ExxonMobil
Refining and Supply Company
Downstream-Safety, Health & Environment
3225 Gallows Road
Fairfax, Virginia 22037

ExxonMobil
Refining & Supply

June 5, 2002

Ted Johnson, Project Manager
Uranium Recovery and Low-Level Waste Branch
Division of Waste Management
U.S. Nuclear Regulatory Commission
Mail Stop T-8A33
11545 Rockville Pike
Rockville, MD 20852-2738

Re: Highland Reclamation Project
Source Materials License SUA-1139
Docket No. 40-8102.
As-Built and Construction Quality Assurance Report
Converse County, WY

Dear Mr. Johnson:

Enclosed are three copies of an As-Built and Construction Quality Assurance Report for the Uranium Tailings Basin at the Highland Reclamation Project. The report describes tailings basin reclamation activities performed in 1985 through 1990 and 2000 and 2001. The results of quality assurance tests obtained during reclamation activities are included in the report or are referenced from reports previously submitted to the U. S. Nuclear Regulatory Commission (NRC). Based on the quality assurance testing result, Exxon Mobil believes that the surface reclamation requirements for the Highland tailings basin have been met. Therefore, Exxon Mobil requests that Condition 40 be deleted from the above referenced License.

If you have any questions or comments regarding the enclosed report or License amendment request, please call me at (703) 846-1150.

Sincerely,

M. E. Hoff

Mark E. Hoffman, P.E.
Project Manager

/meh
Enclosures

c: L. L. Miller -- Shepherd Miller
File -- Radioactive Material License
Reclamation -- NRC

Prepared For:

Exxon Mobil Corporation
3225 Gallows Road
Fairfax, Virginia 22037

AS-BUILT AND CONSTRUCTION QUALITY ASSURANCE REPORT FOR THE URANIUM TAILINGS BASIN AT THE HIGHLAND RECLAMATION PROJECT

Prepared By:

Shepherd Miller
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Fort Collins, Colorado 80525

SHEPHERD MILLER

May 31, 2002

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1.0 INTRODUCTION

This report presents the as-built conditions and construction quality assurance information associated with reclamation of the uranium tailings basin at the Highland Reclamation Project. This report has been prepared for Exxon Mobil Corporation (Exxon Mobil) by Shepherd Miller.

1.1 Site Background

The Highland Uranium Operations site is located approximately 35 miles north of Douglas, in Converse County, Wyoming. The site is located in east-central Wyoming, within the westernmost end of the Cheyenne River basin, near the drainage divide with the North Platte River basin (Figure 1.1). The site area is within the Powder River Basin structural feature of eastern Wyoming. The site is characterized by gently rolling hills and broad drainages, underlain by Tertiary Wasach and Fort Union Formation sandstones and shales. The mineralized zones on site were within three sandstone units of the upper Fort Union Formation. Annual precipitation at the site averages approximately 12 inches, and annual pond evaporation averages approximately 44 inches (WWL, 1994).

Exxon Minerals Company developed the Highland Uranium Operations as a surface and underground mining facility for recovery of uranium by milling of ore, as well as by solution mining. As outlined in WWL (1984), surface mining began in 1970 and continued until 1984. Underground mining was conducted on site from 1977 through 1982.

Overburden from surface mining operations was used for surface mine backfill, stockpiled on site, and used for reclamation work. Pits 1 and 2 were completely backfilled, with the North and Middle Dumps being the locations of additional mine overburden placement (Figure 1.2). Pits 3 and 4 were left open, with pit slopes reclaimed in 1986-1987. The groundwater and surface runoff that has accumulated in Pits 3 and 4 is referred to as the Highland Reservoir (Figure 1.2).

The mill started operation in October 1972 under authorization from the Atomic Energy Commission through License No. SUA-1132 (Exxon, 1994). The mill processed Highland Uranium Operations ore from October 1972 through mid-1984. A conventional acid-leach

process was used, processing approximately 11.3 millions tons of ore during this 12-year operating period. Exxon Minerals Company initiated solution mining at the site in 1972, with operations expanded in 1979. The solution mining operations were transferred to Everest Minerals. These operations were acquired by Power Resources Corporation, which continues solution mining and uranium recovery operations at the site.

1.2 Tailings Basin Background

Highland Uranium Operations tailings were discharged into a valley impoundment covering approximately 200 acres east of the mill site (Figure 1.2). The impoundment was underlain by the existing shale units, and was formed by a zoned earth embankment constructed across an eastward-draining tributary of Box Creek (labeled as the North Fork of Box Creek in WWL, 1984 and as an unnamed tributary of Box Creek in Exxon, 1994). Tailings slurry was conveyed by pipeline from the mill and discharged from the perimeter of the impoundment, and from causeways extended out into the tailings basin (WWL, 1984). The resulting tailings beach areas and ponded areas comprising the tailings basin are shown in Figure 1.3. As mentioned above, approximately 11.3 million tons of tailings (primarily fine-grained sand to silt-sized material) were discharged into the tailings basin during the 12 years of mill operation.

Tailings impoundment reclamation was conducted by Exxon Minerals Company after mill shutdown in 1984, and by Exxon Coal and Minerals Company (Exxon) after mid-1986. This work consisted of evaporation of residual ponded water, placement of random fill and interim cover to facilitate residual water management and construction of a reclamation soil cover over the tailings surface. This work was documented in WWL (1991a) and submitted by Exxon to U.S. Nuclear Regulatory Commission (NRC). Follow-up items associated with tailings basin reclamation were identified by NRC (NRC, 1992), and addressed in WWL (1993).

With NRC approval, one area of the reclamation cover was left partially completed to allow additional tailings settlement to take place and to provide an area for evaporation of water from groundwater remediation pumping (Exxon, 1989e). Following a period of settlement monitoring and water evaporation, Exxon Mobil completed reclamation of the tailings basin in 2000 and 2001.

1.3 Purpose and Scope of Report

This report summarizes the reclamation work and construction quality assurance testing associated with 1985 through 1990 activities (documented in WWL, 1991a). This report also describes the reclamation activities and construction quality assurance test results associated with the tailings basin work in 2000 and 2001. This report has been prepared to provide background and supporting information to be used in evaluation of future transfer of the tailings basin property to the U.S. Department of Energy (DOE).

This report has been organized to outline the key reclamation activities at the Highland site in chronological order (in subsequent sections of the report). Site photographs, construction quality assurance data from 2000 and 2001, and pertinent information not provided in WWL (1991a) are included in appendices to this report.

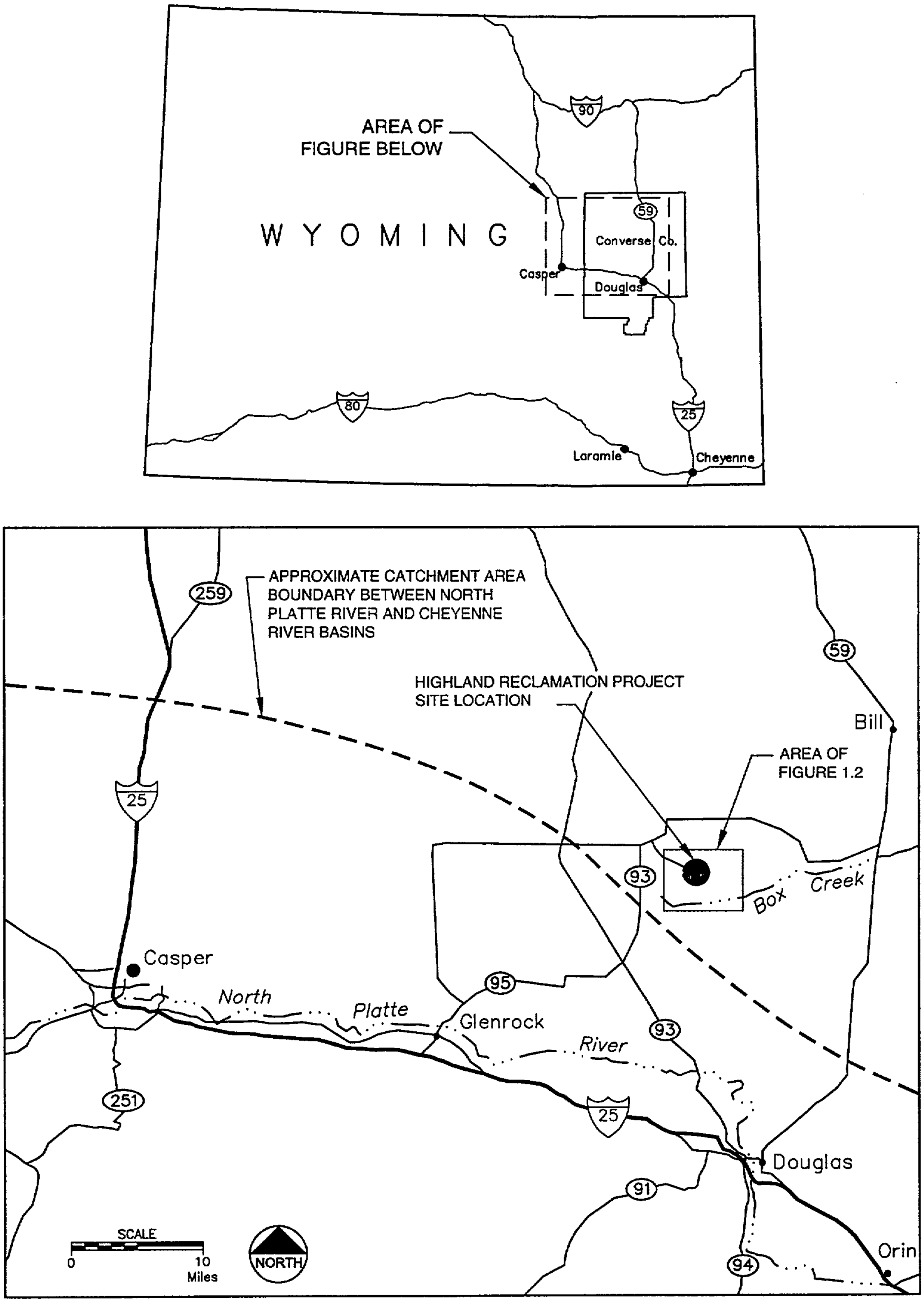

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FIGURE 1.1
SITE LOCATION MAP

Date:	MAY 2002
Project:	100548-2
File:	LOCMAP.DWG

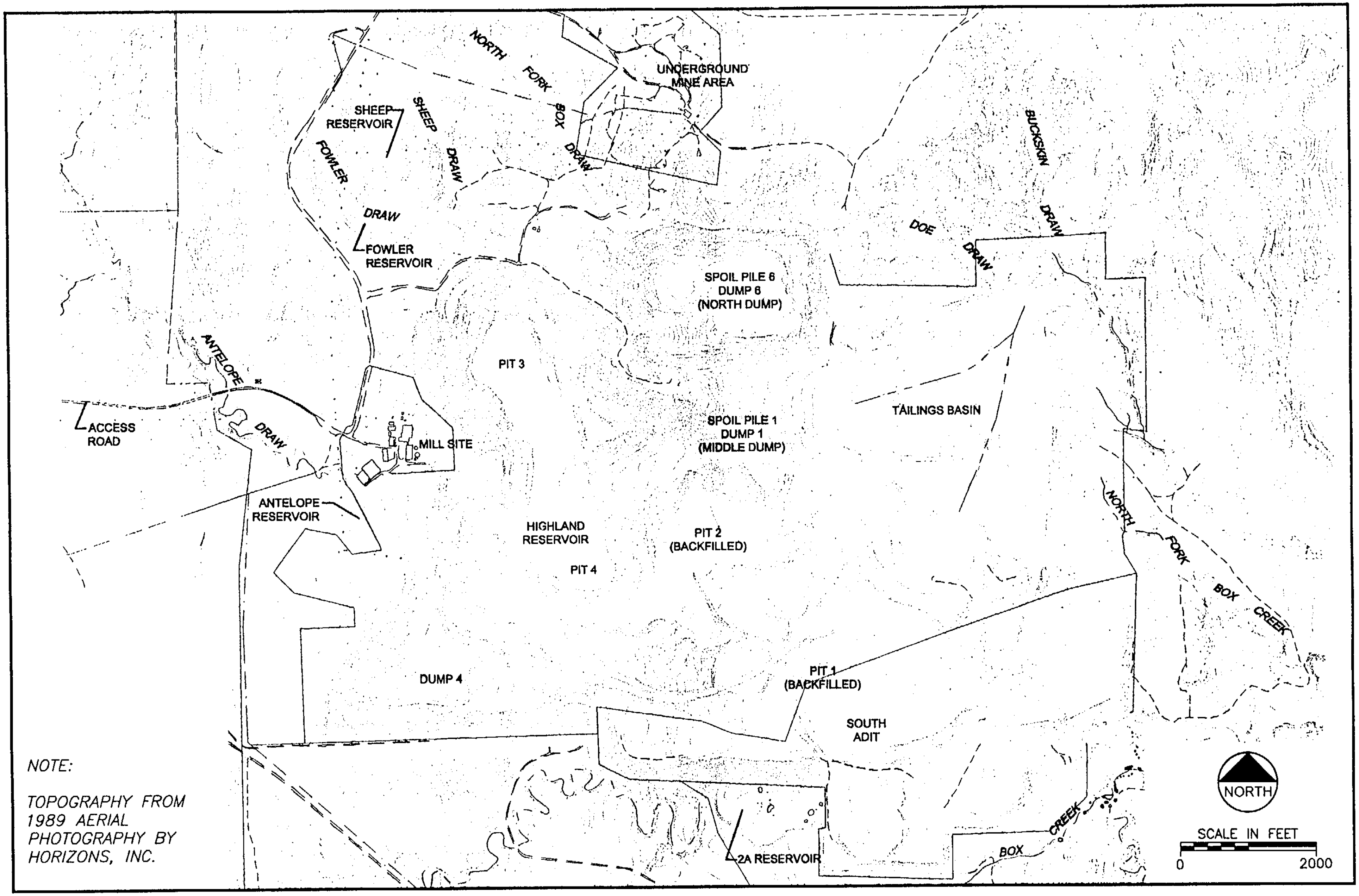

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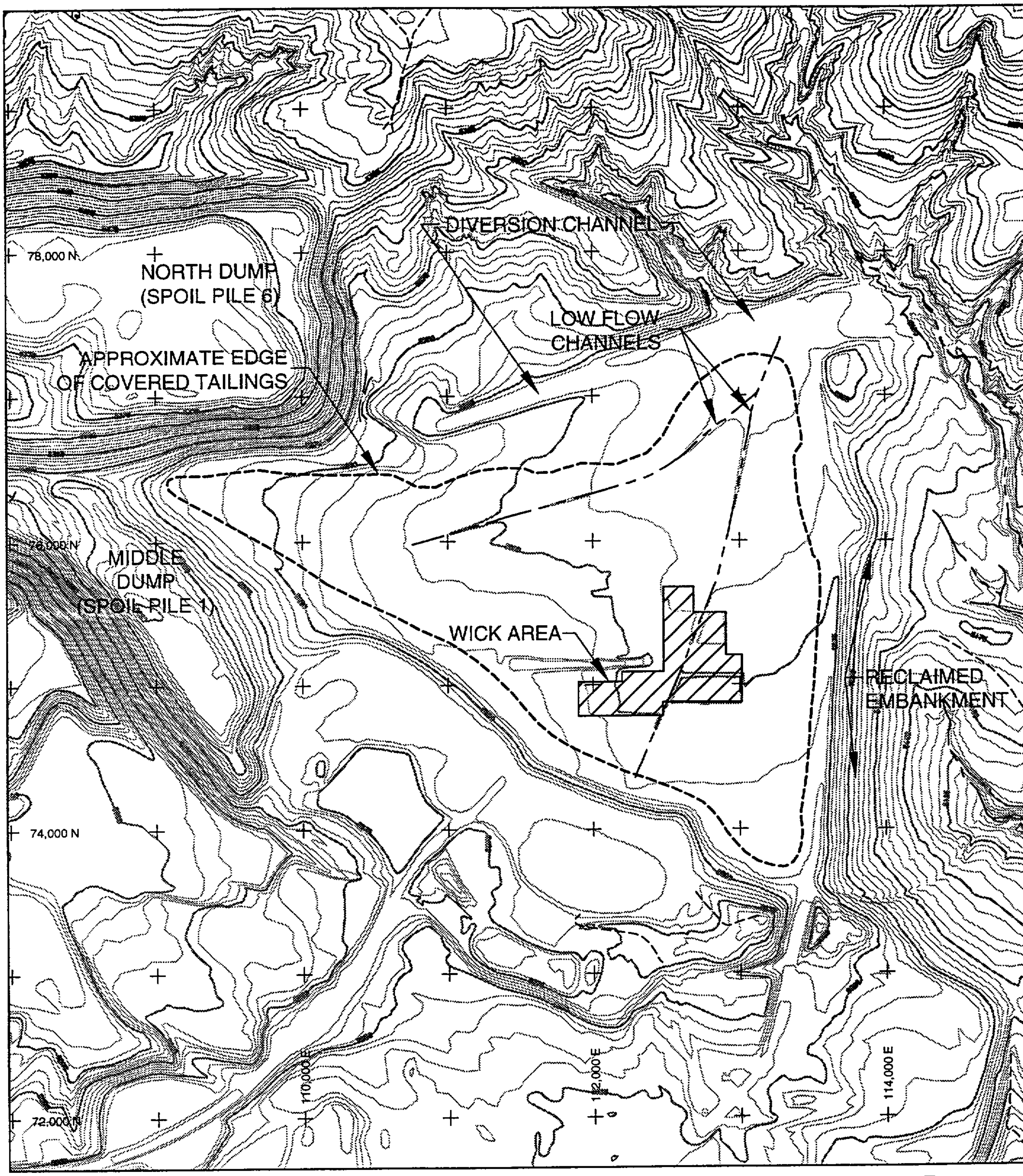
FIGURE 1.2
SITE LAYOUT MAP

Date:	MAY 2002
Project:	100548
File:	SITELAYOUT



NOTE:

TOPOGRAPHY FROM 1989 AERIAL PHOTOGRAPHY BY HORIZONS, INC.

NORTH

SCALE IN FEET

0 1000

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FIGURE 1.3
TAILINGS BASIN
LAYOUT MAP

Date:	MAY 2002
Project:	100548-2
File:	TAILFIG-1A

2.0 RECLAMATION PLAN DESIGN AND APPROVAL

This section outlines the evolution of the plan for reclamation of the Highland tailings basin from initial closure plan preparation in 1984 through NRC approval for construction in 1989.

2.1 1984 Reclamation Plan

The reclamation plan for the tailings basin (WWL, 1984) was submitted to NRC in December 1984 (Exxon, 1984). The key elements of the reclamation plan are outlined below.

1. A four-foot thick soil cover over the regraded tailings surface, consisting of 3.5 feet of compacted mine overburden and 0.5 feet of topsoil.
2. A diversion channel excavated into existing shale units along the north side of the tailings basin to collect and convey runoff from natural slopes north of the basin to the north end of the reclaimed tailings embankment (Figure 2.1).
3. Drainage of runoff from the tailings basin conveyed by two swales discharging onto natural shale units at the north end of the tailings embankment (Figure 2.1).
4. Regrading the tailings embankment slope by reducing the top elevation of the embankment crest, providing for a runoff discharge area at the north end of the embankment, and regrading the outside slope of the embankment from a 5:1 (horizontal:vertical) slope at the embankment crest to a 9:1 slope at the reclaimed embankment toe.
5. Providing erosional stability of reclaimed surfaces with revegetated surfaces, wide drainageways, and slopes ranging from 0.5 to 2.0 percent.

Erosional stability included long-term wind erosion analyses, gully intrusion prediction analyses, and evaluation of maximum runoff velocities from the probable maximum precipitation (PMP) event at the site. The one-hour duration PMP used in the initial analyses was 12 inches (WWL, 1984). Erosional stability analyses were conducted to be consistent with guidelines in Nelson and others (1983).

2.2 NRC Review Issues

Review and approval of the reclamation plan by NRC was conducted in a series of written requests for additional information (NRC, 1985a, 1985b, 1987, 1988, 1989b), with written responses provided by Exxon (Exxon, 1985, 1986, 1987a, 1987b, 1987c, 1987d, 1987e, 1988a,

1989d). The key technical issue discussed in the requests and additional information was erosional stability of the reclaimed tailings surface. Analyses were updated to be consistent with guidelines in Nelson and others (1986). The one-hour duration PMP for erosional stability analyses was revised from 12 to 14 inches, based on updated PMP estimate methods (Exxon, 1985; WWL, 1985). Erosional stability analyses were expanded to include critical shear stress analyses recommended by NRC (NRC, 1985a).

Modifications to the reclamation plan from this period of review were reflected in the construction drawings and specifications developed in WWL (1988b and 1989a). These modifications are outlined below, and are shown in Figure 2.1.

1. Placement of rock mulch over the surface of the western limb or end of the tailings basin, which had a reclaimed slope of approximately two percent.

2. Placement of a strip of rock mulch along the reclaimed embankment crest to address NRC concerns about wind erosion and gullying.

