PERIODIC REVIEW

Minnie Mine Millsite
Facility/Site ID # 426

Leecher Canyon
Carlton, Washington 98814

Central Region Office

TOXICS CLEANUP PROGRAM

March 2010

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1.0 INTRODUCTION

This document is a review by the Washington State Department of Ecology (Ecology) of post-cleanup site conditions and monitoring data to ensure that human health and the environment are being protected at the Minnie Mine Property (Site). Cleanup at this Site was implemented under the Model Toxics Control Act (MTCA) regulations, Chapter 173-340 Washington Administrative Code (WAC).

Cleanup activities at this Site were completed by Ecology through an emergency remedial action and interim remedial action. The cleanup actions resulted in concentrations of arsenic, barium, cadmium, copper, selenium, vanadium and zinc in soil exceeding MTCA Method A cleanup levels. The MTCA Method A cleanup levels for soil are established under WAC 173-340-740(2). WAC 173-340-420 (2) requires that Ecology conduct a periodic review of a site every five years under the following conditions:

- Whenever the department conducts a cleanup action;
- Whenever the department approves a cleanup action under an order, agreed order or consent decree;
- Or, as resources permit, whenever the department issues a no further action opinion;
- And one of the following conditions exists:
    (a) Institutional controls or financial assurance are required as part of the cleanup.
    (b) Where the cleanup level is based on a practical quantitation limit.
    (c) Where, in the department's judgment, modifications to the default equations or assumptions using site-specific information would significantly increase the concentration of hazardous substances remaining at the site after cleanup or the uncertainty in the ecological evaluation or the reliability of the cleanup action is such that additional review is necessary to assure long-term protection of human health and the environment.

When evaluating whether human health and the environment are being protected, the factors the department shall consider include [WAC 173-340-420(4)]:

(a) The effectiveness of ongoing or completed cleanup actions;
(b) New scientific information for individual hazardous substances of mixtures present at the Site;
(c) New applicable state and federal laws for hazardous substances present at the Site;
(d) Current and projected site use;
(e) Availability and practicability of higher preference technologies; and
(f) The availability of improved analytical techniques to evaluate compliance with cleanup levels.

The department shall publish a notice of all periodic reviews in the site register and provide an opportunity for public comment.

2.0 SUMMARY OF SITE CONDITIONS

2.1 Site History

The Minnie Mine property is located in Leecher Canyon 2.3 miles east of Carlton in Okanogan County, Washington. As part of the Okanogan National Forest, the facility is owned by the United States Department of Agriculture Forest Service (USFS).

Mining claims associated with the facility were staked by Fred Higby, who operated a small cyanide leach plant in 1982. The cyanide heap leach operation was later operated by Cordilleran Development, Inc., which ceased mining in 1986.

During operation, the plant consisted of three process ponds, two leach pad liners, a process plant building, and the open pit mine itself. The process ponds consisted of a pregnant pond containing dissolved ore, a barren pond containing the leaching solution, and a freshwater pond. Approximately 8,000 short tons (3,400 cubic yards) of gold-bearing ore were mined from the open pit.

2.2 Site Conditions

Prior to remedial actions, small amounts of cyanide remained in the ore heap and to some extent in the contents of the ponds. Analysis of composite grab samples indicated that the concentration of cyanide in the ore heap solids was between 1 milligram per kilogram (mg/kg) and 10 mg/kg Weak Acid Dissociable cyanide (WAD CN).

In the bottom of the ponds, sludges remained which consists of precipitates from the neutralization process. Interim analysis of the grab samples from both the pregnant and barren ponds indicated that these sludges potentially contained concentrations of heavy metals near or above the levels necessary for classification as dangerous wastes under Federal and State of Washington regulations.

Water collected from precipitation exceeded loss from evaporation at the Site and this lead to the ponds refilling about every two years. In order to maintain safe pond levels, cyanide solutions were neutralized with calcium hypochlorite and then sprinkled out onto the adjacent ground surface with review and approval by the Washington State Department of Ecology.

