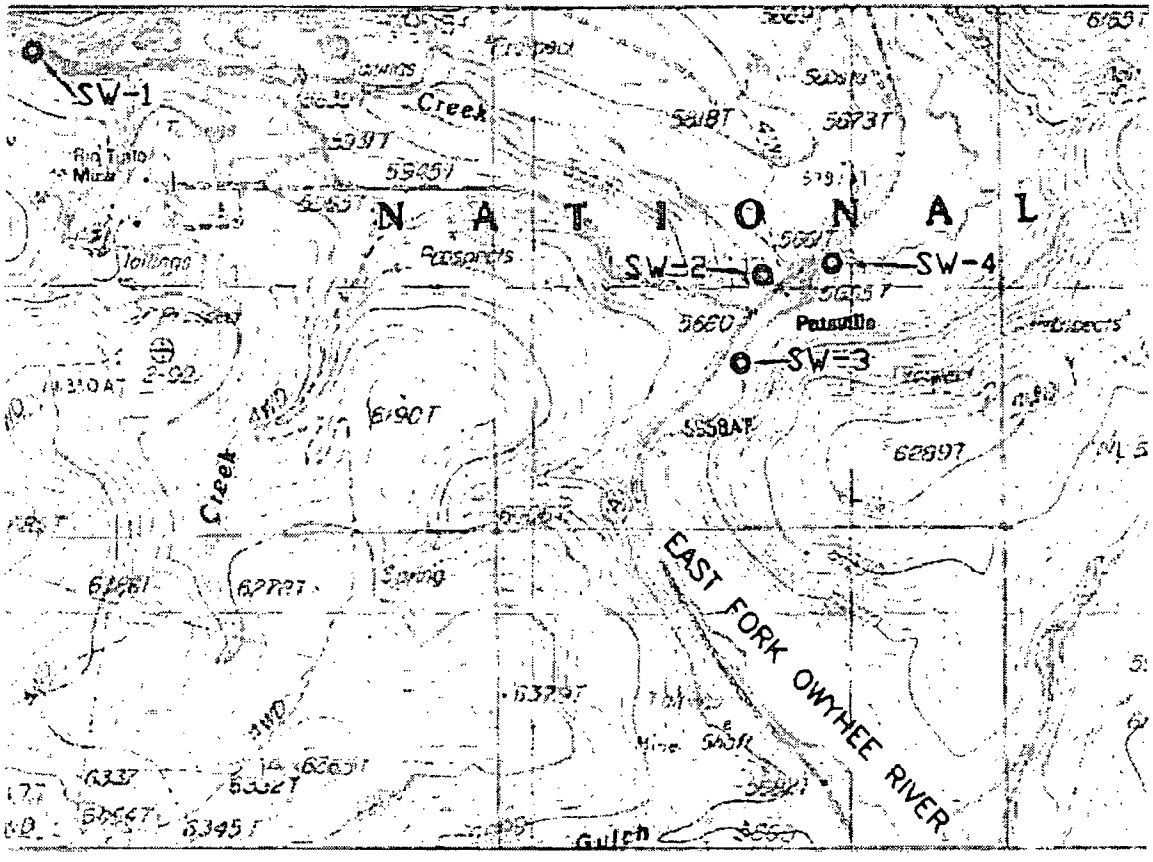
Performance Standard Analytes Dissolved cadmium (Cd), dissolved copper (Cu) and dissolved zinc (Zn)
Supplemental Analytes Total iron (Fe) and total aluminum (Al), Hardness, total dissolved solids (TDS), total suspended solids (TSS)
Field Parameters pH, temperature, specific conductance, dissolved oxygen, turbidity, stream discharge

Table 2. Compliance thresholds for Performance Standard Analytes (dissolved Cd, Cu and Zn [**bolded** numbers are calculated standards at 90 mg/L hardness, for reference purposes].