3. Changing the cross section of the two drainages on the reclaimed tailings surface from a broad, gently-sloping swale to a surface sloping toward a rock-mulch covered low-flow channel.

4. Inclusion of a setback in the reclaimed overburden slope above the southern edge of the tailings impoundment. A setback (or excavation into the reclaimed overburden slope) was designed with a minimum width of 60 feet. The setback was included to ensure that storm runoff reaches the bottom of the reclaimed slope above mine overburden, and extreme storm runoff is slowed down prior to flowing over the tailings cover (Exxon, 1987e; WWL, 1987b).

2.3 1989 Closure Specifications and Modifications

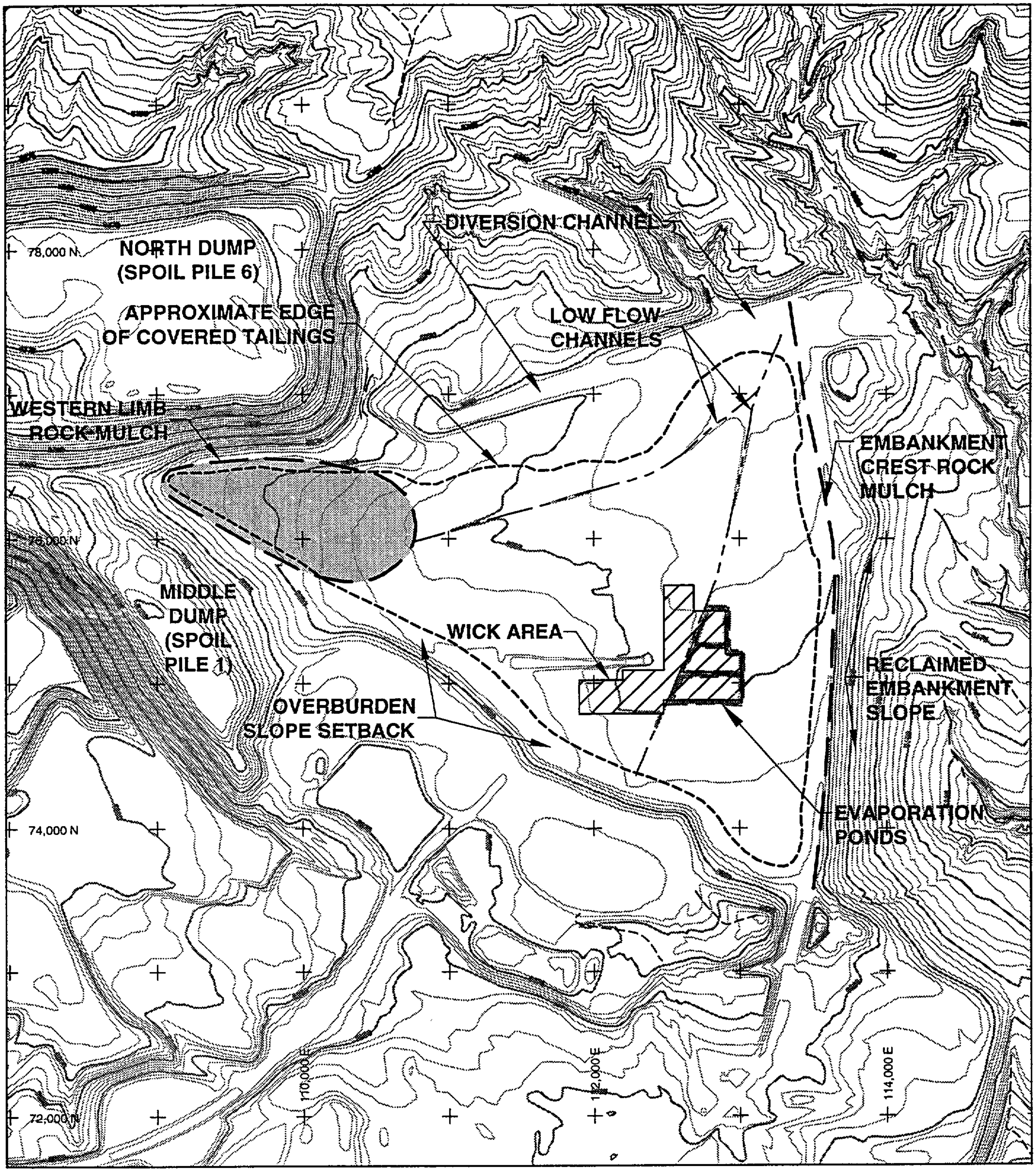
The reclamation plan incorporating the modifications above and approved by NRC for construction (WWL, 1989a) included the material details outlined below.

1. Use of borrow material with higher sand content than presented in the 1984 reclamation plan (WWL, 1989b), as well as use of borrow material with a higher clay content (and correspondingly lower compacted dry density) for cover construction material (WWL, 1989d). These additional materials were tested and found to be as effective for radon attenuation as the borrow material that was originally tested (Exxon, 1989b, 1989d, 1989e; WWL, 1989b, 1989d).

2. Selection of off-site rock sources for areas of rock mulch based on acceptable durability test results (Exxon, 1987a; WWL, 1988a).

3. Agreement on methods and frequency for construction quality assurance testing (Exxon, 1987b), based on NRC guidelines (NRC, 1987).

4. Partial completion of the cover over the area treated with vertical band drains (wicks) (shown in Figure 2.1). The cover in the wick area would be completed at a later date (Exxon, 1989a, WWL, 1989c).



NOTE:

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FIGURE 2.1
TAILINGS RECLAMATION FEATURES

Date:	MAY 2002
Project:	100548-2
File:	TAILFIG-1B

3.0 PRELIMINARY WORK

This section summarizes the work conducted by Exxon in preparing the tailings basin for cover construction and related site reclamation.

3.1 Basin Preparation and Residual Water Evaporation

Following shutdown of the mill in 1984, work was done through 1988 to clean up mill site areas, evaporate residual tailings solution, and prepare the tailings surface for cover material placement. As listed in WWL (1991a), tailings basin work prior to cover construction included the following tasks.

1. Regrading tailings to conform to reclamation plan contours.
2. Constructing random fill berms along elevation contours within the tailings basin to increase ponded areas of residual solution and enhance evaporation.
3. Operating spray systems within lower areas of the tailings basin to enhance evaporation of residual solution.
4. Burying mill site debris in the tailings basin.
5. Placing random fill over tailings, to fill low areas and cover and isolate tailings prior to cover material placement.

3.2 Slimes Investigation

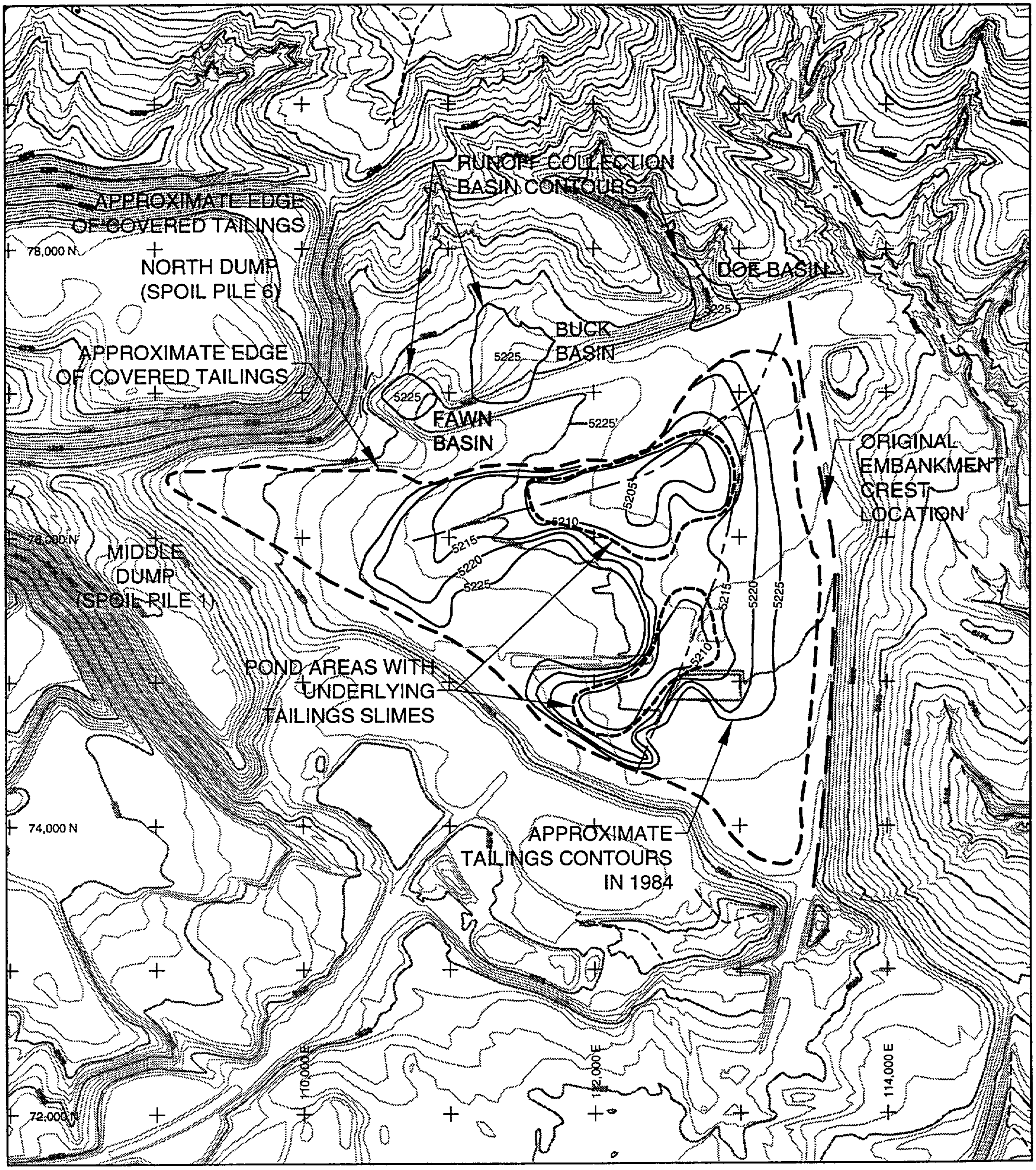
Although tailings discharge took place from several locations within the tailings basin, two areas containing the fine fraction of tailings (tailings slimes) were identified from tailings disposal operation records (WWL, 1984). These areas (shown in Figure 3.1) would exhibit a lower shear strength and rate of consolidation and settlement than areas of primarily tailings sands. In 1987, these two tailings slime areas were investigated in more detail with piezocone sounding and standpipe piezometer installation. Piezocone soundings were made at the locations shown in Figure 3.2, with the results presented in WWL (1989c). The piezocone was pushed through 5 to 15 feet of random fill, through the tailings, and into underlying foundation materials (WWL, 1989c).

This investigation showed that the northern tailings slimes area contains interbedded tailings sands and slimes, and would consolidate relatively rapidly. The southern area consisted of up to 50 feet of continuous, saturated tailings slimes (with no interbedded sand layers), and would consolidate relatively slowly. Based on a comparison of alternatives, Exxon decided to enhance the rate of tailings consolidation in the southern slimes area by installing vertical band drains (wick drains). These drains were installed in the southern slimes area in November 1988 (Figure 3.2), with the area subsequently referred to as the wick area.

3.3 Settlement Monitoring

Prior to wick drain installation, settlement monitoring points were installed at the locations shown in Figure 3.3. Many of these monitoring points were maintained through the period of wick drain installation. Monitoring points were also installed in the wick area following wick installation (WWL, 1989c). Contours of settlement in the wick area (from WWL, 1989e) are shown in Figure 3.3.

As mentioned in Section 2.3, Exxon received approval to construct the cover over the tailings in the basin and to leave the cover over the wick area partially completed (Exxon, 1989a; WWL, 1989c). This was approved to allow additional settlement to take place in the wick area prior to completion of the cover, as well as provide an area for evaporation of ground water from Corrective Action Plan pumping within the tailings basin. The wick area and evaporation pond layout are shown in Figure 3.3.



NOTE:

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FIGURE 3.1
TAILINGS BASIN LAYOUT
AT END OF OPERATIONS

Date:	MAY 2002
Project:	100548-2
File:	TAILFIG-2

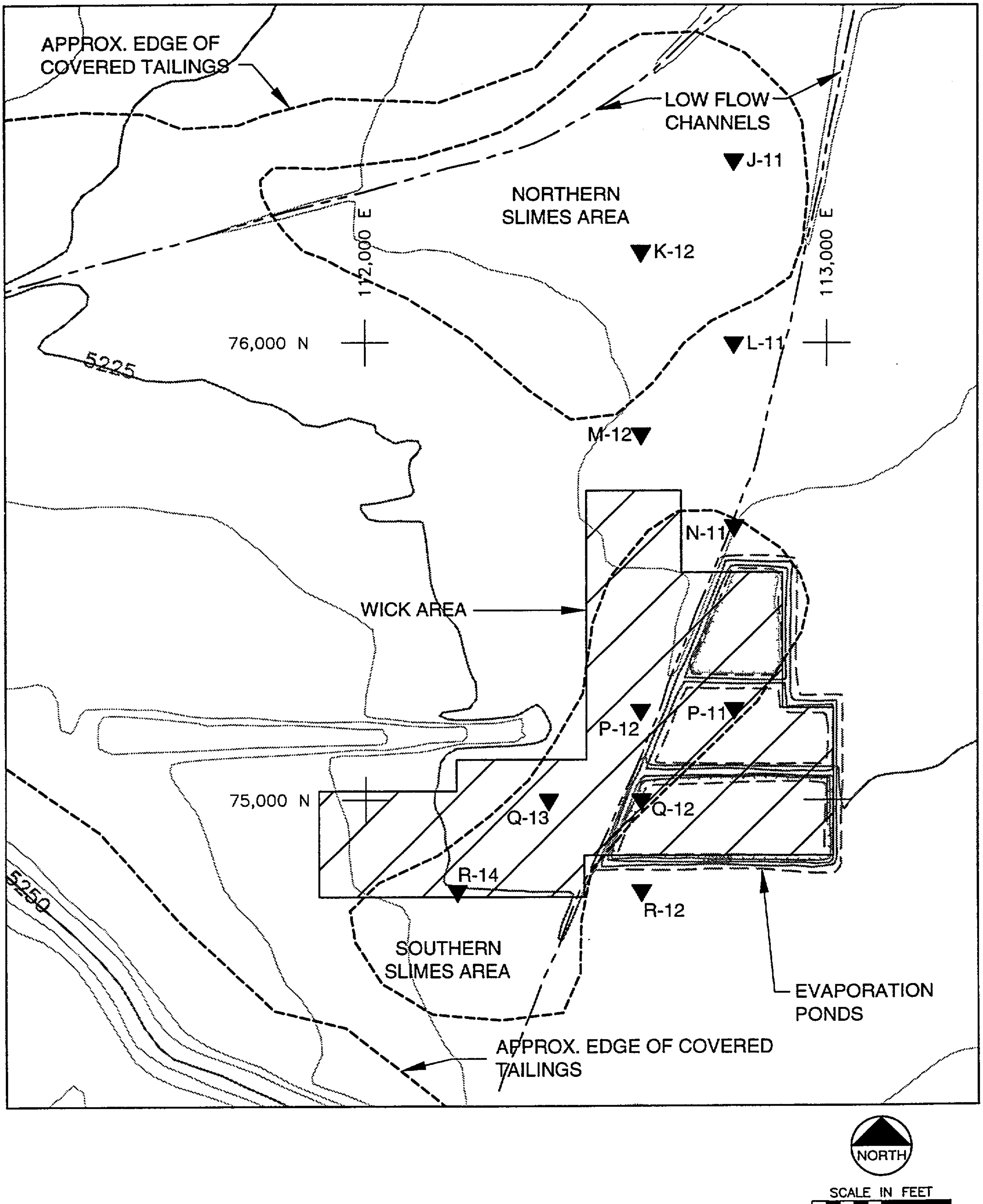

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FIGURE 3.2
PIEZCONE PROBE
LOCATIONS

Date:	MAY 2002
Project:	100548-2
File:	TAILFIG-3

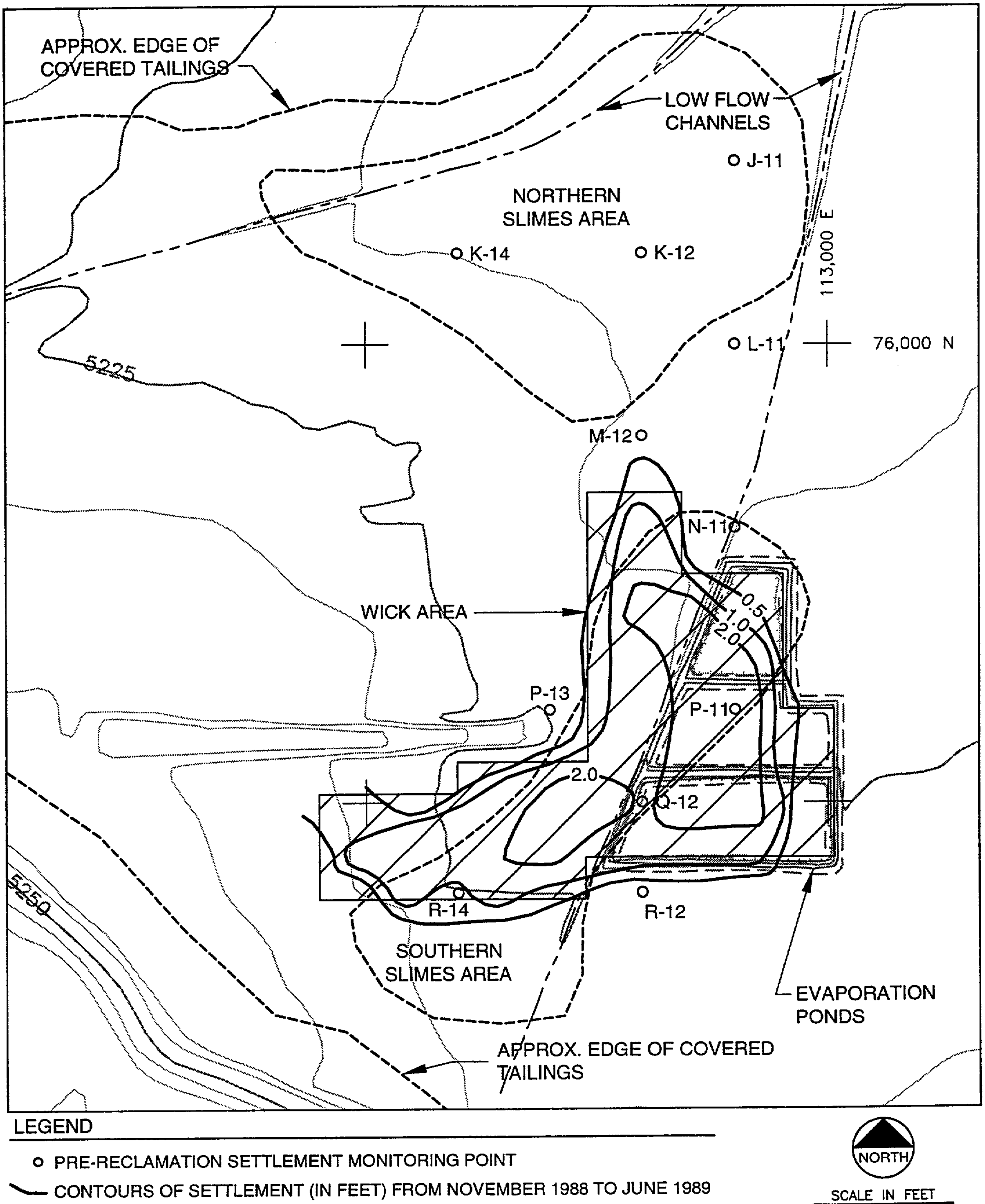

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FIGURE 3.3
TAILINGS SETTLEMENT MONITORING POINT LOCATIONS AND SETTLEMENT CONTOURS

Date:	MAY 2002
Project:	100548-2
File:	TAILFIG-4

4.0 RECLAMATION WORK IN 1988 THROUGH 1990

This section summarizes the tailings basin reclamation work conducted by Exxon from late 1988 through 1990. This phase of work included tailings embankment recontouring, random fill placement, cover (radon barrier) construction, topsoil placement, and rock mulch placement. The work areas are shown in Figure 4.1, with details of the work documented in WWL (1991a and 1993). Selected photographs from this period of work are included in Appendix A.

4.1 Embankment Recontouring

Recontouring of the east (outside) slope of the earthen tailings embankment was conducted from November 1988 through March 1989. Forgey Construction of Casper Wyoming conducted this work under the direction of Exxon. This work consisted primarily of reducing the outside slope of the embankment to a 5:1 (horizontal:vertical) slope at the embankment crest to 9:1 or less at the toe of the slope (with the slope design discussed in WWL, 1984). This was primarily a fill placement operation, with fill material coming from the embankment crest, from excavation of the diversion channel, and from the south abutment of the embankment. Embankment fill was placed in lifts (18-inch maximum thickness) and compacted with a dozer (WWL, 1991a).