2.3 Remedial Actions

2.3.1 Pond Fluid and Sludge Removal

In 1993, Ecology issued Enforcement Order No. DE 93TC-C418 to the USFS. This Order required immediate facility control, the removal of pond fluids, and that a remedial investigation/feasibility study (RI/FS) be conducted. In 1993, the USFS contracted E.T.

Technologies, Inc. to pump the remaining sludge and fluid from the ponds. The sludge and fluid was pumped into tanker trucks and transported to a licensed disposal facility. The remaining liners were removed to prevent the additional collection of precipitation.

Later in 1993, Ecology issued Enforcement Order No. DE 93TC-C528 to the USFS. This Order recognized that the emergency removal actions had been accomplished and called for the completion of the RI/FS.

2.3.2 Site Capping

In 1994, the USFS presented a RI/FS to Ecology. Ecology then issued Enforcement Order No. DE 94TC-C433. This Order required remedial action at the Site in accordance with the Cleanup Action Plan (CAP), which resulted from the RI/FS.

The CAP selected soil capping as the preferred cleanup option for the Site in accordance with MTCA regulations and with the approval of Ecology. It was determined that capping would effectively block the direct contact and ingestion pathways, while monitoring associated with the cap design will evaluate potential threats to ground water.

The CAP called for covering three arsenic-impacted areas of the Site with 1.5 feet of clean (i.e., arsenic concentrations less than 20 mg/kg) native soils. The soils were to be loosely packed and vegetated with shallow-rooting native grasses and designed to encourage natural evapotranspiration of rainwater on the Site.

The Site contained sufficient quantities of native soils which were physically and chemically suitable for capping material. Soils in the on-site borrow area were sampled and found to meet the Site cleanup goal for arsenic (20 mg/kg).

The CAP called for placement of the majority of unprocessed ore in the process ponds. To reduce the likelihood of ground water contacting the unprocessed ore, the ponds were filled with clean soil from the on-site borrow area to raise the grade of the pond bottom above the saturated level. A front-end loader was used to place the clean fill in the pond. The grade of the pond bottoms were raised approximately three feet.

The stockpile of unprocessed ore was loaded and hauled by dump truck to the process ponds. Once the unprocessed ore was placed in the process ponds, the soil cap was constructed. Approximately 1.5 feet of soil was placed over the process ponds, the area where precipitation collected in the ponds was land applied, and the processed ore heap.

Following the completion of the soil caps, the temporary haul roads leading to the processed ore heap were filled in and graded to provide drainage, and the northern borrow area was smoothed out and graded. The swale created by excavating cap material was extended southward past the process pond cap to provide drainage and divert surface runoff away from the cap. Riprap was placed in the drainage ditch adjacent to the north (upstream) end of land application area. The

purpose of the riprap was to protect the cap against erosion by surface water runoff. Slopes of the three caps were measured to verify that they were less than the required 10 percent.

2.4 Ground Water Monitoring

Early sampling results were described and evaluated in the Minnie Mine Millsite Construction Report. Preliminary analysis indicated background soil moisture contained arsenic concentrations at 11.35 micrograms per liter (ug/L) greater than the MTCA Method A cleanup level of 5.0 ug/L. Limited sampling data for down gradient suction lysimeter and ground water monitoring wells indicated qualitatively, arsenic concentrations less than the apparent background of 11.35 ug/L. Because arsenic was elevated in cap lysimeter L-4 monitoring was to continue until a statistical comparison could be made between the arsenic data from the down-gradient compliance monitoring wells and suction lysimeter could be compared to background concentrations. Monitoring of the Barnett well, a domestic well at the mouth of Leecher Canyon was discontinued after approximately two years because of low arsenic values in that well and in monitoring wells closer to the Site.