Thresholds	Dissolved Cd (mg/L)	Dissolved Cu (mg/L)	Dissolved Zn (mg/L)
Calculated 95% Upper Confidence Limit (UCL)[1]	0.00024	0.028	0.030
Acute Performance Standard[2]	[1.136672 – (ln (hardness)) X (0.041838)] X $e^{(1.0166 (\ln (\text{hardness})) - 3.924)}$ **[0.0018]**	0.960 X $e^{(0.9422 (\ln (\text{hardness})) - 1.700)}$ **[0.012]**	0.978 X $e^{(0.8473(\ln (\text{hardness})) + 0.884)}$ **[0.107]**
Chronic Performance Standard[2]	[1.101672 – (ln (hardness)) X (0.041838)] X $e^{(0.7409 (\ln (\text{hardness})) - 4.719)}$ **[0.00023]**	0.960 X $e^{(0.8545(\ln (\text{hardness})) - 1.702)}$ **[0.008]**	0.986 X $e^{(0.8473(\ln (\text{hardness})) + 0.884)}$ **[0.108]**

[1]- 95% UCLs calculated from SW-4 water quality monitoring database for January, 2005 to March, 2010.
[2]-Acute and Chronic Performance Standards are based on the aquatic life standards in NAC 445A.144.

WATER QUALITY COMPLIANCE PROTOCOL
MONITORING LOCATIONS



RIO TINTO MINE
WATER QUALITY COMPLIA
MONITORING LOC

Record of Decision—Appendix 2

Final

Rio Tinto Ambient Monitoring Protocol

(December 15, 2011)

A. Purpose

Generate and analyze specific surface water quality data in the East Fork Owyhee River (EFOR) drainage to determine if persistent water quality anomalies in the EFOR mainstem exist after construction of the Remedy for the Rio Tinto Mine Site and achievement of Performance Standards on the Owhyee River, and if so, are likely attributable to releases from the underground mine workings at the Site.

B. Sampling Stations

The sampling stations, as shown on the attached Figure 1, are identified as lower Mill Creek (SW-2), EFOR upstream from Mill Creek confluence (SW-3), EFOR downstream from Mill Creek confluence (SW-4), EFOR downstream from Station SW-4 (SW-9), EFOR at Mountain City (pre-2012, SW-10, and post January 1, 2012, SW-10A), and California Creek (CC-1).

C. Rationale for Analysis

Statistical sensitivity analyses (*retrospective power analyses*) were conducted on the preconstruction 2009 sampling station data sets to determine the magnitude of concentration differences that would be required, within expected standard deviations, to determine statistical significance from triplicate sampling station data. The results of these analyses indicated that there was approximately an 80% probability of detecting as little as a 1.5 μg/L difference in concentrations (preconstruction 2009 SW-3 data) or as much as a 4.75 μg/L difference in concentrations (preconstruction 2009 SW-10 data).

Based on site-specific geologic controls, if releases from the underground mine workings at the Site are causing or will cause a Persistent Anomaly, as defined in Section F(4) below, in the EFOR mainstem, such anomaly is expected to appear in the EFOR between Stations SW-4 and SW-10A, but especially between Stations SW-9 and SW-10A.

D. Parameters

The list of parameters described below was selected to include anions, cations, metals and metalloids which could be helpful in identifying water quality conditions potentially attributable to mine workings discharges to the EFOR, if any.

Field Parameters: Six parameters including river/stream discharge, turbidity, dissolved oxygen, temperature, pH, and specific conductance.

Laboratory Parameters: Twenty-three parameters including hardness, total dissolved solids, pH, sulfate, dissolved organic carbon, total and dissolved aluminum, arsenic, cadmium, calcium, copper, iron, magnesium, manganese, and zinc.

Diagnostic Parameters: Dissolved copper, cadmium and zinc (consistent with the *Performance Standard* analytes identified in the Water Quality Compliance Protocol).

Triplicate samples will be collected and analyzed for Laboratory Parameters and Diagnostic Parameters.