Additional recontouring work conducted at this time consisted of filling in the runoff collection basins north of the diversion channel (with original locations shown in Figure 3.1). Material from the Middle Dump was used for this fill.

4.2 Cover Construction

Construction of the cover over the tailings was conducted from May through August 1989. Forgey Construction of Casper Wyoming conducted this work under the direction of Exxon. The minimum total cover thickness was 4.0 feet (3.5 feet of radon barrier material and 0.5 feet of topsoil).

Radon barrier material was obtained from excavation of the diversion channel and from the Middle Dump. While there was some variation in material excavated from the diversion channel (due to layering of natural materials), the Middle Dump materials were fairly uniform. The

radon barrier material was primarily a sandy to gravelly, silty clay of low to medium plasticity. The gravel particles were primarily weathered siltstone or claystone. Fines fraction and Atterberg limit test results from radon barrier material samples collected during construction are summarized in Figure 4.2) from WWL, 1991a).

The radon barrier material specifications (from WWL, 1989a, 1989b, 1989d) included: (1) a minimum of 40 percent passing the No. 200 sieve, (2) a minimum liquid limit of 25, (3) a minimum plasticity index of 8, and (4) a maximum particle size of six inches. As outlined in WWL (1991a) and summarized in Figure 4.2, all but one initial index test met material specifications.

The radon barrier was constructed by placement, moisture conditioning, and compaction in lifts not exceeding 12 inches. Each lift was to be compacted to a minimum of 95 percent of Standard Proctor dry unit weight for the material and within one percent below to three percent above the optimum moisture content (WWL, 1989a). The Standard Proctor test results used for comparison with field compaction test results are summarized in Figure 4.3 as the maximum points from the Proctor tests; the complete curves from the tests are presented in WWL (1991a).

Field compaction (in terms of dry unit weight and moisture content) was measured with nuclear density gauges, with the results presented in WWL (1991a). The moisture content and unit weight (density) measurements were checked with sand cone tests, with gauge calibration adjustments made when necessary (WWL, 1993). Areas and lifts of the radon barrier were approved based on meeting index test and compaction specifications.

4.3 Rock Placement

The construction specifications approved by NRC (WWL, 1989a) included three areas of rock placement within the reclaimed tailings basin (shown in Figure 4.1): (1) the embankment crest, (2) the western limb, and (3) the low-flow channels. The rock used for these areas was primarily a feldsic granite obtained from an alluvial gravel pit near Douglas, Wyoming and hauled to the site and placed by Valentine Construction of Glenrock, Wyoming (WWL, 1993).

Durability. The rock was tested for durability prior to placement on site, and met applicable criteria for durability at that time. Tests were conducted on two samples collected in 1988, two samples collected in 1989, and one western limb area sample collected in January 1990 (WWL, 1991a). Based on criteria outlined in Nelson and others (1986), the rock quality scoring was over 90 percent (where the minimum acceptable criterion without oversizing is 80 percent). These durability test results were compared with current criteria outlined in NRC (1990). Although the current scoring and weighting factors for igneous rock are different from those in Nelson and others (1986), rock quality scoring under current criteria ranged from 84 to 90 percent. Eighty percent is still the minimum criterion without oversizing (NRC, 1990).

In addition, three composite low-flow channel rock samples were collected by Shepherd Miller in August 2001 and tested for durability. The rock quality scores from these samples ranged from 85 to 91 percent (Appendix E), and confirms the results of previous durability testing of this rock.

The three rock-covered areas in the tailings basin (shown in Figure 4.1) differ by particle size and placement method. Their placement and particle-size distribution testing history are outlined below.

Embankment crest rock. A strip of minus 1.5-inch size rock was placed along the crest of the recontoured tailings embankment (on top of the topsoil) in late 1989 (WWL, 1991a). Exxon tested the rock for particle-size distribution in January 1991. The test results summarized in Figure 4.4 show that the placed rock meets particle-size distribution specifications.

Western limb rock mulch. A zone of minus 3-inch rock mulch was placed on top of the cover in the western limb (west end) area of the tailings basin in late 1989 and early 1990 (WWL, 1991a). The rock was tested for particle-size distribution by Exxon in November 1989 and by WWL in January 1990. As documented in WWL (1991a), additional rock was brought and rock thicknesses were evened out prior to topsoil placement over and into the rock. The test results summarized in Figure 4.5 show that the placed rock meets particle-size distribution specifications. In September 1992, WWL checked areas of the western limb for rock mulch thickness and composition, and concluded that the area met specifications (WWL, 1993).

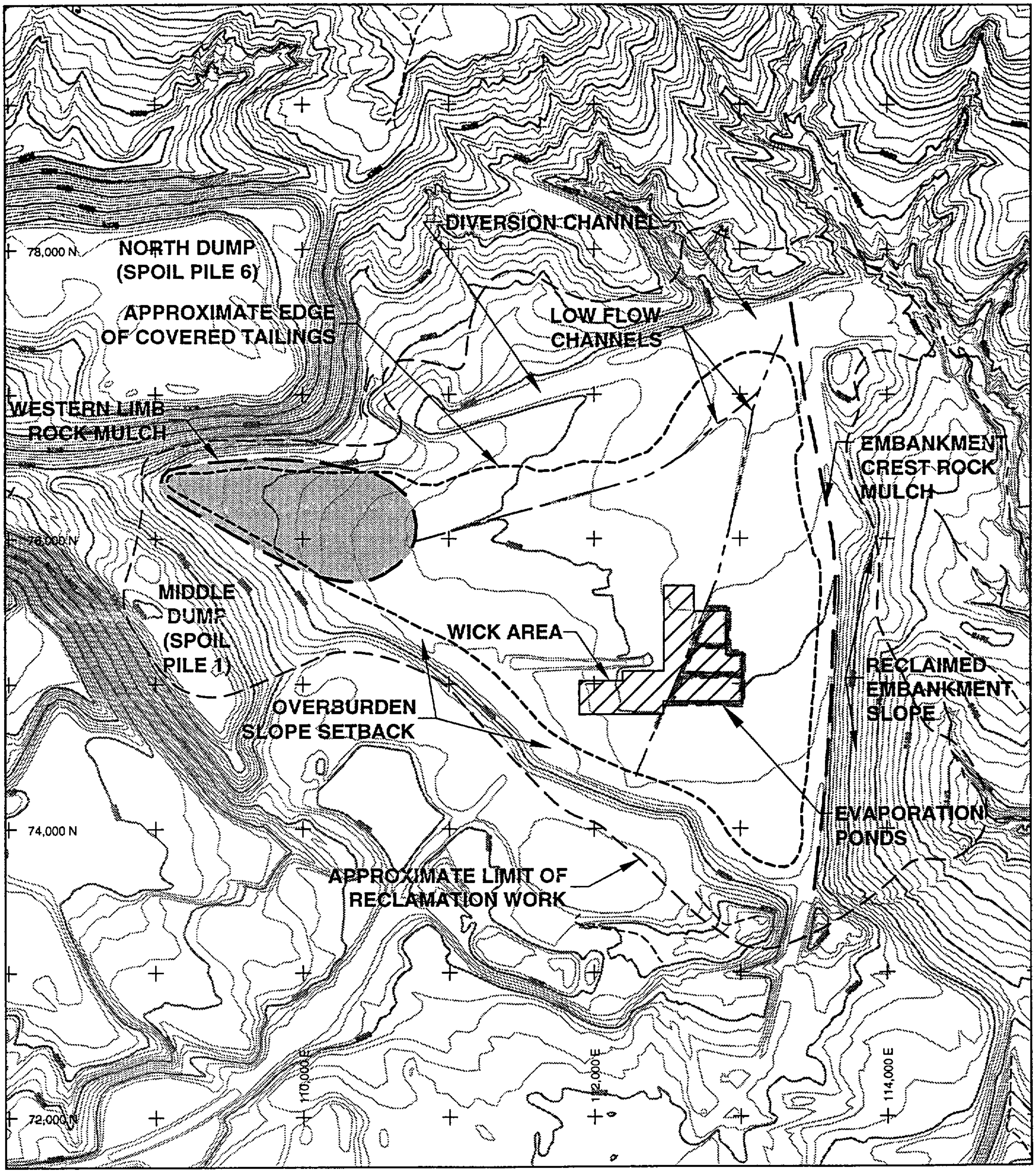
Low-flow channel rock mulch. A zone of minus 8-inch rock mulch was placed in the side slopes and bottom of the low-flow channels in early 1990. Testing by WWL in April 1990 showed that the particle-size distribution of the low-flow channel rock was lacking in 4 to 8-inch size material. Additional rock was placed and spread in the low-flow channels in late 1990, and particle-size distribution testing was conducted by WWL in January 1991 (WWL, 1991a). The test results summarized in Figure 4.6 show that the low-flow channel rock meets particle-size distribution specifications.

4.4 Construction Quality Assurance Testing

Construction quality assurance testing for the cover was conducted as outlined in WWL (1989a), which was structured to follow guidelines in NRC (1987). These tests included the material index and field compaction tests discussed in Section 4.2 above, with the testing frequency (per day or per volume of material) based on the guidelines in NRC (1987). As discussed in WWL (1993), both the test results and testing frequencies met construction quality assurance requirements outlined in WWL (1989a).

4.5 NRC Review and Supplemental Report

NRC conducted an inspection of the reclamation construction documented in WWL (1991a), and provided the results of this inspection in NRC (1992). NRC identified nine follow-up items to be addressed when tailings basin reclamation is complete. These follow-up items were addressed in WWL (1993) and submitted by Exxon to NRC, prior to completion of tailings basin reclamation.



NOTE:

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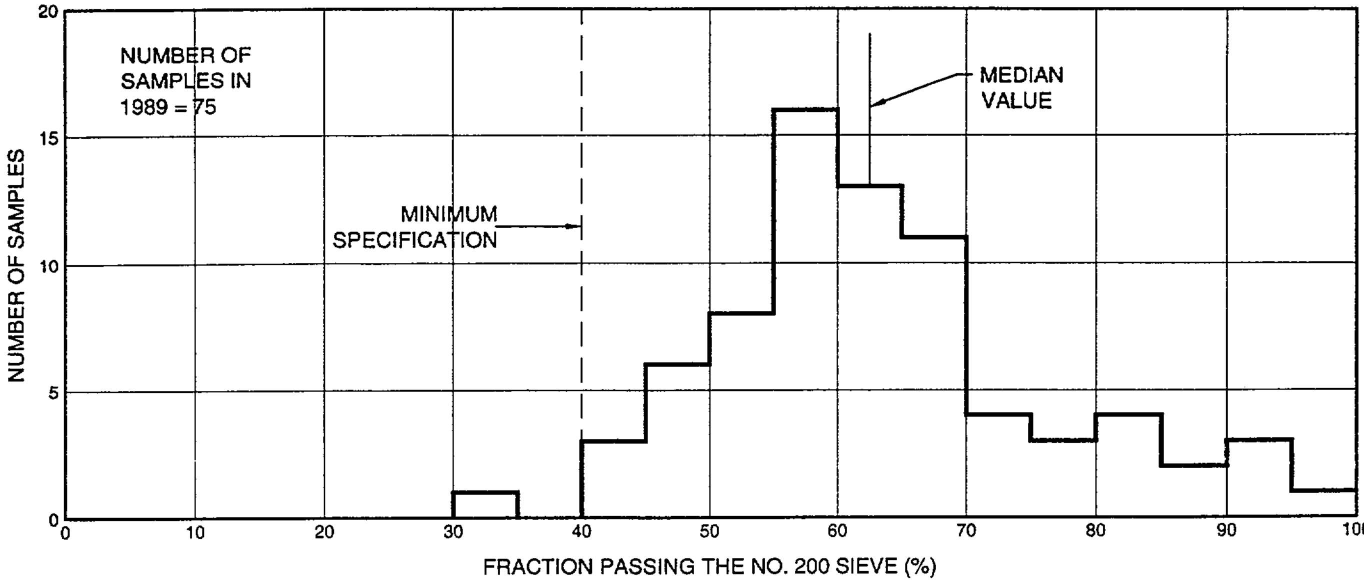
FIGURE 4.1
TAILINGS RECLAMATION
WORK 1988 THROUGH 1990