Ground water monitoring was conducted until 2003. Except for suction lysimeter L-4, arsenic in all down-gradient ground water monitoring stations is below the calculated background standard of 12.69 ug/L. Lysimeter L-4 has been dry since late 1999, and inference from past ground and surface water observations suggests that it could be many years before sampling opportunities are again available from that lysimeter.

2.5 Institutional Controls

It was determined that institutional controls would be required at the Site because contamination remains in soil at concentrations exceeding MTCA Method A cleanup levels. Due to the challenges in recording environmental covenants on federally-owned property, institutional controls were implemented through internal USFS Official Land Status Records.

The restrictions for the property are as follows:

(a) The Forest Service or its permittees shall not compromise or otherwise impair the engineered Minnie Millsite soil cap or associated facilities.

(b) The Forest Service will not conveyor relinquish title, easement, leasehold or other interest in any portion of the Site without serving notice upon the prospective purchaser, lessee, transferee, assignee, or other successor as contemplated by Washington Department of Ecology Enforcement Order DE94TC-C433 and 42 U.S.C. 9620(h).

Screen images from the USFS Land Status Record Database are available as Appendix 6.3.

The Site currently remains on the Washington State Hazardous Sites List.

3.0 PERIODIC REVIEW

3.1 Effectiveness of completed cleanup actions

Based upon the Site visit conducted on February 24, 2010, the soil cover at the cap area continues to eliminate exposure pathways (ingestion, contact) to contaminated soils. The property remains vacant and is not easily accessible by the public. A photo log is available as Appendix 6.4.

Due to remaining soil contamination at concentrations exceeding MTCA Method A cleanup levels, institutional controls in the form of a USFS Land Status Record Restrictions were implemented at the Site. These restrictions assure that the contaminated area remains covered with a soil cap so that hazardous materials are not released to the environment.

3.2 New scientific information for individual hazardous substances for mixtures present at the Site

Cleanup levels at the Site were based on regulatory standards rather than calculated risk for chemicals and/or media. These standards continue to be protective of site-specific conditions.

3.3 New applicable state and federal laws for hazardous substances present at the Site

The cleanup at the Site was governed by Chapter 173-340 WAC (1996 Ed.). WAC 173-340-702(12) (c) [2001 ed.] provides that,

"A release cleaned up under the cleanup levels determined in (a) or (b) of this subsection shall not be subject to further cleanup action due solely to subsequent amendments to the provision in this chapter on cleanup levels, unless the department determines, on a case-by-case basis, that the previous cleanup action is no longer sufficiently protective of human health and the environment."

Contamination likely remains at the Site above MTCA Method A cleanup levels and the cleanup action is still protective of human health and the environment.

3.4 Current and projected Site use

The Site is currently vacant and protected from use by USFS Land Use Restrictions. There have been no changes in current or projected future Site or resource uses.

3.5 Availability and practicability of higher preference technologies

The remedy implemented included containment of hazardous substances, and it would continue to be protective of human health and the environment if a restrictive covenant had been recorded

for the Site. While higher preference cleanup technologies may be available, they are still not practicable at this Site.

3.6 Availability of improved analytical techniques to evaluate compliance with cleanup levels

The analytical methods used at the time of the remedial action were capable of detection below MTCA Method A cleanup levels. The presence of improved analytical techniques would not affect decisions or recommendations made for the Site.

4.0 CONCLUSIONS

- Soil cleanup levels have not been met at the Site.

- The long-term integrity of the clean soil cap is ensured through the use of United States Forest Service Land Use Restrictions, so the requirements for containment technologies in WAC 173-340-360(8) are being met.

Based on this periodic review, the Department of Ecology has determined that the cleanup actions completed at the Site are protective of human health and the environment. No additional remedial actions are required by the property owner. It is the property owner's responsibility to continue to inspect the Site to ensure that the integrity of the clean soil cap is maintained.