E. Initial Sampling Schedule

Ambient monitoring under this Protocol will commence after compliance with Performance Standards is achieved at Station SW-4, as set forth in the Water Quality Compliance Protocol. If this occurs prior to July 1 of any year, then the ambient monitoring will commence in July of that same calendar year. If compliance with Performance Standards is achieved at Station SW-4 after July 1 of any year, then the ambient monitoring will commence in July of the following calendar year.

Two successive years of monthly sampling will be conducted in the five low-flow months of July, August, September, October and November. These low-flow months were selected in order to reduce EFOR dilution effects and thereby enhance analytical sensitivity to water quality variations in the mainstem during this monitoring period.

F. Decision Process for Identification of Water Quality Anomalies

Step 1. Determining whether there is a Potential Anomaly.

(a) If the monthly mean concentrations of all of the Diagnostic Parameters at Station SW-10A are less than or equal to the monthly mean concentrations for the same Diagnostic Parameters at Station SW-9, then there is no anomaly and the protocol is complete. If there are any instances where the monthly mean concentration of a Diagnostic Parameter at Station SW-10A is greater than at Station SW-9, then the analysis will proceed to Step (1)(b).

(b) If the monthly mean concentration of one or more Diagnostic Parameters at Station SW-10A exceeds the Chronic Performance Standard (see Table 1 of the Water Quality Compliance Protocol) for that Diagnostic Parameter, then there is a "Potential Anomaly," and the analysis will proceed to Step 2. If not, then the protocol is complete.

Step 2. Determining whether any Potential Anomaly is Statistically Significant.

For any Potential Anomaly identified in Step (1)(b), if the monthly mean concentration of a Diagnostic Parameter at Station SW-10A exceeds the monthly mean concentration of the same Diagnostic Parameter at Station SW-9, and the exceedance is statistically significant (determined by Analysis of Variance [ANOVA] or other appropriate statistical methodology consistent with applicable regulatory guidance and standard industry practice), then there is a "Statistically Significant Anomaly," and the analysis will proceed to Step 3. If not, then the protocol is complete.

Step 3. Additional Sampling.

(a) If a Statistically Significant Anomaly identified in Step 2 is confirmed to occur in two or more consecutive months in either of the initial two years of the sampling program, then a third year of five-month, low-flow monitoring will be conducted, and the analysis will proceed to Step 4. If not, then the protocol is complete.

(b) Should the analysis under Step 2 identify that a Statistically Significant Anomaly exists in November but not October of monitoring years 1, 2 or 3 (if a third year of sampling is required pursuant to Step (3)(a)), then follow up sampling will be conducted in December of that same year, subject to the ability to safely access the sampling stations. To facilitate same year November/December sampling, if indicated, sampling shall be undertaken early in November to allow extended sampling opportunities in December. If safety concerns prohibit the collection of a sample in December at any sampling station, grab samples can be collected to meet the December sampling requirement at an agreed upon alternative sample location or at the original sample station as soon as safe sampling conditions are present.

Step 4. Determining whether there is any Persistent Anomaly.

If a Statistically Significant Anomaly occurs in two or more consecutive months during any two years of the sampling program, then there is a "Persistent Anomaly," and the analysis will proceed to Step 5. If not, then the protocol is complete.

Step 5. Evaluation of a Persistent Anomaly.

If a Persistent Anomaly is identified pursuant to Step 4, then the Settling Defendants will submit a report to NDEP and EPA by April 1 of the year following the final year of ambient protocol monitoring, which summarizes and evaluates the data collected pursuant to this protocol. NDEP and EPA will evaluate the report and determine whether or not the Persistent Anomaly is attributable to conditions or circumstances other than a release from the mine workings, such as loading from California Creek, irrigation withdrawals or returns, or other non-mine-site related differences between the sampling stations. If NDEP and EPA both determine that the Persistent Anomaly is attributable to such other conditions or circumstances, then the protocol is complete. Otherwise, further investigation may be required by NDEP or EPA pursuant to the terms of the Consent Decree.