Date:	MAY 2002
Project:	100548-2
File:	TAILFIG-1B



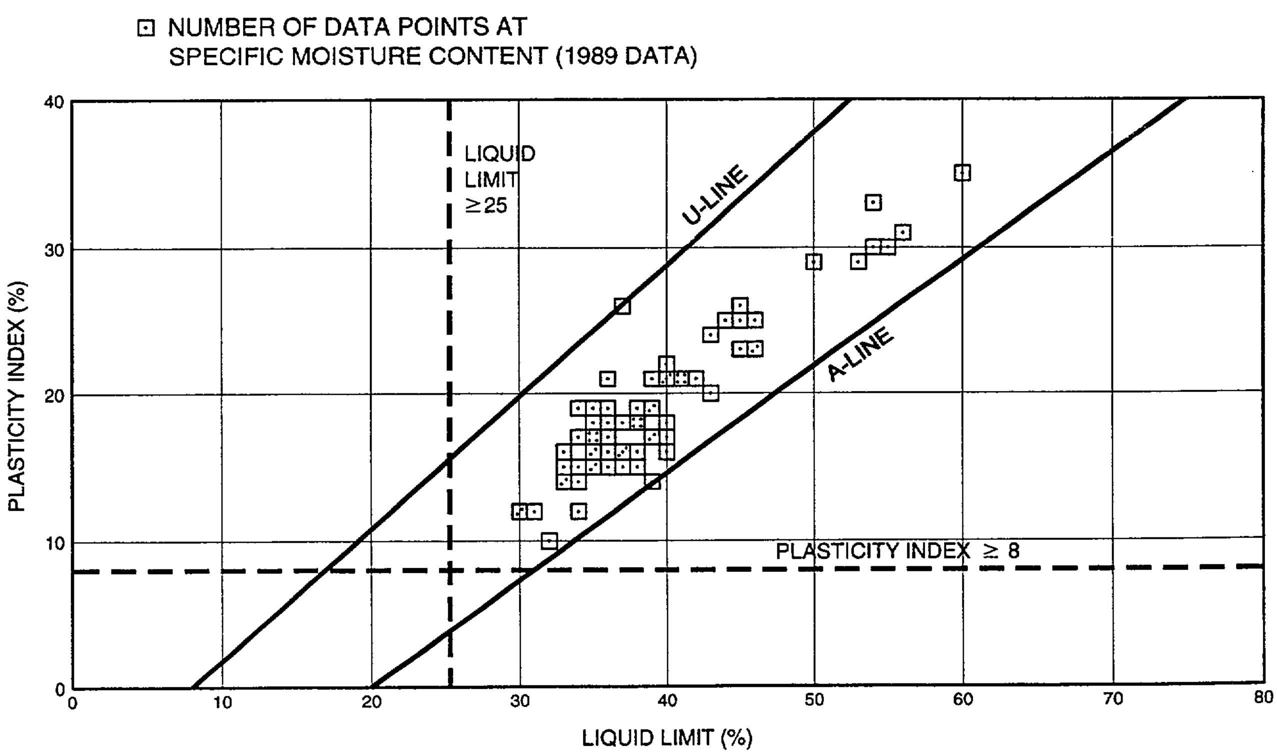


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FIGURE 4.2
COVER MATERIAL
INDEX TEST RESULT SUMMARY

Date:	MAY 2002
Project:	100548-2
File:	PLASTICITY.dwg

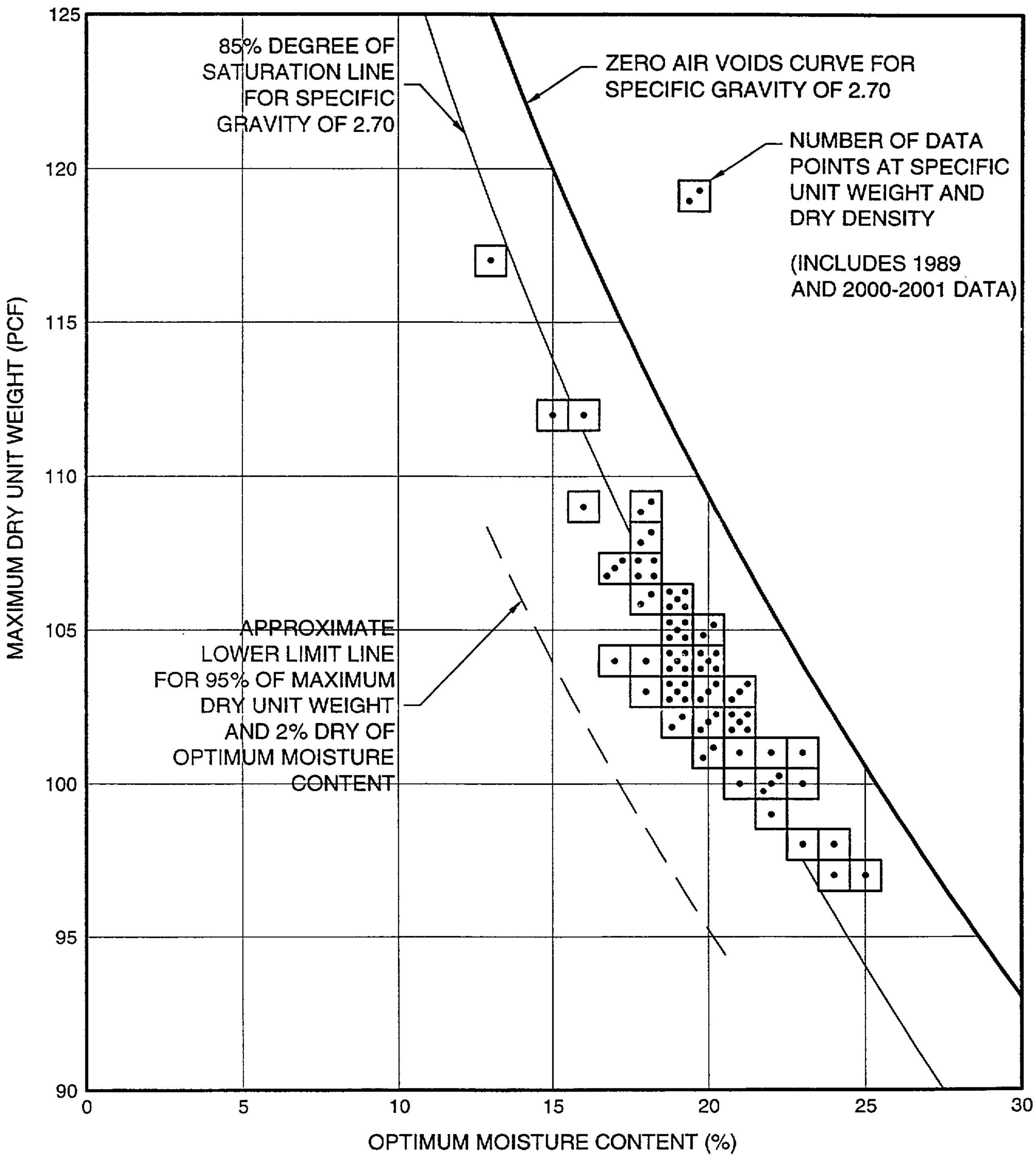

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FIGURE 4.3
COVER MATERIAL
STANDARD PROCTOR TEST SUMMARY

Date:	MAY 2002
Project:	100548-2
File:	PROCTOR-TEST.dwg

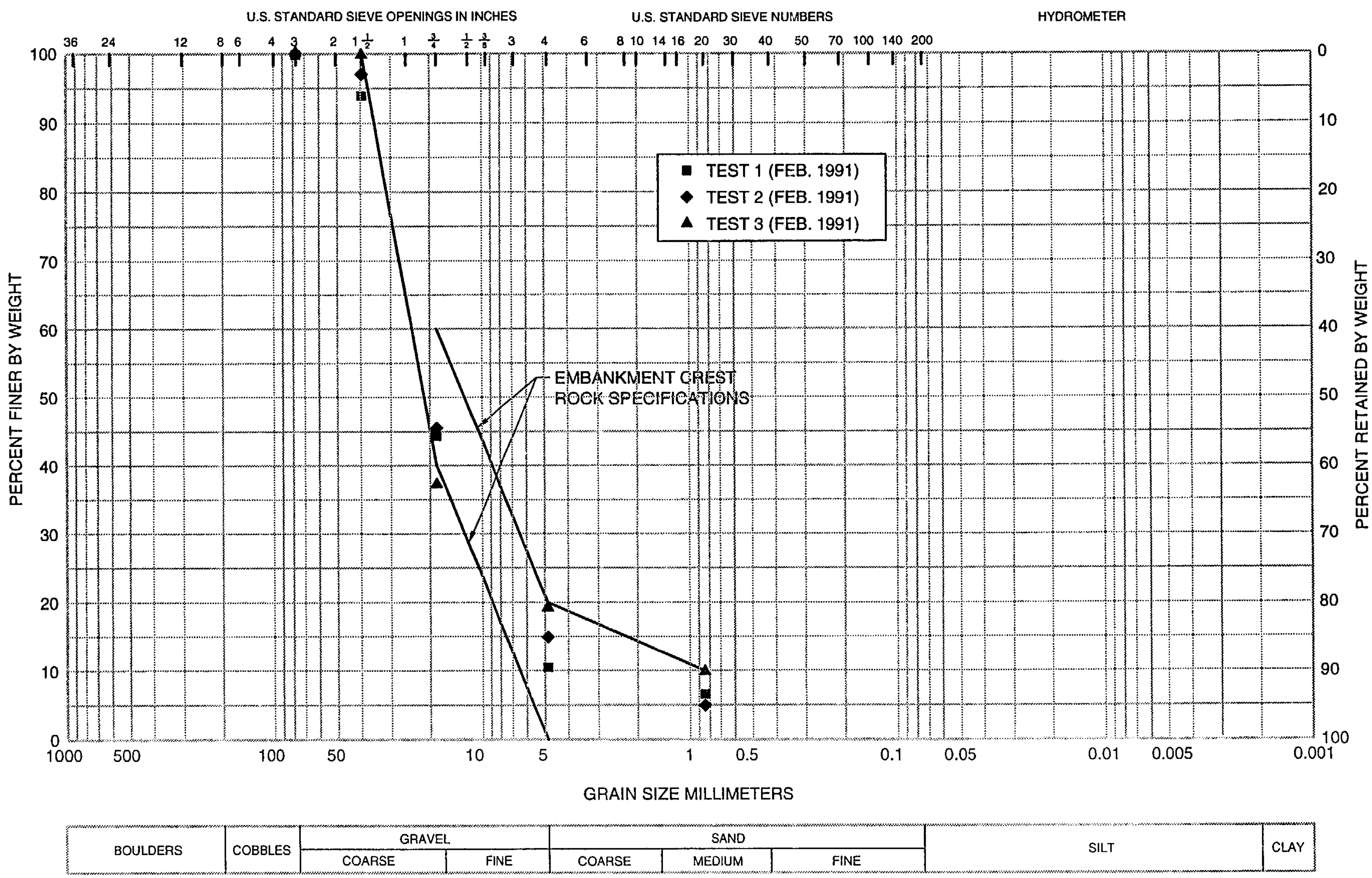

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FIGURE 4.4
SUMMARY OF EMBANKMENT CREST ROCK TESTING

Date:	MAY 2002
Project:	100548-2
File:	GSD-01.DWG

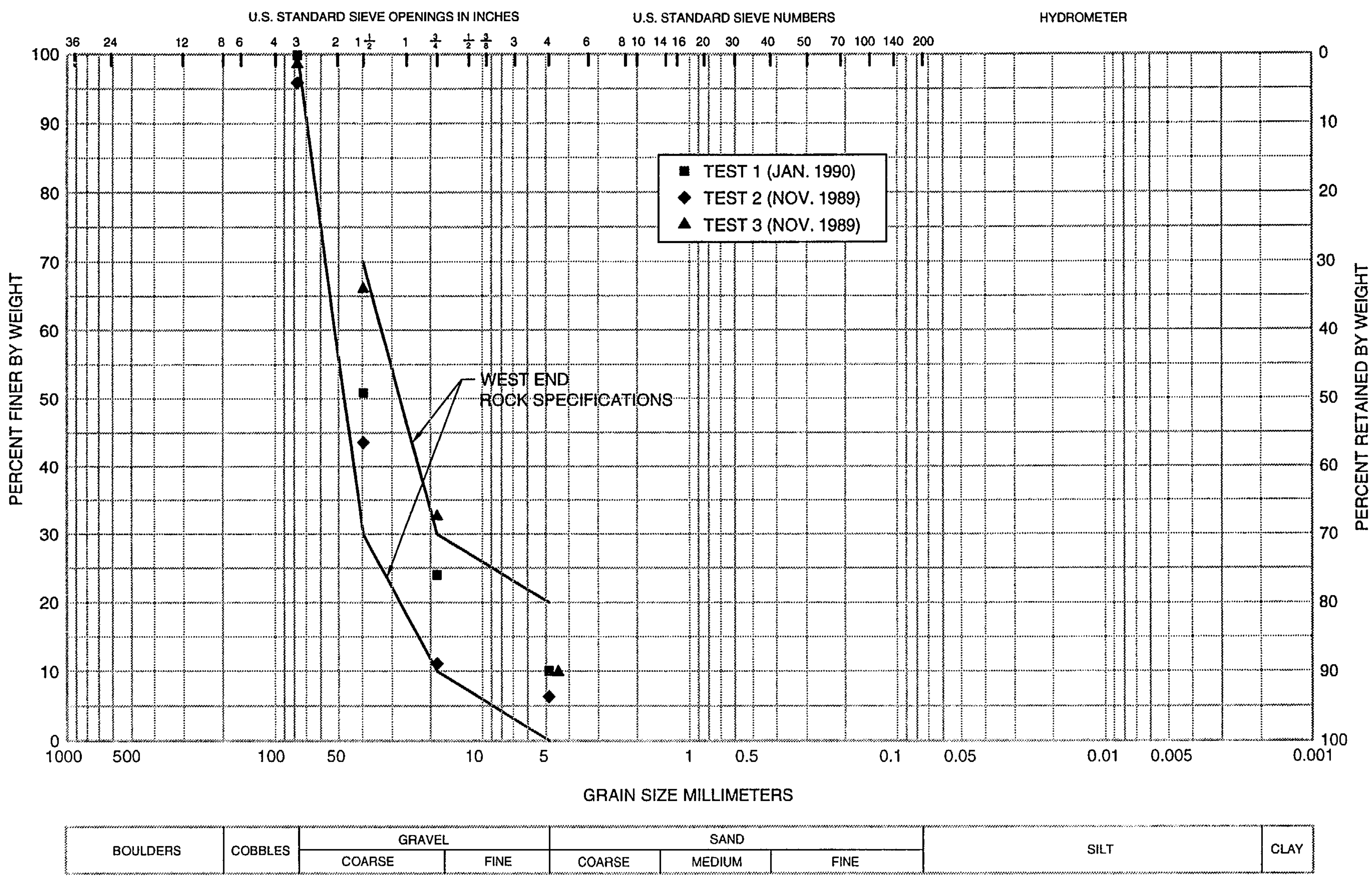

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FIGURE 4.5
SUMMARY OF WESTERN LIMB ROCK TESTING

Date:	MAY 2002
Project:	100548-2
File:	GSD-01.DWG

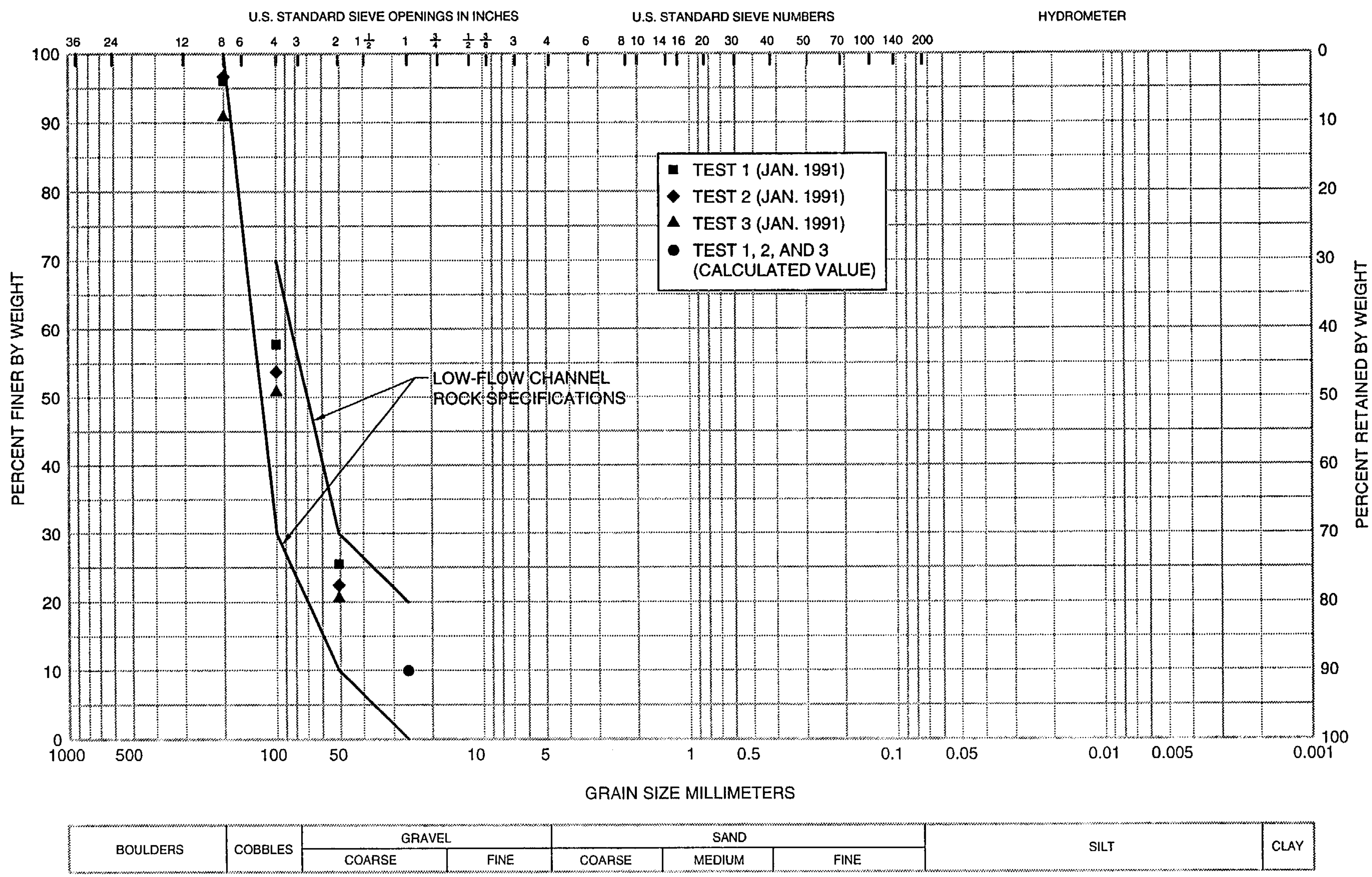

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FIGURE 4.6
SUMMARY OF LOW-FLOW CHANNEL ROCK TESTING

Date: MAY 2002
Project: 100548-2
File: GSD-01.DWG

5.0 INTERIM OBSERVATIONS AND MONITORING

This section outlines the observation and monitoring conducted by Exxon during the interim period between the phases of reclamation work. As described above, Exxon received approval to construct the cover over the tailings in the basin, and to leave the cover over the wick area partially completed (Exxon, 1989a, 1989f; WWL, 1989c, 1989e). Following tailings basin reclamation in 1988 to 1990, this area was monitored to allow additional settlement to take place prior to completion of the cover, as well as provide an area for evaporation of ground water from Corrective Action Plan pumping. This section outlines this monitoring during the interim period prior to completion of the cover in 2000 and 2001.

5.1 Settlement Monitoring

Exxon proposed installation of thirteen settlement monitoring points within the tailings basin (Exxon, 1989f). Seven of the points in tailings sands areas were dropped from the monitoring list. Six remaining settlement monitoring points in tailings slimes areas were surveyed for elevation on a quarterly basis during this interim period. The points are shown in Figure 5.1, along with monitoring points used prior to and after this period. Settlement data for all of the longer-term monitoring points used in the tailings basin are summarized in Figure 5.2.

The settlement monitoring data have shown that since cover construction in 1989, monitoring points outside of the wick area have shown minimal settlement. This includes monuments L-12 and L-14 within the northern slimes area (Figure 5.1). This performance outside of the wick area is consistent with tailings stratigraphy and predictions in WWL (1989c). Within the wick area (characterized by thick zones of continuous tailings slimes), monitoring points had total settlement values of two or more feet, with the rate of settlement decreasing after 1998.

As outlined in Exxon (1989f), the cover over the tailings in the wick area was to be completed after the cover surface has reached 90 percent consolidation (with consolidation based on Taylor's square root of time analysis method, outlined in Holtz and Kovacs, 1981). Using this method with the post-1989 settlement data in Figure 5.2, 90 percent consolidation has been reached on or before year 1997. This degree of consolidation is based on starting either at the

end of random fill placement (in 1987) or at the end of cover construction (in 1989). The coefficient of consolidation measured on a sample of tailings slimes collected prior to reclamation was equivalent to approximately 2.0 x 10^{-3} cm^2/sec (WWL, 1989e). A similar value (2.5 x 10^{-3} cm^2/sec) was calculated for tailings slimes in the wick area (from the settlement data in Figure 5.2).

5.2 Water Management

The three evaporation ponds shown in Figure 5.1 were used for storage and evaporation of water from groundwater Corrective Action Plan pumping. The evaporation ponds were constructed as berms placed on top of the partially completed cover (outlined in Exxon, 1989g). The evaporation ponds were operated under the Corrective Action Plan until NRC approved Alternate Concentration Limits for groundwater in 1999. The evaporation ponds were reclaimed in 2000, as described in Section 6.

5.3 1996 Prairie Fire

On September 4, 1996, a lightning-caused prairie fire burned nearly 80,000 acres in the site area, including approximately 90 percent of the vegetation on the tailings basin cover. Approximately one week later, Colorado State University staff members inspected the site on behalf of NRC (documented in Abt and Bonham, 1996). In April 1997, NRC requested that Exxon provide information on several issues identified in the 1996 inspection regarding the long-term performance of the tailings basin cover (NRC, 1997). In May 1997, Exxon sent a preliminary response to NRC addressing these issues (Exxon, 1997), with supporting technical analyses provided in SMI (1997). In March 1998, NRC concluded that the 1996 prairie fire did no permanent damage to vegetation and that the reclamation design meets long-term stability requirements (NRC, 1998a).

5.4 Gully Intrusion

Following heavy thunderstorms in the site area in 1991, Exxon personnel observed minor gully formation in the northern and southern groin areas of the reclaimed embankment slope (at the contact between the ends of the reclaimed embankment slope and natural ground). As a result,

Exxon commissioned an evaluation of erosion protection in the northern groin area under various design storm events (documented in WWL, 1991b). Subsequent observation of the embankment slope area by Exxon showed that the gullys from 1991 had stabilized with establishment of vegetation on the embankment slope. Exxon postponed placement of erosion protection or other work in the embankment slope area pending the results of additional slope monitoring.

During the site inspection for NRC in 1996 (Abt and Bonham, 1996), the gullys in the north and south groin areas were observed. NRC subsequently requested that Exxon conduct additional gully intrusion analyses on the reclaimed embankment slope. Initial gully intrusion analyses had been documented in WWL (1984, 1985). The additional analyses (documented in SMI, 1998) used gully intrusion analysis methods recommended by NRC that were not available in 1985 (Nelson and others, 1986; Thorton and Abt, 1997). Conclusions from SMI (1998) based on these additional gully intrusion analyses, as well as an inspection of the embankment slope and groin areas by SMI personnel in 1997, are outlined below.

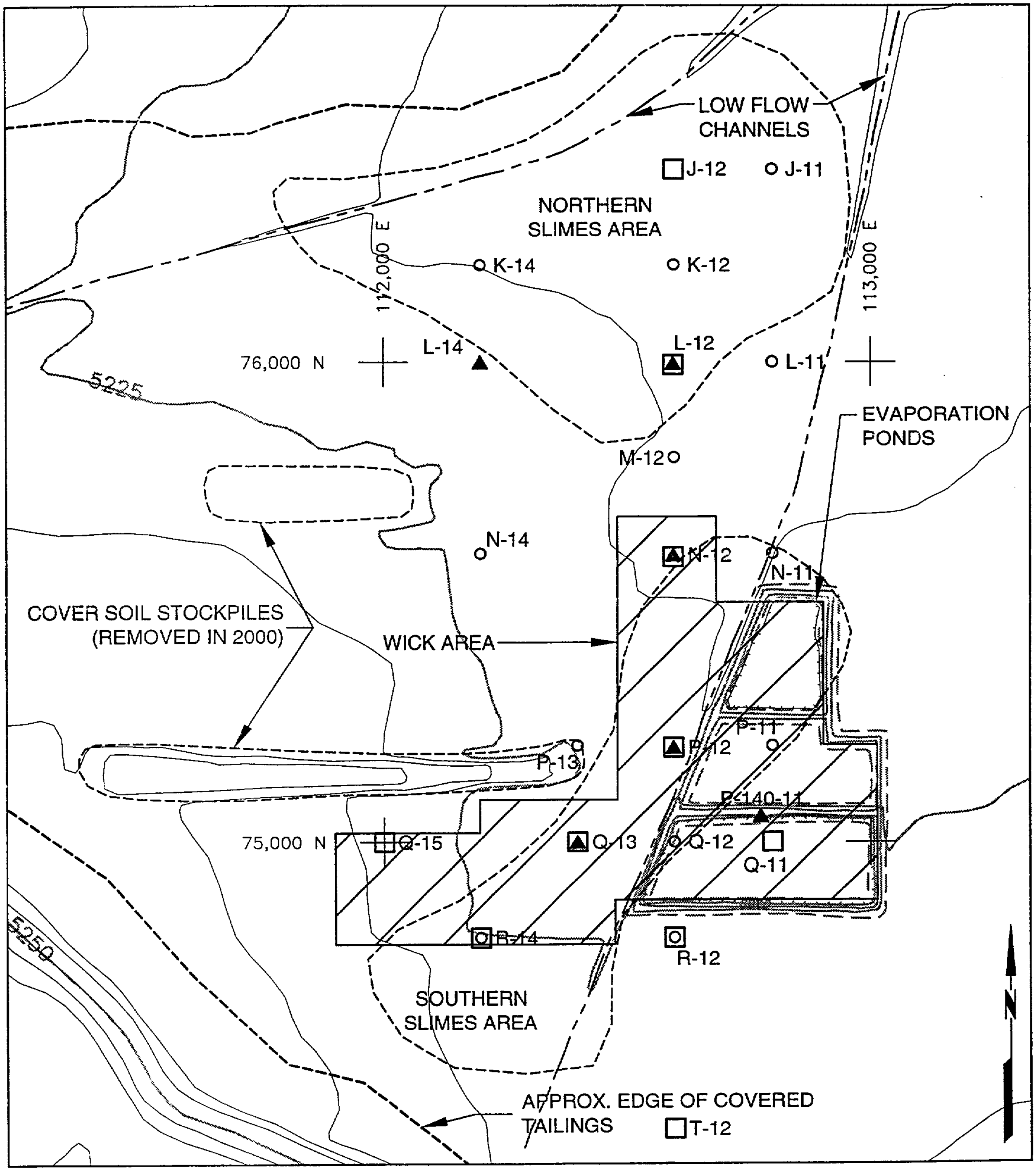
1. The reclaimed downstream slope of the tailings embankment was designed as a sacrificial slope (WWL, 1984, 1985). Although rilling and gullying was expected to occur, the remaining width of the reclaimed earthen embankment would preclude exposure of tailings.

2. Inspection of the embankment slope in 1997 showed gullying conditions similar to those observed by Exxon in 1991, with gully depths of 6 to 12 inches and vegetation established within the gullys.

3. Re-evaluation of the reclaimed embankment slope for gully intrusion (using more recent analysis methods) showed no potential for exposure of tailings.

4. No additional erosion protection on the embankment slope or groin areas was recommended, but continuation of embankment slope inspection as part of post-closure monitoring was recommended.

In July 1998, NRC concluded that the analyses in SMI (1998) were acceptable and that the reclamation design for the embankment continues to meet long-term stability requirements (NRC, 1998b).