4.1 Next Review

The next review for the Site will be scheduled five years from the date of this periodic review. In the event that additional cleanup actions or institutional controls are required, the next periodic review will be scheduled five years from the completion of those activities.

5.0 REFERENCES

Ecology. *Enforcement Order No. DE 93TC-C418.* July 29, 1993.

United States Department of Agriculture. *Removal Decision Document.* October 7, 1993.

Ecology. *Enforcement Order No. DE 93TC-C528.* November 16, 1993.

Olympus Environmental. *Phase II Remedial Investigation/Feasibility Study.* August 2, 1994.

Ecology. *Enforcement Order No. DE 94TC-C433.* October 3, 1994.

Olympus Environmental, Inc. *Minnie Mine Millsite CAP Engineering Report.* November 8, 1994.

Olympus Environmental Inc. *Minnie Mine Millsite Cleanup Action Plan Construction Report.* October 26, 1995.

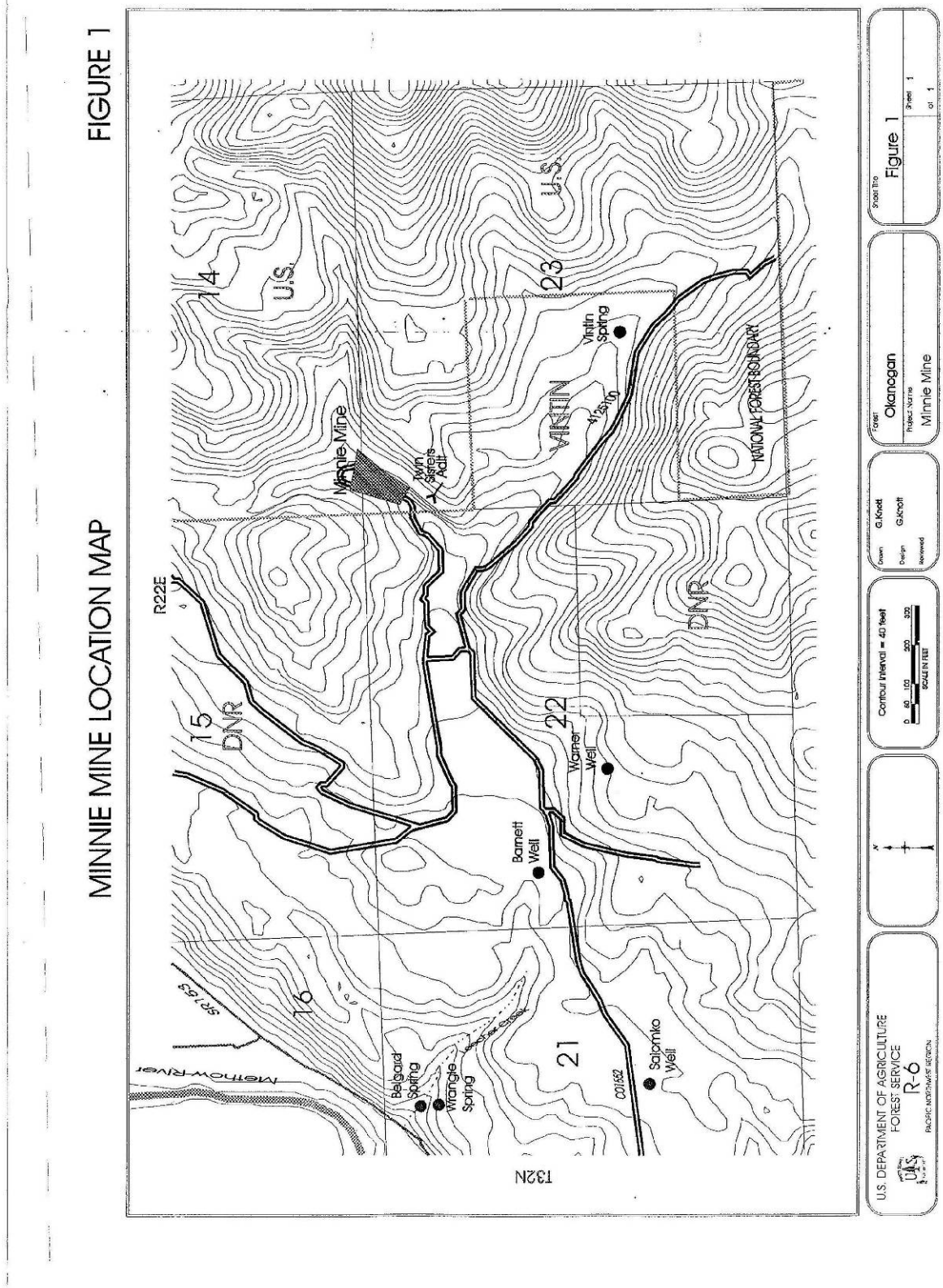
United States Department of Agriculture. *Minnie Mine Millsite Cleanup Action Plan Monitoring Report.* December 15, 2003.