P.O. Box 219 Owyhee, Nevada 89832-0219 (775) 757-3161

November 22, 2010

Scott Smale
NDEP Rio Tinto Project Manager
901 S. Stewart Street, Suite 4001
Carson City, NV 89701

Subject: Rio Tinto Mine Proposed Plan

Dear Mr. Smale,

The Nevada Division of Environmental Protection (NDEP) and U.S. Environmental Protection Agency (EPA) have released their Proposed Plan for the Rio Tinto Mine. The Proposed Plan would accomplish the following tasks:

1. Remove the tailings from the Mill Creek valley and place them in an engineered capped on-site repository designed to prevent surface and/or groundwater infiltration;

2. Improve the condition of the Mill Creek channel to support fish migration; and

3. Monitor water quality to confirm successful remediation and to confirm there are no impacts to ambient water quality in the East Fork Owyhee River as a result of the mine pool or related impacts.

The Tribes support the Rio Tinto Mine Proposed Plan developed by NDEP and EPA and appreciate the opportunity the agencies have provided the Tribes to work with them on reaching this compromise with the Rio Tinto Working Group. However, the Tribes request that NDEP and EPA address the following concerns:

- *The plan must ensure that all material identified as tailings are removed during implementation and that only non-toxic sludge materials are left in place. Materials left in place must be protected from future mobilization as a result of flood events or similar circumstances. Consideration should be given by the RTWG and NDEP/EPA to removal of the sludge as a modification to the plan during implementation.*

- *The plan must result in the design and implementation of changes to Mill Creek to accomplish fish passage during critical high flow periods and to ensure geomorphologic integrity during flood events and other similar circumstances.*

- *Monitoring of the potential mine pool impacts on the East Fork Owyhee River must continue for as long as there is a realistic possibility that the mine pool contains significant contamination and might impact the river (e.g. until mine pool sampling is performed indicating no impacts to groundwater).*

- *The RTWG and agencies must agree to provide adequate funding and opportunity for the Tribes to participate in the implementation of the plan and post-remedy monitoring.*

Sincerely,

Robert Bear, Chairman

Shoshone-Paiute Tribes of the Duck Valley Indian Reservation

November 17, 2010

Mr. Scott Smales, NDEP Rio Tinto Project Manager

We are happy to learn that a plan is ready to be implemented to clean up the Rio Tinto tailings. It has been a long process and it is time to remedy the problems. We are land owning neighbors on the west side of the Rio Tinto mine site and our cattle graze on our private land and the forest lands surrounding it.

One of our concerns is that it appears that there may be some work planned on our deeded land. In the past, a test well was drilled on our land without our knowledge or consent. We don't want to see the mistake repeated! We need to be involved in any plans that pertain to our land.

We also have a concern about water for our livestock. We are not sure where the boundary line starts on our deeded property and we are not sure if the fresh water pond lies within our deeded property. Over the years our livestock have used the fresh water pond as a source of stock water late in the year when the stream bed above the pond dries up. If the pond is removed and the channel realigned to its original creek bed, and the creek is then lined with rock as it is above the pond now, our livestock won't be able to access it.

Another concern is a corridor for our livestock to travel through the mine site. When we now move our livestock out of our forest allotment we travel on the road through the mine. Will we still be allowed to use this corridor or will we have to move the livestock around the mine perimeter?

We were disappointed that we didn't receive notice of the meeting that was held in Elko. We were told about the meeting the day before the meeting was to be held when Gary Aho called and asked us if we planned to attend. We were unable to attend because we had other commitments. Gary Aho has been our liaison over the years since this process began. He has been good to keep us informed and abreast as to the progress of the clean up and we appreciate that. We regret that Gary doesn't seem to have as important a role as he has in years past. Gary has been good to work with.

We would appreciate being added to the mailing list for future updates.

Sincerely,

Dennis and Marcia Bieroth
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