LEGEND

- o PRE-RECLAMATION SETTLEMENT MONITORING POINT
- ▲ POST-RECLAMATION SETTLEMENT MONITORING POINT
- □ POST-FILL PLACEMENT SETTLEMENT MONITORING POINT

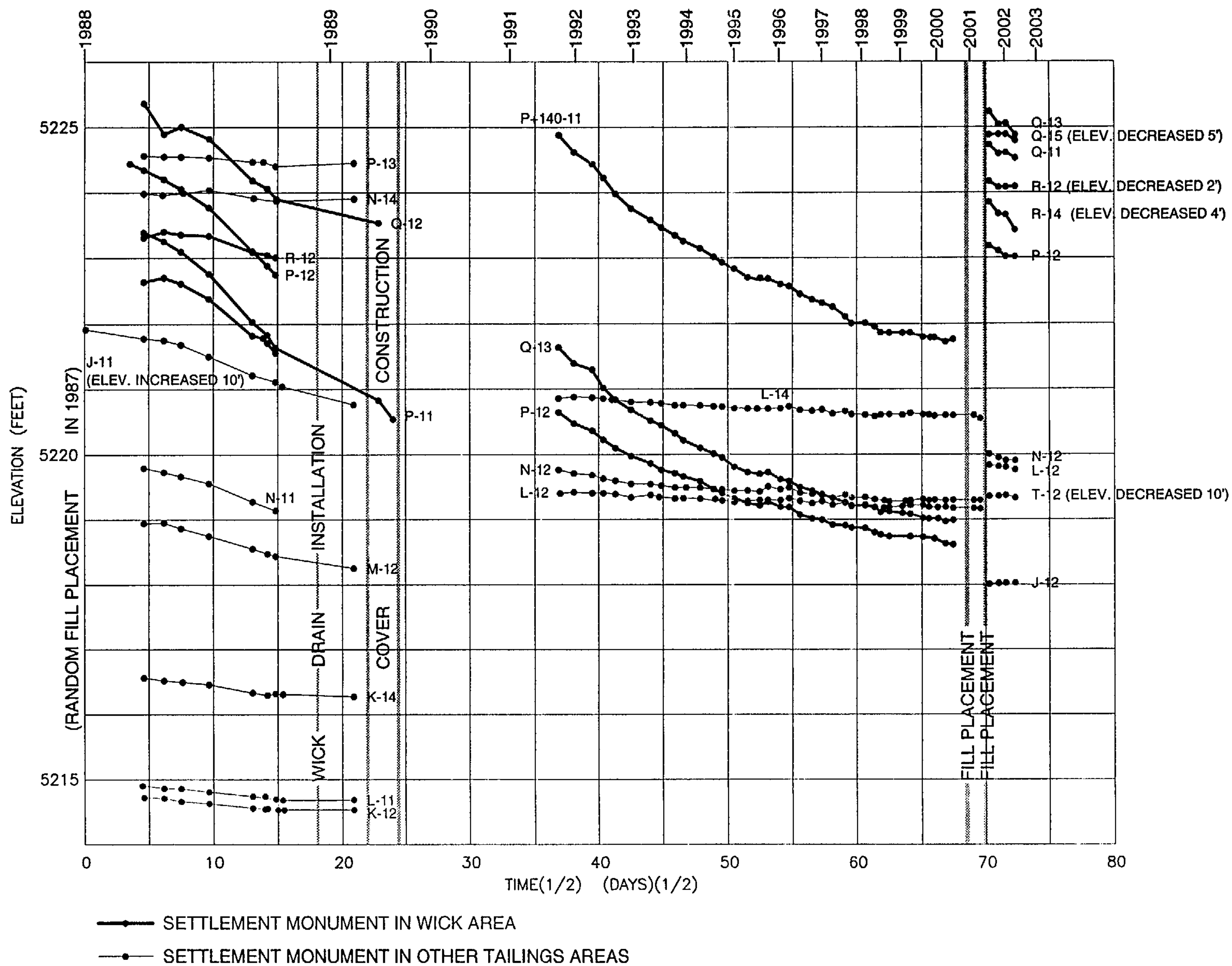
SCALE IN FEET

0 300

SHEPHERD MILLER

FIGURE 5.1
SETTLEMENT MONITORING POINT LOCATIONS

Date:	MAY 2002
Project:	100548-2
File:	SURVEY-2.DWG



SHEPHERD MILLER

FIGURE 5.2
TAILINGS SETTLEMENT DATA SUMMARY

Date:	MAY 2002
Project:	100548-2
File:	TAILDATA-1

6.0 RECLAMATION WORK IN 2000 AND 2001

This section outlines the reclamation work conducted by Exxon Mobil for completion of the tailings basin cover in the wick area in 2000 and 2001. Work consisted of: (1) delineation of the area and volume of fill placement to meet final grades, (2) completion of the tailings cover in this area, and (3) extension of the southern low-flow channel through this area. The work area or approximate limits of reclamation work (shown in Figure 6.1) include the fill placement and primary soil borrow areas. The fill placement area extends beyond the wick area, as described below.

6.1 Fill Placement Area Background

As outlined in Exxon (1989f), the tailings cover in the wick area was partially completed, with topsoil left off of the area shown in Figures 6.1 and 6.2, and the top of radon barrier surface in the evaporation pond area left one foot lower than the final grade. The two cover soil stockpiles immediately west of the evaporation ponds (shown in Figures 6.1 and 6.2) contained sufficient material for the one foot of cover, and topsoil remaining in Stockpiles 21 and 25 (Figure 6.1) was to be used for the remaining area to be covered with topsoil.

The extent and amount of actual settlement from 1991 to 2000 is summarized by fill depth contours in Figure 6.2, based on the difference between existing elevations in 2000 and final grade elevations, surveyed on a 100-foot grid basis. These fill depth contours are consistent with the measured settlement data shown in Figure 5.2. As shown by the settlement contours in Figure 6.2, the depths of fill required to meet final grades ranged from zero to over four feet. Limited areas within the four-foot contour area had fill depths of over eight feet.

6.2 Fill Placement Strategy

Due to the amount of settlement in this area, varying depths of fill placement were required, including thicknesses greater than those of the cover. The cover profile in this area was maintained in a manner consistent with the original cover design, where the upper part of the profile consists of: (1) 0.5 feet of topsoil, (2) 3.5 feet of radon barrier, and (3) random fill.

Exxon's strategy for placement and compaction of additional fill (that was incorporated by NRC into the radioactive materials license) is outlined below (from Exxon, 1989f).

> "Additional fill will be placed in the wick area if needed at a later date to achieve the design elevations prior to topsoiling. We anticipate that this fill will not need to be compacted in order to assure that erosion will not damage the integrity of the radon barrier. However, if this assurance cannot be demonstrated to the satisfaction of the NRC, we hereby commit to assure that this fill material will satisfy the radon barrier specifications."

Due to the amount of settlement that had taken place in this area and the amount of fill required, Exxon Mobil conservatively chose to use materials for additional fill that met the cover material specifications in WWL (1989a). Exxon Mobil also chose to place and compact these materials according to the specifications in WWL (1989a). The profile of the existing fill, underlying materials, and materials placed in 2000 and 2001 is shown in Figure 6.3.

The additional fill material was tied into the existing cover material at the edges of the work area (shown in Figure 6.3). Based on the depth of fill required to meet final grades, the fill area was delineated to outline areas requiring: (1) random fill plus radon barrier material and topsoil (where more than four feet of fill were required), (2) radon barrier material and topsoil (where between 0.5 and four feet of fill were required), and (3) topsoil only (where less than 0.5 feet of fill were required). The areas of topsoil only were delineated to provide a transition to (and tie-in with) existing surface grades at the boundaries of the fill area. Areas requiring more than four feet of fill to reach the final design grade were backfilled with random fill up to the four-foot fill level. Radon barrier material was placed to within 0.5 feet of final grade, and topsoil was then placed and spread to meet final grades.

6.3 Construction Specifications and Standards

As shown in Figures 6.1 and 6.2, the fill placement area extended outside of the area that was left without topsoil in 1989. Therefore, topsoil excavation and stockpiling was conducted in this area to salvage topsoil and ensure that new radon barrier material was tied into existing radon barrier

material (Figure 6.3). Site preparation in the work area consisted of stripping and stockpiling topsoil from this area as well as from construction access and haul roads. The remaining cover materials in the work area were not excavated in order to prevent exposure of the underlying random fill or tailings.

Prior to construction in 2000, Shepherd Miller personnel collected two samples of sediments from the evaporation ponds for analysis of radium-226. This was done to confirm that these sediments had radium-226 activity concentration values that were not elevated and were consistent with background values for the site area. Radium-226 activity concentration values were 1.27 and 1.11 pCi/g (Appendix F)

The construction specifications in WWL (1989a) were updated for the 2000-2001 work (Appendix F). The material properties of the radon barrier material (summarized in Section 4.2) as well as the compaction specifications and construction quality assurance testing frequency from WWL (1989a) were used. The updated specifications (Appendix F) included material properties and compaction requirements for random fill that were not in WWL (1989a).

Exxon (1989f) mentioned scarifying and re-compacting the upper 18 inches of radon barrier prior to placement of additional cover. Due to the period of climatic cycles between cover completion and original cover construction, the original cover was wetted but not scarified prior to placement of new material (Appendix F).

The construction work was conducted under Exxon Mobil health and safety requirements, including a specific site health and safety plan (SMI, 2000). A site safety meeting was held by Shepherd Miller with all construction personnel on the first day of construction in 2000 to review health and safety plan requirements.

6.4 Construction Materials

Radon barrier and random fill materials for completion of the tailings basin cover were obtained from the same source as used during initial cover construction. The areas (shown in Figure 6.1)

are: (1) the two cover material stockpiles immediately west of the fill area (obtained from the Middle Dump in 1989), and (2) a borrow area opened on the southeast end of the Middle Dump.

Topsoil stockpiles 21 and 25 (Figure 6.1) were used for the remaining topsoil. These stockpiles were originally created during mine backfill operations. Rock for the extension of the south low-flow channel was obtained from a stockpile created in 1990 (Figure 6.1).

6.5 Construction Sequence

Carr Construction, based in Casper, Wyoming, was the earthmoving contractor retained for construction of the tailings basin cover, establishment of the final site grade, and topsoil placement over the settled tailings area. The water used for dust suppression and moisture-conditioning was supplied from the Highland Reservoir (Figure 1.2) by Pronghorn Pump and Repair of Glenrock, Wyoming. Construction quality assurance testing and construction surveying was provided by Shepherd Miller of Fort Collins, Colorado. All three groups were retained by Exxon Mobil for this work.

The Carr Construction equipment included three to six push-loading scrapers of varying sizes (Cat 621, 627B, and 657) for loading, hauling, and spreading material. Moisture-conditioning and material blending were done with a Cat 14G grader, one Cat water wagon and one water truck. Compaction was done with a Cat 815 wedgefoot compactor. Material placement and compaction production ranged from approximately 3,000 to 6,000 cubic yards per day.

This work was conducted over two separate construction periods. Work began on October 24, 2000 and was stopped early due to freezing ground conditions on November 8, 2000. At the end of the 2000 construction season, open borrow areas, access roads, and exposed work areas were graded to drain and sealed to minimize erosion and degradation of compacted surfaces. When work resumed on April 6, 2001, the exposed work areas were moisture-conditioned and compacted prior to placement of additional fill. Work was completed on June 6, 2001.

From the field engineer reports in Appendix B, the overall period of construction in 2000 and 2001 was 56 days, with radon barrier and random fill placement taking place over 38 days within

this period. The estimated volumes of cover fill materials placed during this period totaled approximately 216,000 cubic yards, consisting of approximately 38,000 cubic yards of topsoil, 128,000 cubic yards of radon barrier material, and 50,000 cubic yards of random fill material (Appendix F).

Soil borrow areas were also reclaimed for drainage and covered with topsoil. Seeding of the work area was conducted in late 2001 and early 2002, dictated by available topsoil moisture. Seeding and revegetation maintenance is conducted for Exxon Mobil by Pronghorn Pump and Repair (the contractor currently conducting maintenance work for Exxon Mobil at the Highland site). The current revegetation program utilizes plant species lists outlined in WWL (1984).

6.6 Quality Assurance Observation and Testing

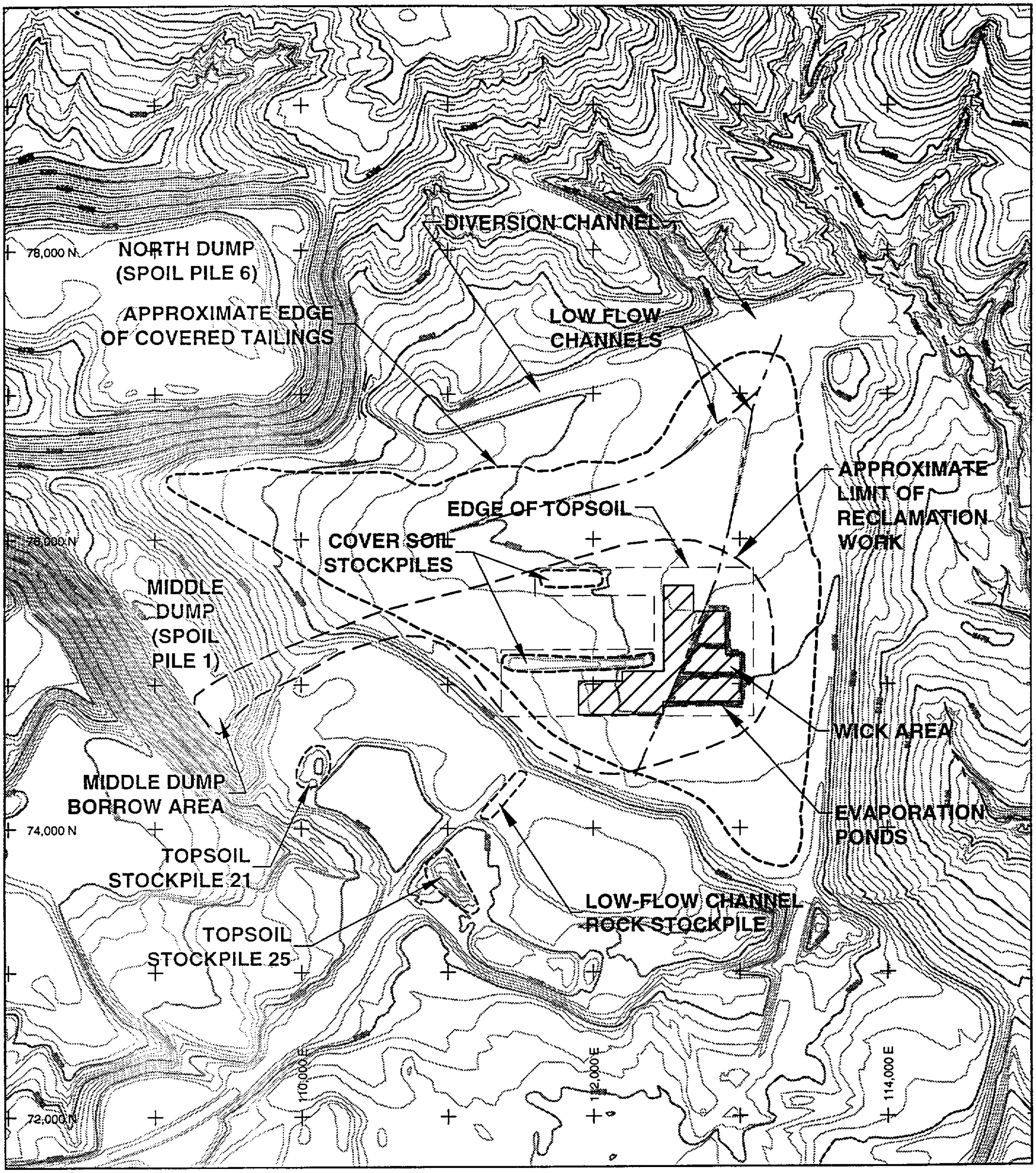
Shepherd Miller personnel were routinely on site during construction to observe field conditions and construction procedures, to add or replace grade stakes, and to conduct construction quality assurance (CQA) sampling and testing to check conformance with the specifications. CQA tests and construction observations were generally made twice weekly (barring interruption due to the weather). Daily reports containing information about work areas, the CQA tests, and key contractor communication for each site visit are presented in Appendix B. CQA test results are presented in Appendices C and D.

CQA testing was conducted based on the testing frequency outlined in Appendix F. Field compaction (in-place density) tests were scheduled to keep up with the rate and area of compaction. Efforts were made to schedule tests such that areas ready for testing were open and not covered with a subsequent lift or topsoil. In areas where this could not be avoided, excavations were made at the selected test location down to the level of the untested lift, with tests taken at that level. In the event of a failed field compaction test, the Carr Construction representative was notified and the area reworked as appropriate. The failed tests were noted and re-tests taken following reworking. In-place density test locations were spread across the fill placement area in an effort to avoid clustering of tests in higher traffic areas.

Material property tests and Standard Proctor tests were run on samples collected on the days of field of compaction testing. These tests were conducted in Shepherd Miller's laboratory or by Smith Geotechnical in Fort Collins. Discussions for each of the material types tested and testing frequencies are presented in Section 7.0.

In summary, work progressed to meet the intent of the design and specifications. No field conditions arose that resulted in design changes or revisions to the grading plan. Borrow material remained consistent in characteristics and compliance with material specifications, and no changes were made to the location of borrow material excavation. The only materials rejected from the borrow area were oversize sandstone pieces, which were pushed aside during excavation and placement and subsequently moved to rock disposal areas adjacent to the borrow area (Appendix A).

The additional cover material in the fill placement area resulted in a cover system that was significantly thicker than the original cover (Figure 6.3), and would significantly enhance the anticipated performance of the cover over the fill placement area (for radon attenuation and reduction of infiltration).



NOTE:

TOPOGRAPHY FROM 1989 AERIAL PHOTOGRAPHY BY HORIZONS, INC.

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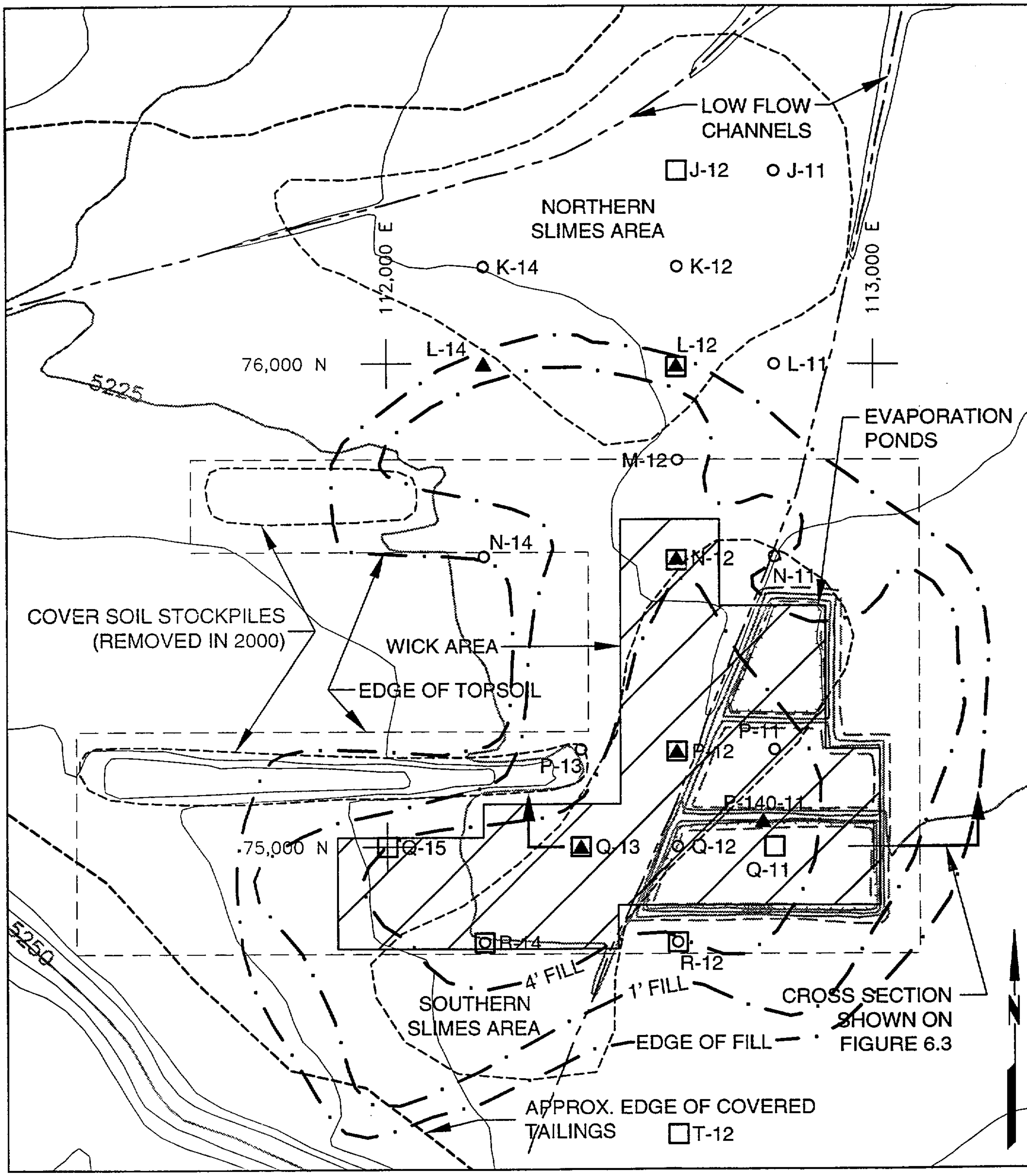
FIGURE 6.1
TAILINGS RECLAMATION
WORK 2000 AND 2001