United States Department of Agriculture. *Minnie Mine Millsite Cleanup Action Plan Monitoring Report.* July 11, 2006.

Ecology. *Site Visit.* February 24, 2010

6.0 APPENDICES

6.1 Vicinity Map



6.2 Site Plan

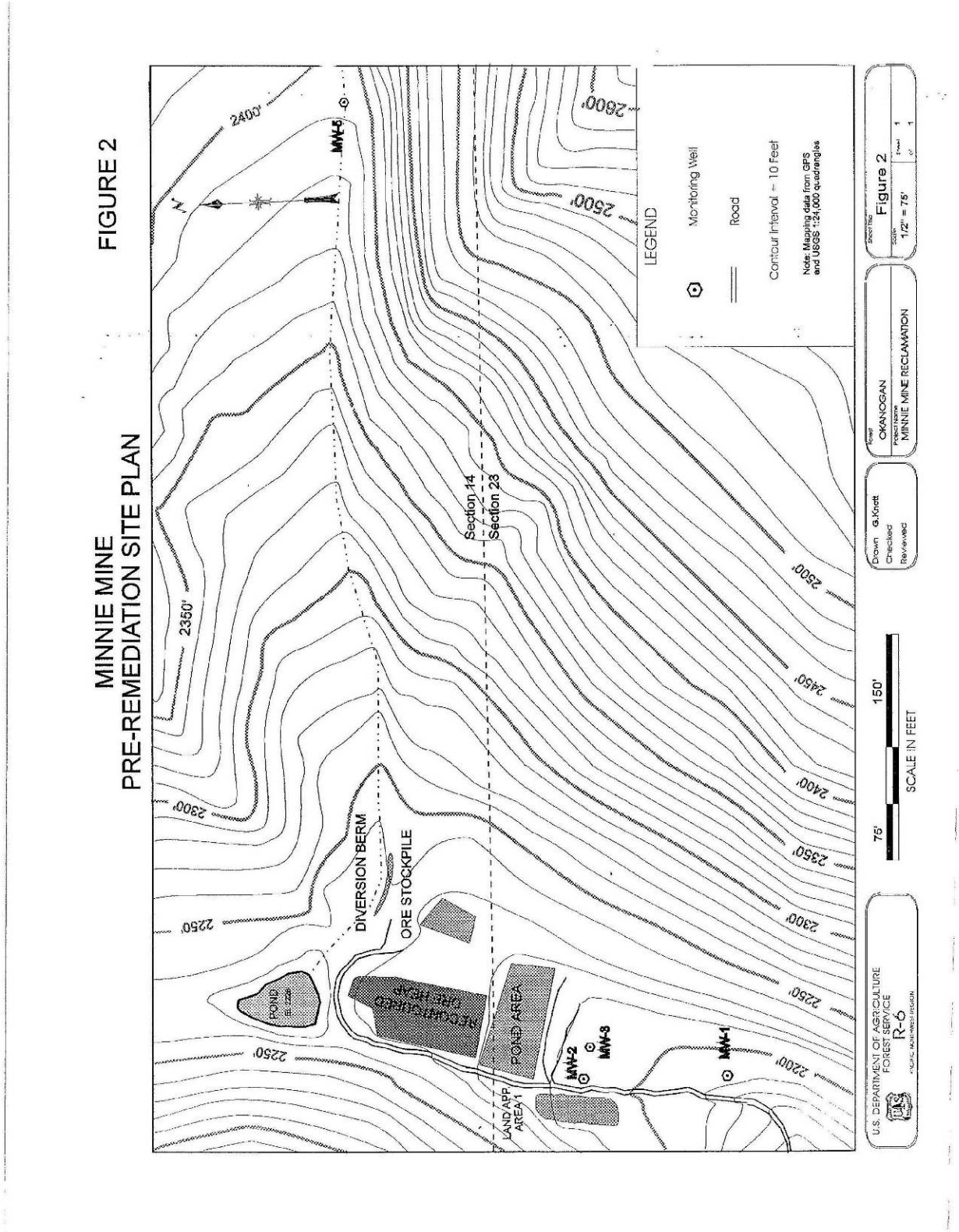
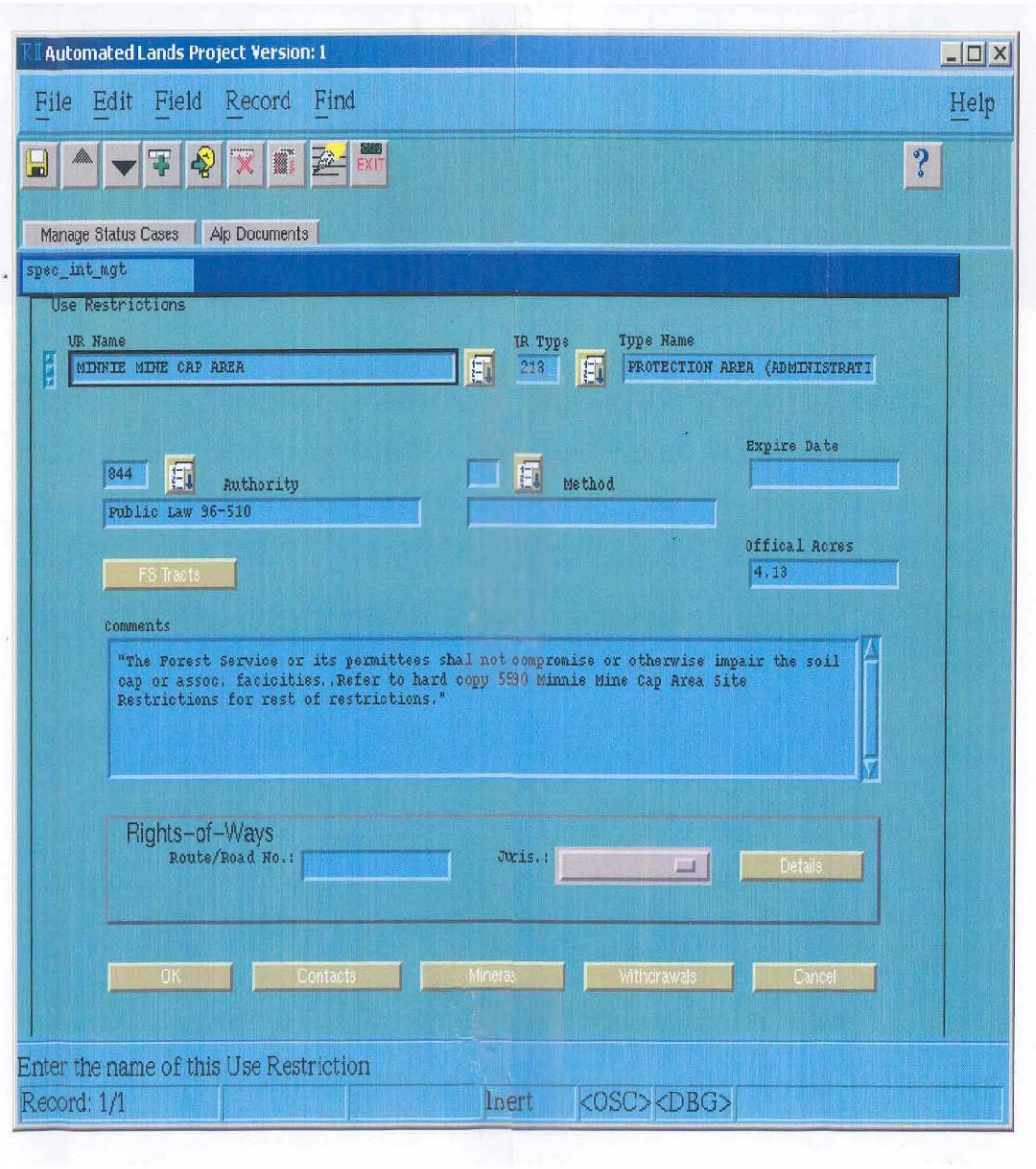
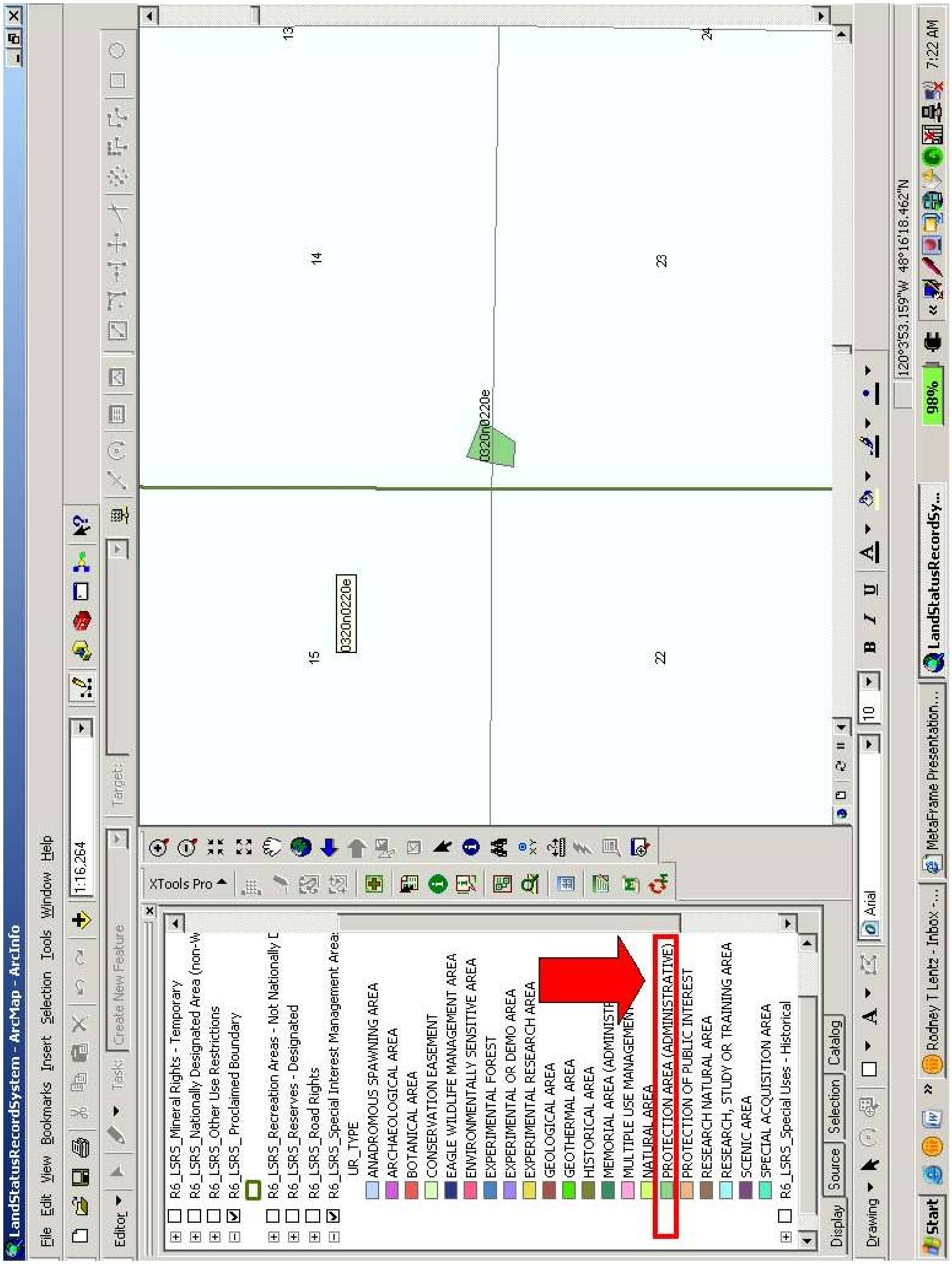