Date:	MAY 2002
Project:	100548-2
File:	TAILFIG-1C



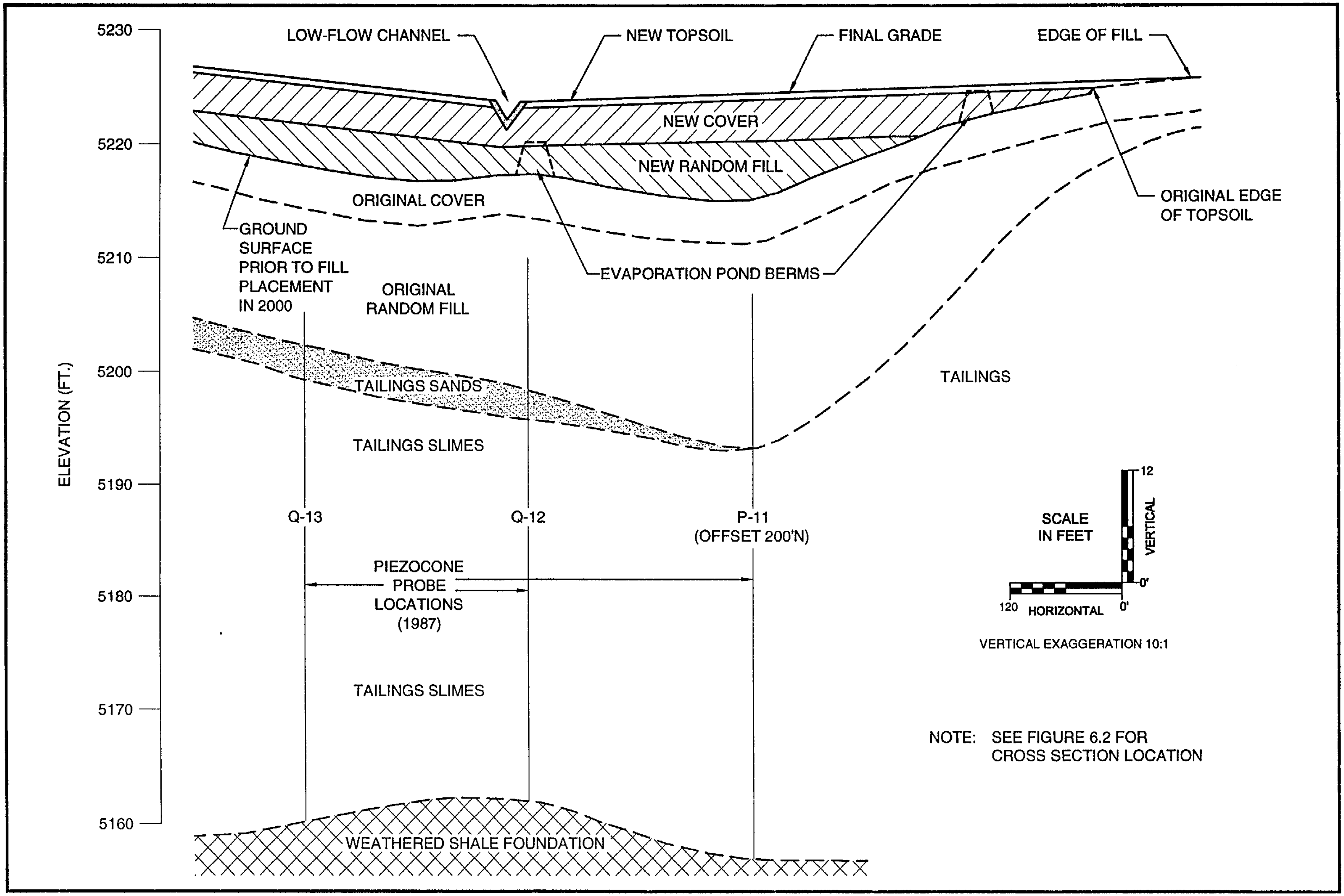
LEGEND

- o PRE-RECLAMATION SETTLEMENT MONITORING POINT
- ▲ POST-RECLAMATION SETTLEMENT MONITORING POINT
- □ POST-FILL PLACEMENT SETTLEMENT MONITORING POINT

SHEPHERD MILLER

FIGURE 6.2
SETTLEMENT MONITORING POINT LOCATIONS AND DATA

Date:	MAY 2002
Project:	100548-2
File:	SURVEY-2.DWG



SHEPHERD MILLER

FIGURE 6.3
ADDITIONAL FILL AREA CROSS SECTION

Date:	MAY 2002
Project:	100548-2
File:	XS-FILL.DWG

7.0 FILL MATERIALS

This section outlines the CQA test results and testing frequency for the fill materials placed in 2000 and 2001. These results are compared with the specifications used for these materials from Appendix F (updated from WWL, 1989a). Test locations and construction grade control were based on the 200-foot grid system shown in Figure 7.1. This was the same grid system used for construction and CQA testing in 1989 and 1990.

7.1 Random Fill

The material and compaction specifications (from Appendix F) for random fill placement are discussed below in terms of the observations during construction (documented in Appendix B) and test results (compiled in Appendix D).

Material specifications. The material specifications for the random fill were simply that material be obtained from the cover soil stockpiles or the Middle Dump. This specification was met, with the majority of random fill obtained from the cover soil stockpiles during the initial stages of construction in 2000.

Compaction specifications. The compaction specifications for the random fill included the following elements: (1) placement of material in lifts (maximum 12-inch compacted thickness), (2) compaction of material within a moisture content range (4 percent below to 2 percent above optimum moisture content), and (3) testing of the upper random fill surface for in-place density (at least 90 percent of Standard Proctor density). Observation of construction procedures (documented in Appendix B) found that the intent of the elements 1 and 2 above were met.

From the results in Appendix D, there were 14 in-place density tests on the top surface of compacted random fill (using the sand cone test, ASTM D-1556). All tests met the 90 percent of Standard Proctor dry density (unit weight) specification (ASTM D-698). The Standard Proctor test values in Figure 7.3 were used for comparison with measured in-place density values.

The volume of random fill placed in 2000-2001 was approximately 50,000 cubic yards (Appendix F). The upper random fill surface area is approximately 420,000 square feet (9.6 acres), based on the area within the 4-foot fill contour shown in Figure 6.2. A compacted, one-foot thick zone of random fill covering this area has a volume of approximately 15,600 cubic yards. Although not required in the specifications, the frequency of random fill compaction testing (14 tests on approximately 15,600 cubic yards) was approximately one test per 1000 cubic yards.

7.2 Radon Barrier Material

The material and compaction specifications (from Appendix F) for radon barrier material placement are discussed below in terms of the observations during construction (documented in Appendix B) and test results (compiled in Appendices C and D).

Material specifications. The radon barrier material was obtained from the cover soil stockpiles and the south end of the Middle Dump (Figure 6.1). The radon barrier material specifications (Appendix F) included: (1) a minimum of 40 percent passing the No. 200 sieve, (2) a minimum liquid limit of 25, (3) a minimum plasticity index of 8, and (4) a maximum particle size of six inches.

As summarized in Figure 7.2, the fraction passing the No. 200 sieve results are similar to the 1989 results (Figure 4.2). All but one 2000-2001 test met specifications for fraction passing the No. 200 sieve (ASTM D-1140). This sample was obtained directly from the borrow area, and represented sandier material that was subsequently mixed with other materials during loading, spreading, moisture-conditioning, and compaction.

The Atterberg limit test results summarized in Figure 7.2 are similar to the results from 1989 (Figure 4.2). All but two samples met specifications for Atterberg limits (ASTM D-4318). The two samples not meeting specifications were recorded as non-plastic in Appendix C, and were obtained directly from the borrow area. These sandier materials represented material that was subsequently mixed with other materials prior to compaction in the radon barrier. This is

reflected by the Atterberg limit test results that met specifications from compacted radon barrier material samples (Appendix C).

The Standard Proctor test results are summarized in Figure 7.3 for both 1989 and 2000-2001 samples. Comparison with the 1989 test results (Figure 4.3) shows similar maximum points, indicating no significant material variation within the borrow area portion of the Middle Dump. Selected Standard Proctor test maximum values used for comparison with measured in-place density values are also shown in Figure 7.3. These values were selected to represent the range of clay content of the materials as well as the more frequently measured Standard Proctor test values from the excavated Middle Dump materials.

Compaction specifications. The compaction specifications for the radon barrier material included the following elements: (1) placement of material in lifts (maximum 12-inch compacted thickness), (2) compaction of material within a moisture content range (2 percent below to 2 percent above optimum moisture content), and (3) testing of each lift for in-place density (at least 95 percent of Standard Proctor density). These elements are consistent with the specifications used in 1989 (WWL, 1989a), except that the moisture content range was modified from 1 percent below to 3 percent above optimum (in WWL, 1989a) to 2 percent below to 2 percent above optimum (Appendix F). This modification was made from observation of radon barrier compaction in 1989, and that the most effective compaction was achieved at moisture contents near Standard Proctor optimum moisture content, and not at moisture contents above (wet of) optimum.

From observation of construction procedures (documented in Appendix B) material placement in lifts with thicknesses less than 12-inches (element 1 above) was done. Material compaction (elements 2 and 3 above) within the specified range of moisture contents was measured with in-place density testing.

Compaction testing. In-place density was measured using the 6-inch diameter sand cone test (ASTM D-1556). The moisture content of the material collected from each sand cone test was measured by oven drying (ASTM D-2216) in Shepherd Miller's laboratory. Although nuclear density gages were used for in-situ density testing in 1989 (WWL, 1991, 1993), sand cone tests

were used for all of the in-place density tests in 2000-2001. This was due to the relatively small amount of compacted fill to be placed relative to NRC calibration requirements between nuclear density gage and sand cone test results.

The limiting factor in the rate of radon barrier construction was incorporation of moisture into the placed fill. From the test results in Appendix D, natural, near-surface moisture content values in the cover soil stockpiles and Middle Dump borrow area ranged from approximately 4 percent in October 2000 to approximately 18 percent in April 2001, with an average at depth of approximately 12 percent. Optimum moisture content values were primarily 18 to 20 percent (Figure 7.3). A moisture content increase from 12 to 20 percent required addition of approximately 27 gallons of water for each cubic yard of radon barrier material, or approximately 81,000 gallons of water per day for a 3,000 cubic yard per day production rate.

From the test results in Appendix D, occasions when radon barrier materials did not meet in-place density specifications were when material was not sufficiently moisture-conditioned and was below the moisture content specification at compaction. These occasions were when sustained high winds prevented adequate water addition to areas of placed fill. This condition was evident during excavation of the sand cone test sample, and was confirmed with test results. These areas were identified for the contractor and re-conditioned for moisture prior to re-compaction and testing. These were documented as failing tests and retests in the in-place density test results (Appendix D).

There were other occasions when radon barrier material was moisture-conditioned and compacted within moisture content specifications, but the top layer of compacted fill had dried out prior to in-place density testing. These occasions were generally when winds had dried out the compacted fill surface. During excavation of sand cone test samples, this condition was observed as dense material throughout, but with the upper inch dried out. The test results showed acceptable dry densities, but with measured moisture content values just below the specified range. These areas met the compaction requirements in Appendix F, since the specified moisture content range was during compaction. These areas were accepted without re-working, with a note in the test results as a "dry" sample (Appendix D).

The sand cone testing was conducted for in-place density measurements by collecting the compacted material sample and obtaining a wet density on site. The collected samples were taken to Fort Collins for moisture content measurement. Since moisture content results were not immediately available on site, measured wet densities and observed sand cone sample excavation (discussed above) were used to judge adequate compaction of radon barrier material. A wet density of 120 pounds per cubic foot (pcf) was used as the field value for assessment of adequate compaction. This field value is consistent with the range of most frequently used Standard Proctor values for the radon barrier material (shown in the table below).

Maximum Dry Density (pcf)	Optimum Moisture Content (%)	Wet Density (pcf) at 95 % of Maximum Dry Density
111	16	122.3
107	18	120.0
104	20	118.6
102	21	117.3

Compaction to 95 percent of Standard Proctor dry density was confirmed after the moisture content measurements were completed.

Testing frequency. From the results in Appendix D, there were 146 in-place density tests on compacted lifts of radon barrier material that met the 95 percent of Standard Proctor dry density (unit weight) specification. The volume of radon barrier material was approximately 128,000 cubic yards (Appendix F). The in-place density testing frequency was higher than the required frequency (in Appendix F) of one test per 1000 cubic yards. The required testing frequency in Appendix F was the same as that included in WWL (1989a) and approved by NRC in 1989 (although it differs from the recommended frequency in NRC, 1987 and 1989a). The number of actual in-place density tests was also higher than the NRC (1989a) recommendation of at least two in-place density tests per day of fill placement (or at least 76 tests for 38 days of random fill placement).

Standard Proctor tests were to be conducted at a frequency of one test per 10,000 cubic yards of material compacted (or 13 tests for 128,000 cubic yards). From the results in Appendix C, 16 Standard Proctor tests were conducted in 2000-2001. These Proctor test results were also consistent with the 76 tests conducted in 1989. One-point Proctor tests (outlined in NRC, 1989)

were not used during the 2000-2001 work, due to the number of full Standard Proctor test results for this material.

Fines fraction (No. 200 sieve wash) and Atterberg limit tests were to be conducted at a frequency of one test per day of radon barrier placement, or at least 38 tests for the 38 days of radon barrier placement. From the results in Appendix C, 58 fines fraction and Atterberg limit tests were conducted in 2000-2001, and the results were consistent with the 75 tests conducted in 1989.

7.3 Topsoil (Revegetation Soil)

The topsoil placed over radon barrier material in the work area was either material stripped and stockpiled from the work area, or obtained from the topsoil stockpiles 21 and 25 (Figure 6.1).

Material description. In general, the topsoil stockpiled on site was similar in material type as Middle Dump material (a sandy clayey silt), but with a higher organic matter content and a more brown to dark orange color than the other cover materials.

Material placement. Topsoil was placed over the compacted cover soil with scrapers and fine-graded to a six-inch lift with a motor grader. Grade stakes were set throughout the area on a 100-foot grid for control of the lift thickness. In some areas, intermediate stakes where placed at a 50-ft spacing for additional control. CQA observations were made during the soil placement and the area was walked to spot-check the topsoil thickness and note areas that appeared to have less than six inches of topsoil (documented in Appendix B).

All of the remaining topsoil in stockpiles 21 and 25 was used for covering the work area or the stockpile sites. The topsoil salvaged from the Middle Dump borrow area was stripped and stockpiled at the beginning of construction in 2000, and replaced after borrow area grading in 2001.

7.4 Verification of Thicknesses and Grades

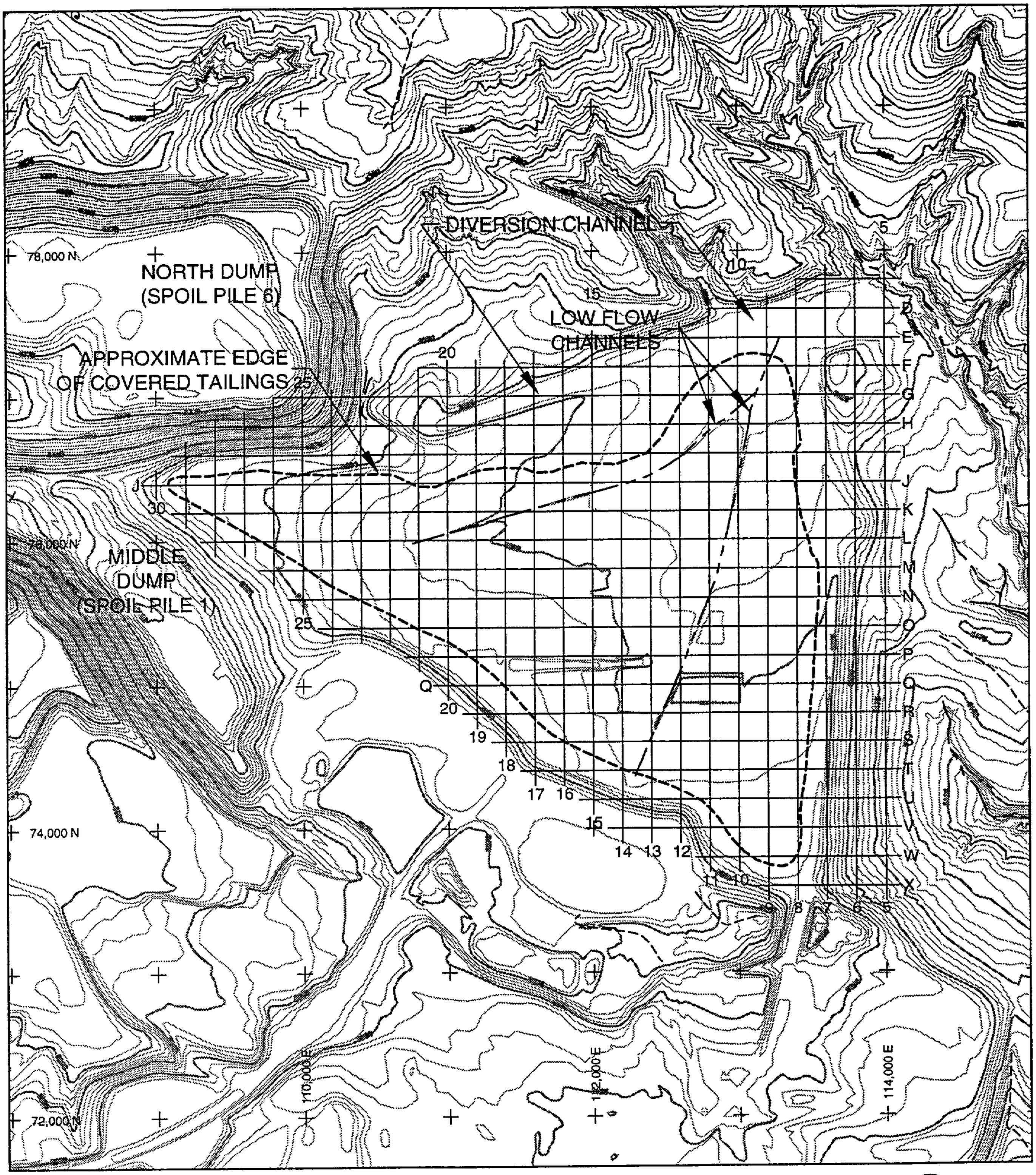
The thickness of random fill material placed in 2000-2001 varied from zero to approximately six feet. The top surface of the random fill zone was established at four feet below final grade.

Grade elevations were established by surveying grid points on a 100-foot spacing, using the coordinate system shown in Figure 7.1.

The thickness of radon barrier material placed in 2000-2001 ranged from zero to 3.5 feet. The bottom surface of the radon barrier was formed by the top random fill surface or the radon barrier surface from 1989. The top surface of the compacted radon barrier was established at six inches below final grade. Grade elevations were established by surveying grid points on a 100-foot spacing, using the coordinate system shown in Figure 7.1. These procedures were used for establishing the thickness and final grades of the radon barrier in 1989 (WWL, 1991, 1993).

The thickness of topsoil placed in 2000-2001 was nominally six inches. The final topsoil surface was established at final grade, with grade elevations established as discussed in Section 7.3. The limits of topsoil placement were the edge-of-topsoil limits from 1989 or the edge of topsoil salvage from 2000 (Figure 7.4). Topsoil was not placed in the low-flow channel section of the work area (described in Section 8).

As mentioned in Section 6.1, the work area for fill placement was established by surveying the wick area in 2000 and comparing ground contours with 1989 post-reclamation contours. The work area included the wick area as well as some adjacent, surrounding areas that had settled since 1989 (Figure 6.2). Final grades in the work area were checked by surveying the completed surface in 2001 (shown in Figure 7.4). Selected transects outside of the work area were surveyed in 2000 and 2001 and compared with 1989 topography (shown in Figure 7.4). This survey work confirms that the 2000-2001 fill placement brings the reclaimed tailings basin surface to grades and slopes consistent with WWL (1989a).



NOTE:

TOPOGRAPHY FROM 1989 AERIAL PHOTOGRAPHY BY HORIZONS, INC.

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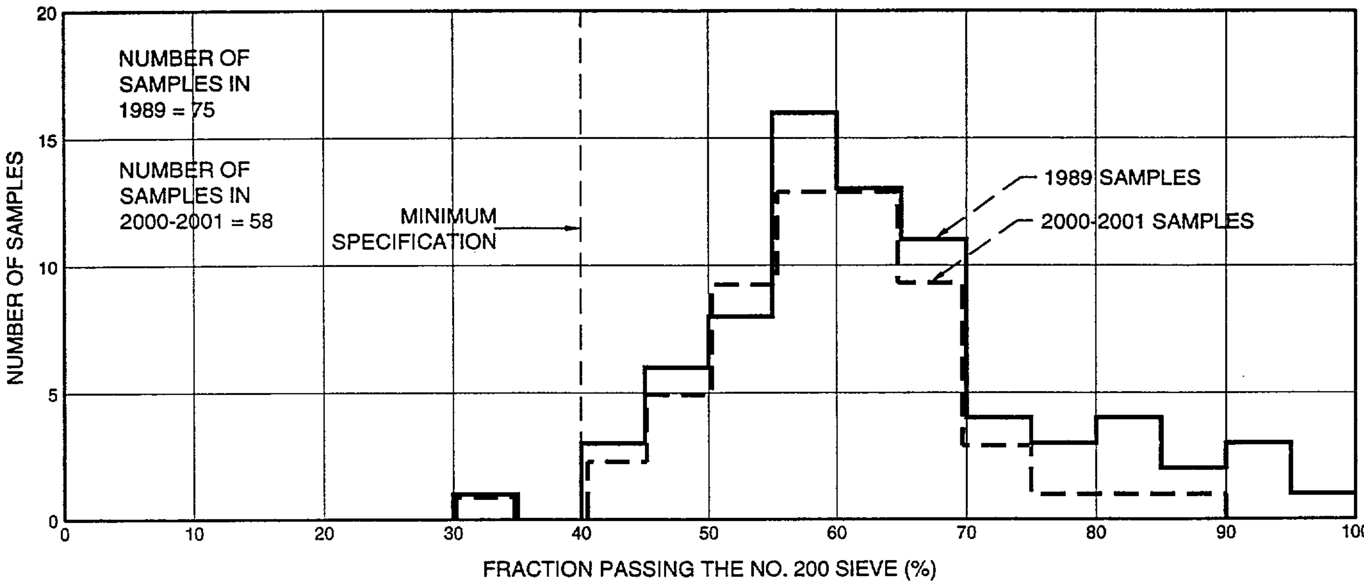
FIGURE 7.1
WORK AREA LAYOUT AND
CONSTRUCTION CONTROL GRID

Date:	MAY 2002
Project:	100548-2
File:	TAILFIG-1A



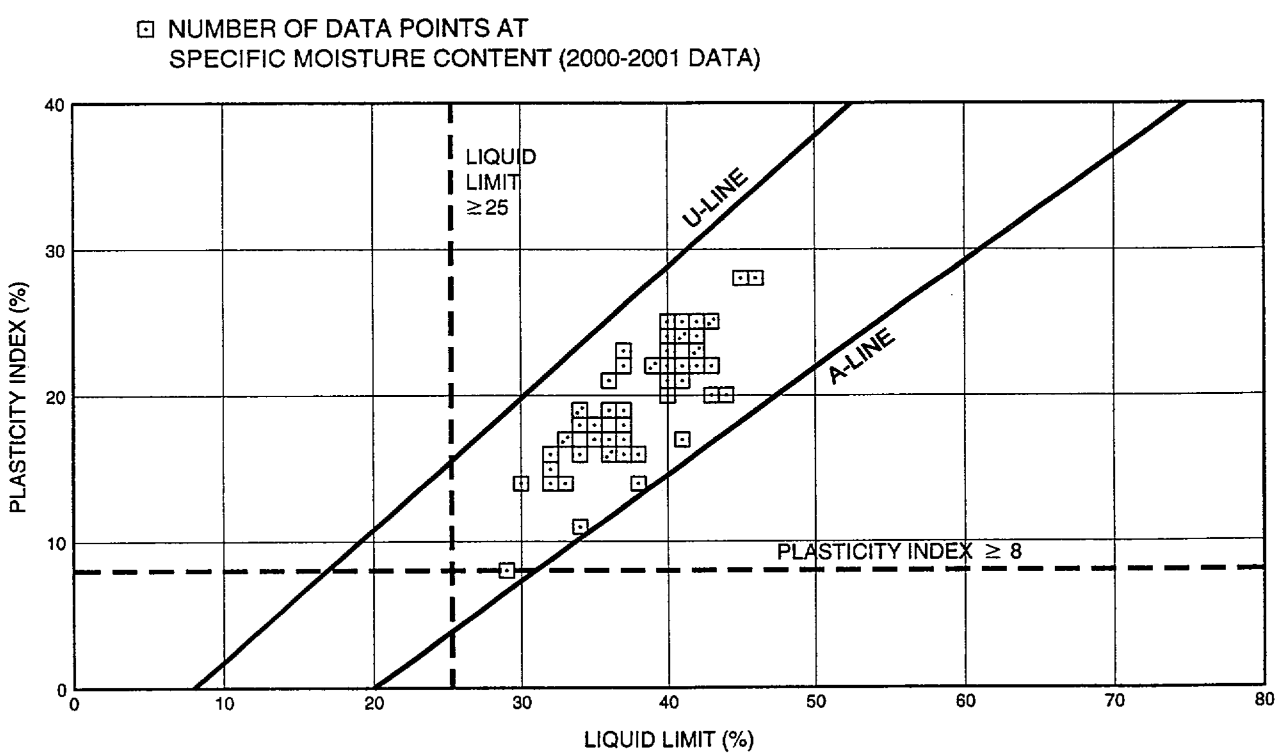


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FIGURE 7.2
COVER MATERIAL UPDATED
INDEX TEST RESULT SUMMARY

Date:	MAY 2002
Project:	100548-2
File:	PLASTICITY.dwg

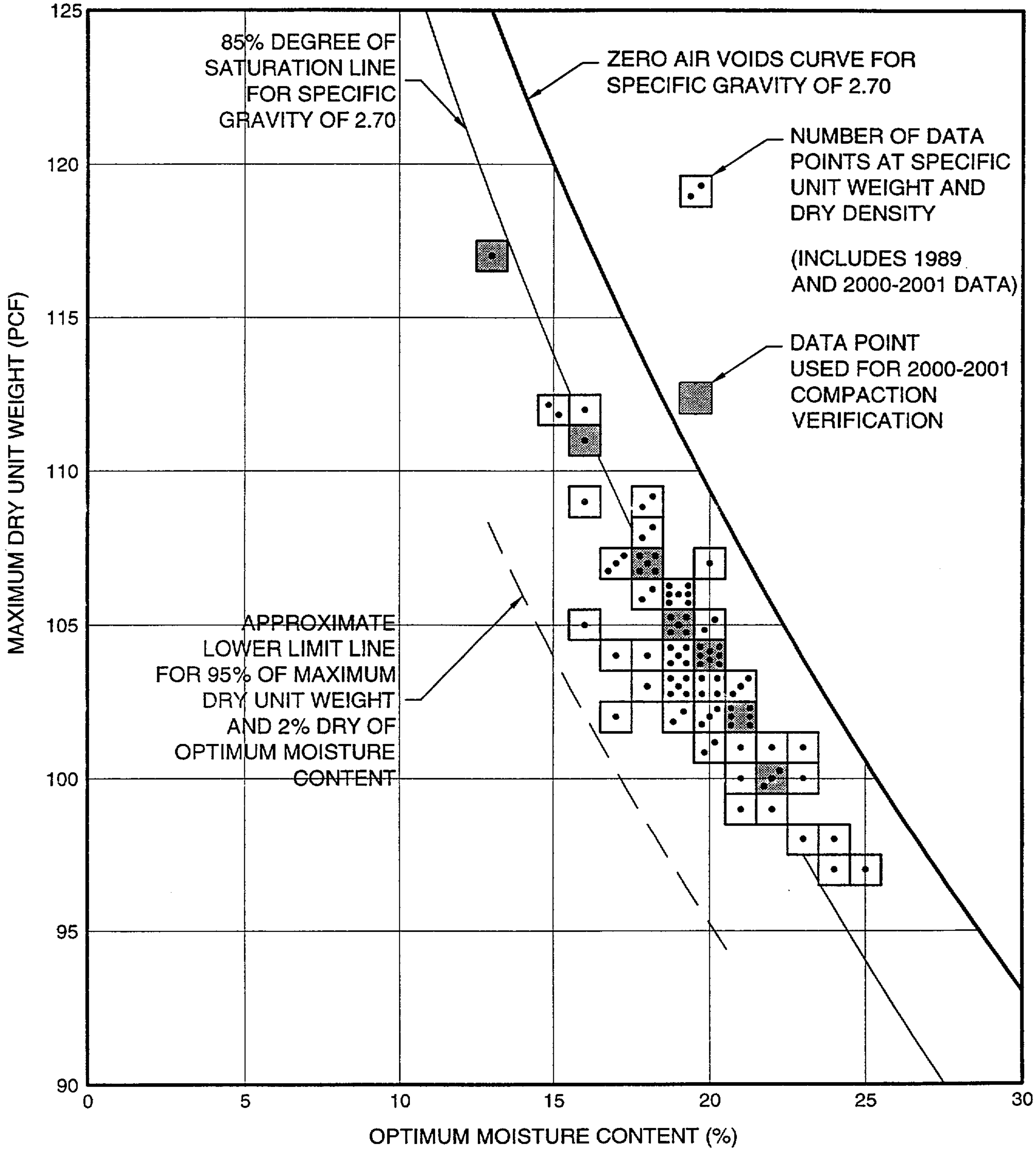

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FIGURE 7.3
UPDATED COVER MATERIAL
STANDARD PROCTOR TEST SUMMARY

Date:	MAY 2002
Project:	100548-2
File:	PROCTOR-TEST.dwg

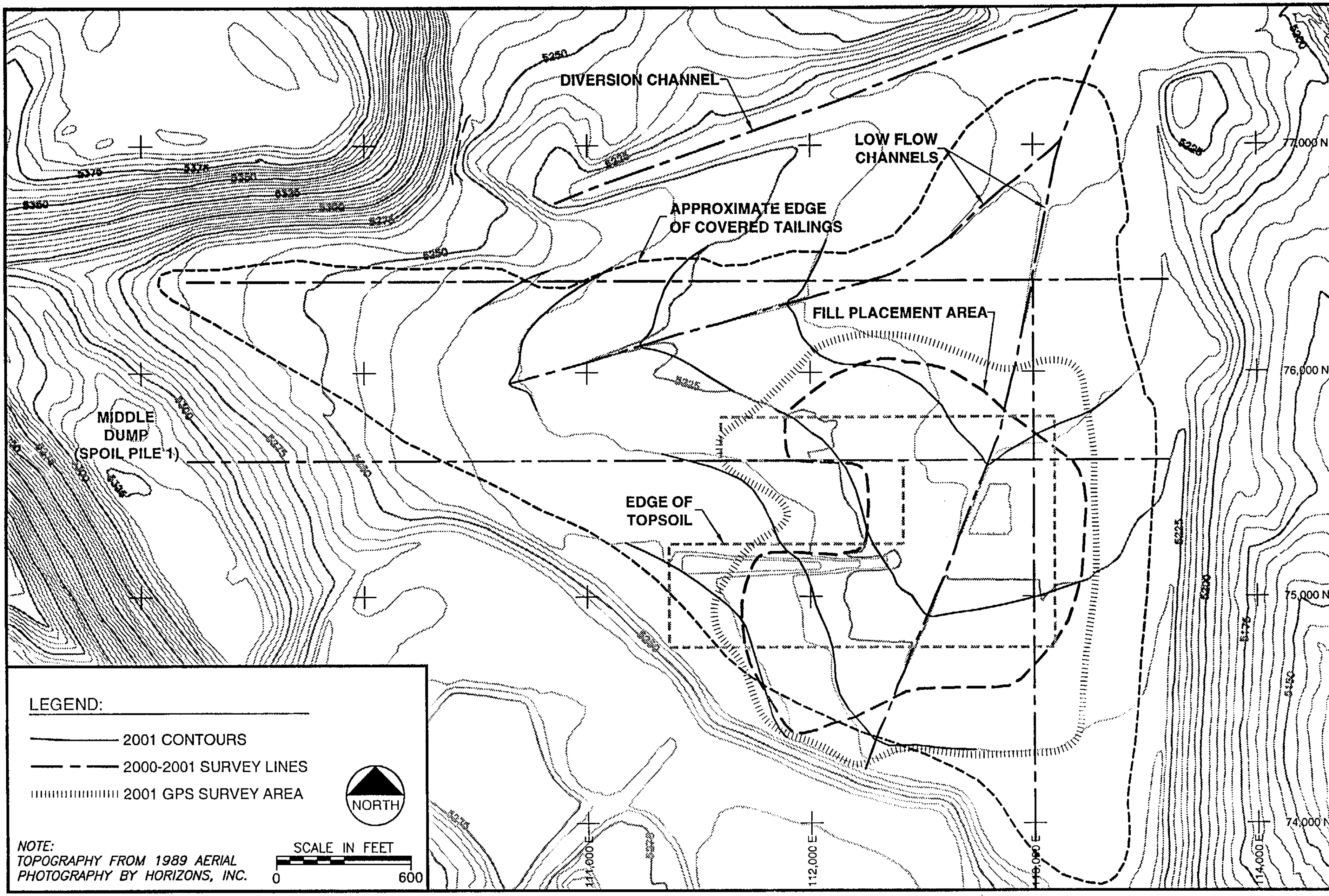

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FIGURE 7.4
RECLAIMED TAILINGS BASIN CONTOURS
AT COMPLETION OF WORK IN 2001

Date:	MAY 2002
Project:	100548\2
File:	TAIL-REC.dwg

8.0 EROSION PROTECTION MATERIALS

This section summarizes the status of erosion protection materials on the surfaces of the reclaimed tailings basin.

8.1 Vegetation

Establishment of vegetation on the reclaimed tailings basin surfaces was started in 1989, using the procedures and the species lists for specific areas documented in Appendix E of WWL (1984). These procedures and species lists were developed from previous testing by Exxon at the Highland site and discussions with the U.S. Soil Conservation Service (in the early 1980's). The species lists in WWL (1984) were also used for revegetation of the Highland mine area.

As described in Section 7.3, the area disturbed by fill placement work in 2000 and 2001 was covered with topsoil in 2001. Seeding of these areas was conducted in late 2001 and early 2002, dictated by more favorable soil moisture conditions using a seed mix consistent with the species lists in WWL (1984).

The vegetated surfaces on the top of the tailings basin and on the reclaimed embankment slope after over 10 years of observation (shown on the photographs in Appendix A) is stable and performing as expected. The acceptable recovery of plant species on the tailings basin after the 1996 prairie fire is discussed in Abt and others (1997) and NRC (1998a).

8.2 Embankment Crest Material

As mentioned in Section 4.3, a strip of minus 1.5-inch size rock from an off-site source was placed along the crest of the recontoured tailings embankment (on top of the topsoil) in late 1989. Particle-size distribution testing of the rock in 1991 shows that the placed rock meets specifications (summarized in Figure 4.4). The embankment crest rock has shown no degradation, erosion, or other significant changes since its placement in 1989 (shown on the photographs in Appendix A) despite being in an exposed area subject to high winds.

8.3 Western Limb Material

As mentioned in Section 4.3, a zone of minus 3-inch rock from an off-site source was placed on top of the radon barrier in the western limb area of the tailings basin in 1989 and 1990. Topsoil was placed on top of the rock and worked into the rock void spaces to form a minimum six-inch thick layer of rock mulch. Particle-size distribution testing of the rock in 1989, 1990, and 1992 showed that the placed rock met specifications (summarized in Figure 4.5), as well as rock mulch thickness and composition requirements.

The western limb rock mulch has shown no degradation, erosion, or other significant changes since its placement and blending in 1989 to 1991. Vegetation and accumulation of windblown soil has covered the rock mulch, making the western limb surface difficult to distinguish from the surrounding vegetated areas (shown on the photographs in Appendix A).

8.4 Low-Flow Channel Rock Mulch

As mentioned in Section 4.3, a zone of minus 8-inch rock from an off-site source was placed in the side slopes and bottom of the low-flow channels in 1990. The off-site source for all of the rock placed in the tailings basin was a gravel pit near Douglas, Wyoming. Topsoil was placed on top of the rock and worked into the rock void spaces to form a minimum six-inch thick layer of rock mulch. Particle-size distribution testing in 1991 (prior to mixing with topsoil) showed that the placed rock met specifications (summarized in Figure 4.6) for the rock component of the rock mulch material.

Rock and topsoil were placed in the entire reach of the western low-flow channel and in the lower and extreme upper reaches of the southern low-flow channel in 1990. The reach of the southern low-flow channel through the wick area was not constructed, and low-flow channel rock for this reach of channel was stockpiled on site in 1990 (shown in Figure 8.1). The low-flow channel rock mulch from the upper reach of the southern low-flow channel was removed and placed on the low-flow channel rock stockpile in 2000, in order to place fill in the area to reach design grades (Figure 8.1).

In June 2001, the stockpiled low-flow channel rock was placed in the upper reach of the southern low-flow channel (from location LFCT6 south, Figure 8.1). Due to the amount of windblown soil that had accumulated in the rock stockpile since 1990 and the amount of topsoil in the rock mulch excavated in 2000, the low-flow channel rock was placed in the channel without additional topsoil (shown in the photos in Appendix A).

In August 2001, backhoe trenches were excavated across selected new and old reaches of the southern and western low-flow channels. The 2001 backhoe trench locations are shown in Figure 8.1, along with the 1991 low-flow channel rock sample locations (described in Section 4.3). At each 2001 trench location, the low-flow channel rock mulch width and thickness was checked with design widths and thickness (in WWL, 1989a). The results are summarized in Table 8.1. This checking showed that the channel and rock mulch width was consistent with channel design widths, and that the rock mulch thickness was consistently several inches thicker than the six-inch minimum value in the specifications.

At selected trench locations, a representative rock mulch sample was collected for grain-size distribution and durability testing. In order to check the grain-size distribution of the low-flow channel rock, the specifications for the rock component of the rock mulch (Figure 4.6) were adjusted to include the soil component of the rock mulch. These adjusted rock mulch specifications (shown in Figure 8.2) are based on 30 to 60 percent by weight finer than one-inch size. The original rock component of the rock mulch was calculated to have approximately 10 percent finer than one-inch size (Figure 4.6). The adjusted specifications were based on soil addition or accumulation of as much as 50 percent of the rock volume. The tested rock mulch sample results (Figure 8.2) show general compliance with the adjusted specifications. Furthermore, the grain-size distribution of the rock mulch placed in 2001 is not significantly different from rock mulch from areas of the low-flow channel constructed in 1990 and 1991 (Figure 8.2).

8.5 Rock Durability

The rock for the areas described above was tested for durability prior to placement on site in 1990, and met applicable criteria for durability at that time (Nelson and others, 1986). These test

results were compared with the currently accepted durability criteria (outlined in NRC, 1990). Rock quality scoring under current criteria ranged from 84 to 90 percent, with 80 percent the minimum criterion without oversizing (NRC, 1990).

The rock from three composite low-flow channel trench samples (collected by Shepherd Miller in August 2001) was tested for durability. The rock quality scores from these samples ranged from 85 to 91 percent (Appendix E), and confirms the results of previous durability testing of this rock.