FIGURE 2
MINNIE MINE
PRE-REMEDIATION SITE PLAN
LEGEND
Monitoring Well
Road
Contour Interval = 10 Feet
Note: Mapping data from GPS and USGS 1:24,000 quadrangles
Section 14
Section 23
DIVERSION BERM
ORE STOCKPILE
RECONTOURED ORE HEAP
POND AREA
LAND APP AREA
POND
MW-1
MW-2
MW-3
MW-5
2400'
2350'
2300'
2250'
2200'
2500'
2600'
2450'
U.S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
R-6
75'
150'
SCALE IN FEET
Drawn G.Knott
Checked
Reviewed
Forest OKANOGAN
Project Name MINNIE MINE RECLAMATION
Sheet Title Figure 2
Scale 1/2" = 75'

6.3 Land Use Restrictions




LandStatusRecordSystem - ArcMap - ArcInfo
File Edit View Bookmarks Insert Selection Tools Window Help
1:16,264
Editor
Task: Create New Feature
Target:
XTools Pro
R6_LSRS_Mineral Rights - Temporary
R6_LSRS_Other Use Restrictions
R6_LSRS_Proclaimed Boundary
R6_LSRS_Reserves - Designated
R6_LSRS_Road Rights
UR_TYPE
ANADROMOUS SPAWNING AREA
ARCHAEOLOGICAL AREA
BOTANICAL AREA
CONSERVATION EASEMENT
EAGLE WILDLIFE MANAGEMENT AREA
ENVIRONMENTALLY SENSITIVE AREA
EXPERIMENTAL FOREST
EXPERIMENTAL OR DEMO AREA
EXPERIMENTAL RESEARCH AREA
GEOLOGICAL AREA
GEOTHERMAL AREA
HISTORICAL AREA
NATURAL AREA
PROTECTION AREA (ADMINISTRATIVE)
PROTECTION OF PUBLIC INTEREST
RESEARCH NATURAL AREA
RESEARCH, STUDY OR TRAINING AREA
SCENIC AREA
SPECIAL ACQUISITION AREA
R6_LSRS_Special Uses - Historical
Display Source Selection Catalog
13
14
15
22
23
24
0320n0220e
Drawing
Arial
10
120°3'53.159"W 48°16'18.462"N
Start
LandStatusRecordSy...
98%
7:22 AM

6.4 Photo log

Photo 1: Site Access - from the west

Photo 2: Swale and Barrow Source - from the west

Photo 3: Capped Process Ponds - from the south

Photo 3: Fenced Access to Leecher Canyon - from the south