Table 8.1 2001 Low-Flow Channel Evaluation Summary[a]

Trench No.[b]	Low-Flow Channel	Sample Collected	Rock Mulch Width (ft)[c]	Design Width (ft)	Rock Mulch Thickness (in)[d]	Design Thickness (in)	Comments
LFCT 1	South	-	21	20	12	6	South end of new channel
LFCT 2	South	-	21	20	11	6	-
LFCT 3	South	x	20	20	13	6	-
LFCT 4	South	x	22	20	10	6	-
LFCT 5	South	-	21	20	10	6	-
LFCT 6	South	x	20	20	13	6	North end of new channel
LFCT 7	South	x	25	20	12	6	South end of old channel
LFCT 8	West	x	20	20	11	6	Surface well vegetated
LFCT 9	West	x	20	20	11	6	Surface well vegetated

[a] Evaluation conducted by Shepherd Miller and Pronghorn Pump and Repair personnel, August 30, 2001
[b] Locations shown on Figure 8.1
[c] Taped distance between edges of rock mulch
[d] Nominal depth from channel surface to lower extent of rock

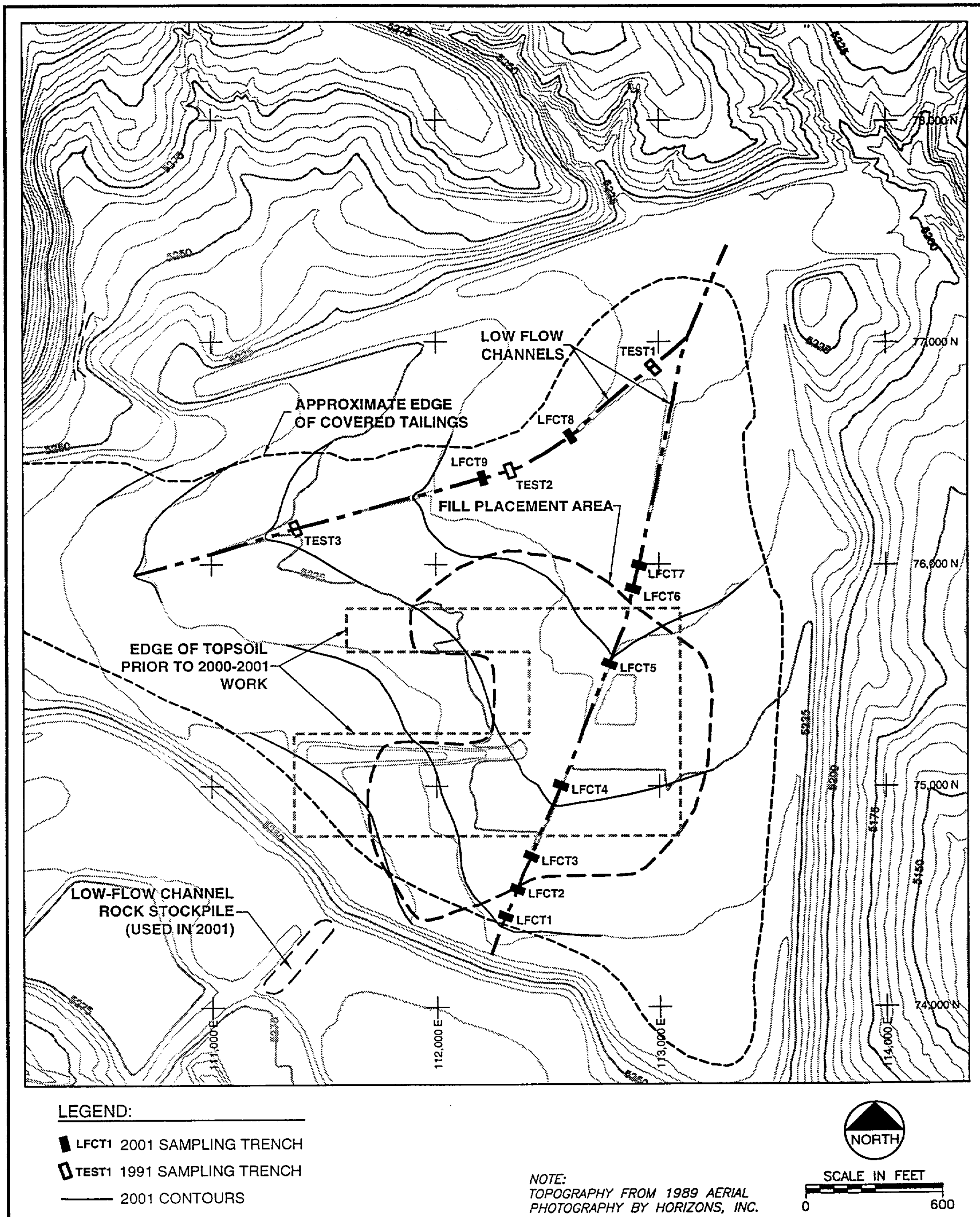

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FIGURE 8.1
LOW-FLOW CHANNELS AND
ROCK SAMPLING LOCATIONS

Date:	MAY 2002
Project:	100548\2
File:	TAIL-REC.dwg

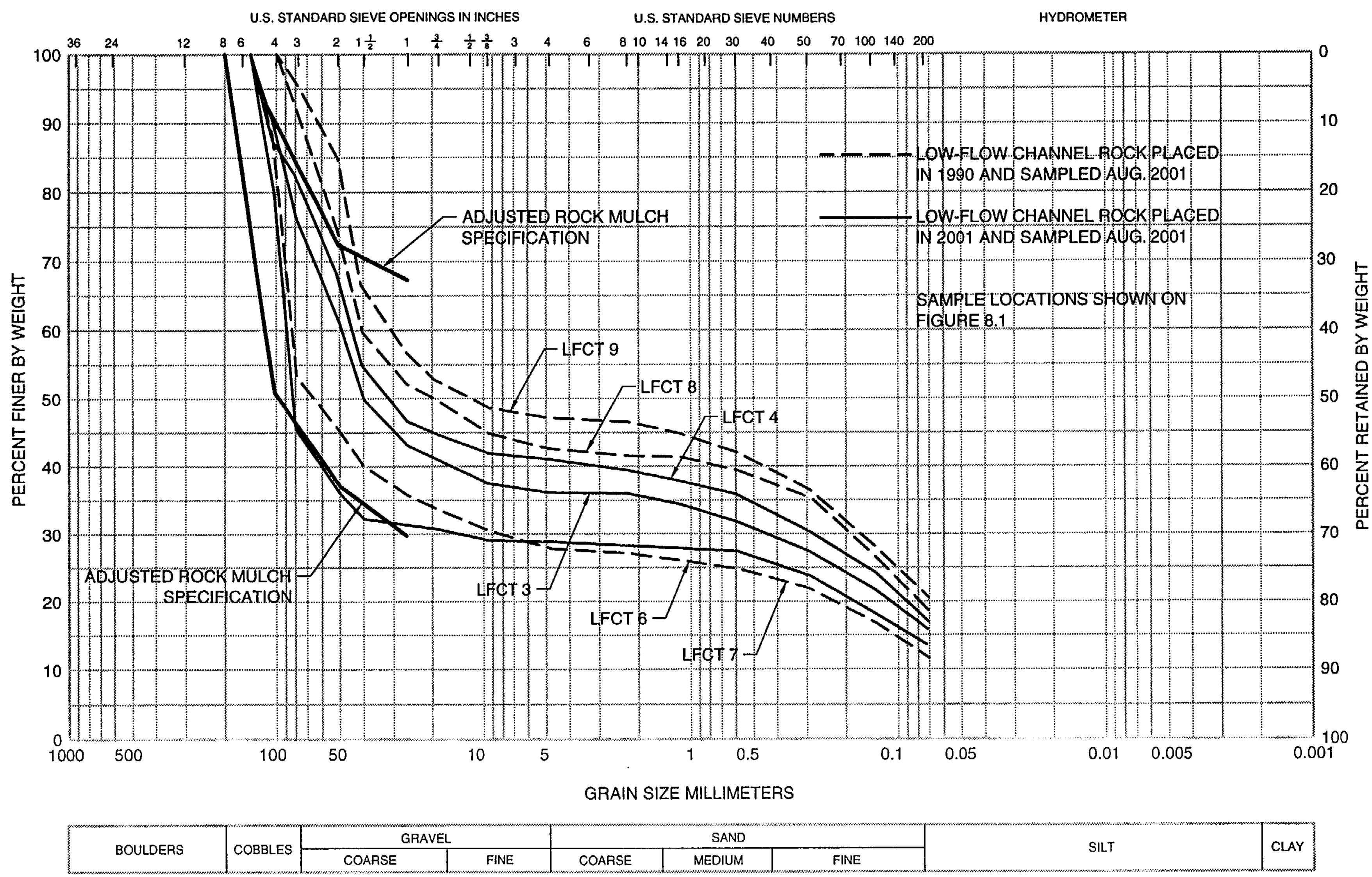

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FIGURE 8.2
LOW-FLOW CHANNEL ROCK MULCH GRAIN-SIZE DISTRIBUTION

Date:	MAY 2002
Project:	100548-2
File:	GSD-02.DWG

9.0 MONITORING AND LONG-TERM EROSIONAL STABILITY

This section reviews the key surface monitoring and long-term erosional stability issues associated with the reclaimed tailings basin, for evaluation of future tailings basin property transfer to the U.S. Department of Energy. The performance criteria for the reclaimed tailings basin are those outlined in Appendix A of 10 CFR 40, as well as specific conditions in the Radioactive Materials License with NRC (SUA-1139).

9.1 Embankment Slope

As mentioned in Section 1.2, tailings were discharged at the head of a valley behind a zoned earth embankment. The embankment was incorporated into the tailings basin reclamation plan as a sacrificial slope that was regraded to 5:1 at the top of the slope and 9:1 over the toe of the original embankment (Section 4.1). A strip of rock was placed on the reclaimed embankment crest for supplemental erosion protection as part of final design review by NRC (Section 8.2).

Inspection of the reclaimed embankment slope has shown acceptable performance for erosional stability (shown in the photos in Appendix A). Two areas of minor gullying (observed initially by Exxon in 1991) at the northern and southern groin areas of the reclaimed embankment have stabilized (Section 5.4). In 1998, NRC concluded that the reclaimed embankment slope meets long-term stability requirements (NRC, 1998b).

9.2 Cover Surface

As outlined in WWL (1984, 1985), the tailings basin cover configuration reflected the tailings discharge history and final configuration, as well as provision for erosional stability. The reclaimed basin surface has vegetated slopes ranging from approximately 0.5 to 2.0 percent, with the basin draining to a spillway over shale bedrock at the north abutment of the reclaimed tailings embankment. Drainage is conveyed over the reclaimed tailings basin surface to the spillway through two drainage channels (Figure 8.1). In 1998 NRC concluded that the vegetated surface areas of the cover and the associated reclamation design meet long-term stability requirements (NRC, 1998a).

The tailings basin cover was constructed in two stages (as described in Sections 4 and 6), with the second stage completed in 2001 to fill in an area of expected settlement and return the cover surface to design grades. Surveying in 2001 (with results shown in Figure 7.4) shows current topographic contours consistent with design grades (from WWL, 1989a).

9.3 Western Limb

During final design review of the drainageways on the cover surface, Exxon agreed to place a rock mulch layer on the cover surface of the western limb area of the tailings basin (Figure 4.1). The rock mulch was placed and tested as outlined in Section 4.3. The erosional stability performance of the western limb rock mulch has been acceptable, with accumulation of soil on the vegetated rock mulch surface (Section 8.3).

9.4 Low-Flow Channels

Along with the western limb rock mulch, the two drainageways on the cover surface were modified to accommodate low-flow drainage channels lined with rock mulch. The low-flow channels were designed to collect and convey drainage as well as to provide erosional stability for the peak runoff from the PMP. The erosion protection materials for the low-flow channels were conservatively sized to be erosionally stable for the peak flow from the PMP in the area of the channel with the greatest depths of flow and highest velocities.

The low-flow channels were constructed in two stages, with the majority of the channels completed in 1991, and the remaining length completed in 2001 (Figure 8.1). Evaluation of the rock mulch in both the new and old reaches of the low-flow channels shows acceptable grades, dimensions, and rock mulch grain-size distributions (Section 8.4). Observation of the low-flow channels since 1991 has shown acceptable erosional stability, with accumulation of soil on the vegetated rock mulch surface (shown on the photos in Appendix A).

9.5 South Slopes and Setback

As mentioned in Section 2.2, a slope setback was included in the cover design along the overburden slope at the southern edge of the tailings basin (Figure 4.1). The setback was

excavated into overburden to allow runoff from the overburden slopes to decrease in velocity prior to flowing over the tailings basin cover. Observation of this slope and the area at the toe of the slope has shown acceptable erosional stability (shown on the photos in Appendix A).

9.6 North Diversion Channel

The north diversion channel was designed to divert runoff from the natural slopes north of the tailings basin away from the reclaimed tailings basin, by conveying this runoff to the east over the tailings basin spillway (Figure 4.1). The diversion channel has shown acceptable erosional stability (shown on the photos in Appendix A).

Two minor areas of minor sediment deposition have been observed in the bottom of the channel since its construction in 1989. These areas are located where natural drainages to the north discharge into the channel, and were first noticed after the prairie fire and thunderstorm in 1996 (Section 5.3). The lower reaches of the two drainages that are producing this sediment were filled in 1989 as part of north diversion channel construction (Figure 3.1). Exxon Mobil has evaluated regrading or adding erosion protection materials in these two drainages immediately above the diversion channel. However, hydraulic analyses under peak runoff conditions from the PMP show that the north diversion channel provides acceptable performance. Even with significant sediment accumulation in the north diversion channel and subsequent overflow from the north diversion channel onto the cover surface, runoff velocities on the cover surface from the PMP do not reach values that would cause erosion (SM, 2002).

9.7 Additional Performance Monitoring

In the post-closure monitoring period prior to property transfer, continuation of current monitoring tasks and additional testing tasks are planned by Exxon Mobil. These tasks are outlined below.

1. Measurement of radon flux from the tailings basin cover surface, using EPA procedures outlined in 40 CFR 61, Subpart T, Method 115.

2. Continued measurement of settlement monitoring points (shown in Figure 5.1) on a quarterly basis.

3. Continued inspection of vegetation coverage and productivity on the tailings basin surface and embankment slopes, as well as surrounding overburden and natural slopes draining to the tailings basin.

4. Continued inspection of the rock and rock mulch-covered surfaces on the tailings basin and embankment crest surfaces, as well as inspection of vegetated surfaces for significant erosion, gullying, or signs of runoff concentration.

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APPENDIX A

PHOTOGRAPHS

List of Photographs

A.1.1 Tailings basin pond at start of reclamation work.

A.1.2 Tailings basin with spray evaporation system.

A.2.1 Southwest corner of tailings basin with evaporation ponds and spray system. Future wick area is on the right side of the photo.

A.2.2 Wick area, with end of vertical band drains (wicks) showing above random fill surface.

A.3.1 Radon barrier material excavated from Middle Dump during 1989 construction.

A.3.2 Random fill placement (at left) and radon barrier placement (at right) during 1989 construction. The Middle Dump borrow area is in the distant center of the photo.

A.4.1 Moisture conditioning of radon barrier material during 1989 construction.

A.4.2 Compaction of radon barrier material during 1989 construction.

A.5.1 Looking southward up the south low-flow channel from junction with west low-flow channel. Chahave been shaped and topsoil placed to edge of channel prior to rock placement. One of the cover soil stockpiles is on the right side of the photo.

A.5.2 Looking northward down south low-flow channel. The edge of topsoil placement and the wick area is the gray area in the center of the photo.

A.6.1 Radon barrier placement during 2000-2001 construction. Water storage tanks are at left and the left and the Middle Dump borrow area is in the distance.

A.6.2 Looking toward fill placement area from middle Dump borrow area during 2000-2001 construction. Typical Middle Dump materials are in the foreground.

A.7.1 Random fill placement during 2000-2001 construction at left side of photo. Temporary topsoil stockpile is at right side of photo.

A.7.2 Looking south along eastern side of fill placement area in 2001, showing transition between existing vegetated cover and new topsoil. Part of the slope setback area can be seen in the distance.

A.8.1 Regraded Middle Dump borrow area and haul road after 2000-2001 construction. Fill placement area and water storage tanks are in the distance.

A.8.2 Looking up west low-flow channel toward western limb and reclaimed Middle Dump borrow area after 2000-2001 construction.

A.9.1 Looking up south low-flow channel across fill placement area after 2000-2001 construction. Old portion of south low-flow channel is in foreground.

A.9.2 Looking northwest across fill placement area after 2000-2001 construction. Final grading of topsoil is taking place. The first lift of rock in the south low-flow channel is in the foreground.

A.10.1 Reclaimed embankment (looking north), with rock-covered crest on left and downstream slope on right.

A.10.2 Reclaimed tailings basin looking northwest, with North Dump and North Diversion Channel in the distance.

A.11.1 Final topsoil grading.

A.11.2 Topsoil Stockpile 25 area.

A.12.1 Looking south at south low-flow channel.

A.12.2 Looking north at south low-flow channel.

A.13.1 Looking north down south low-flow channel, with accumulation of windblown soil in channel.

A.13.2 Looking south up south low-flow channel, with trench to check rock layer thickness and particle-size distribution.

A.14.1 Trench across old section of south low-flow channel, checking rock layer thickness and particle-size distribution.

A.14.2 Trench across section of west low-flow channel (looking east).

A.15.1 Looking up west low-flow channel (looking west). The western limb and Middle Dump borrow area are in the distance.

A.15.2 Upper end of North diversion channel (looking east).

Photo A.1.1 Tailings basin pond at start of reclamation work. (Jul 1987)

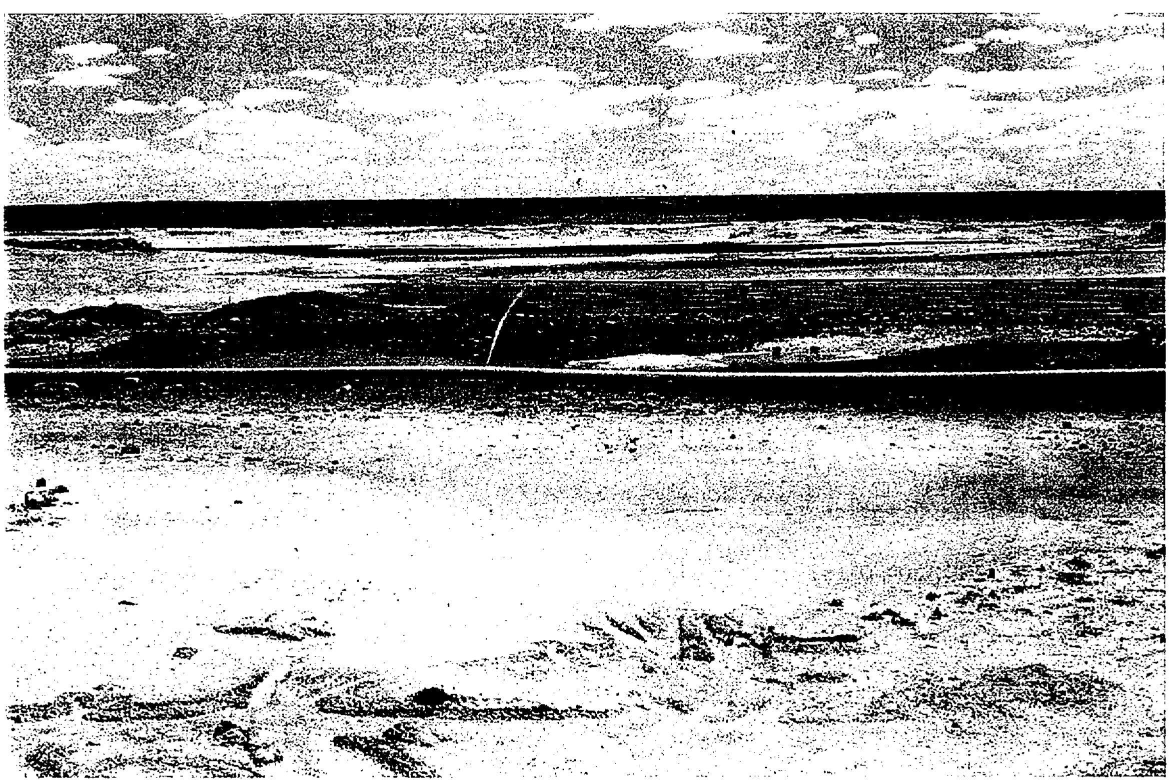


Photo A.1.2 Tailings basin with spray evaporation system. (Jul 1987)

Photo A.2.1 Southwest corner of tailings basin with evaporation ponds and spray system. Future wick area is on the right side of the photo. (Oct 1986)

Photo A.2.2 Wick area, with end of vertical band drains (wicks) showing above random fill surface. (Jun 1989)

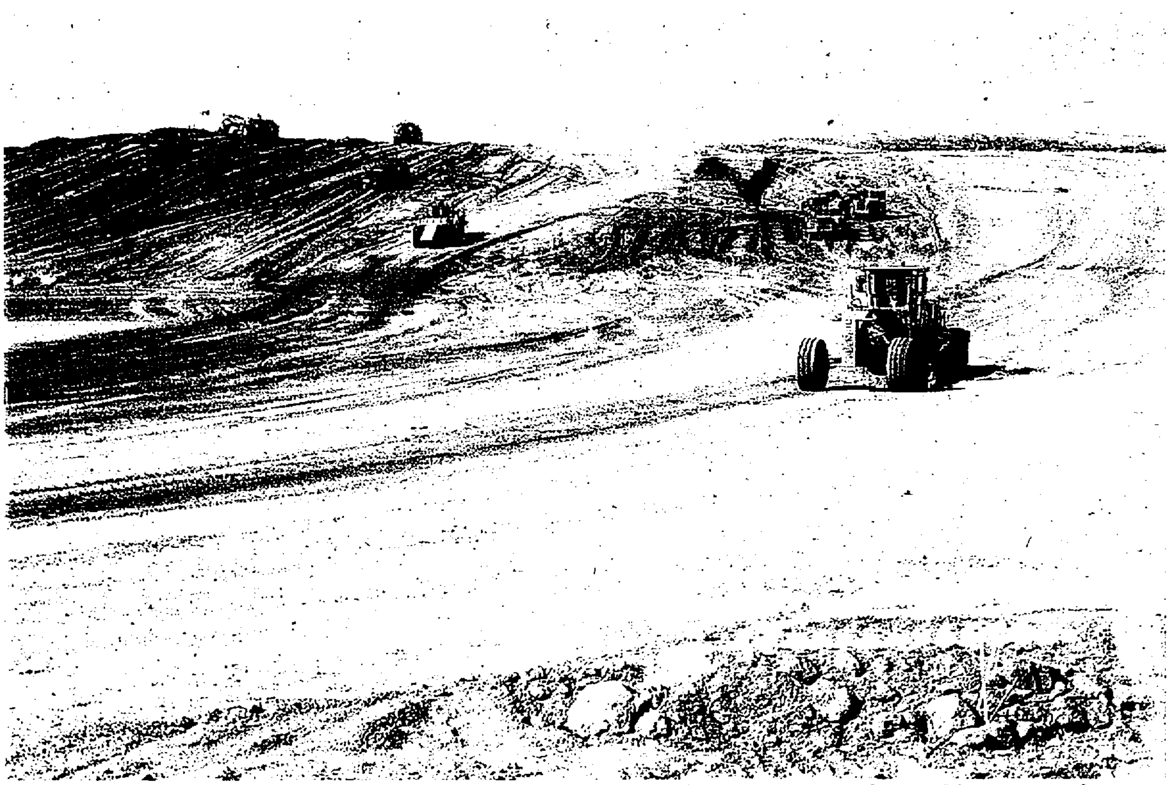


Photo A.3.1 Radon barrier material excavated from Middle Dump during 1989 construction. (Jul 1989)

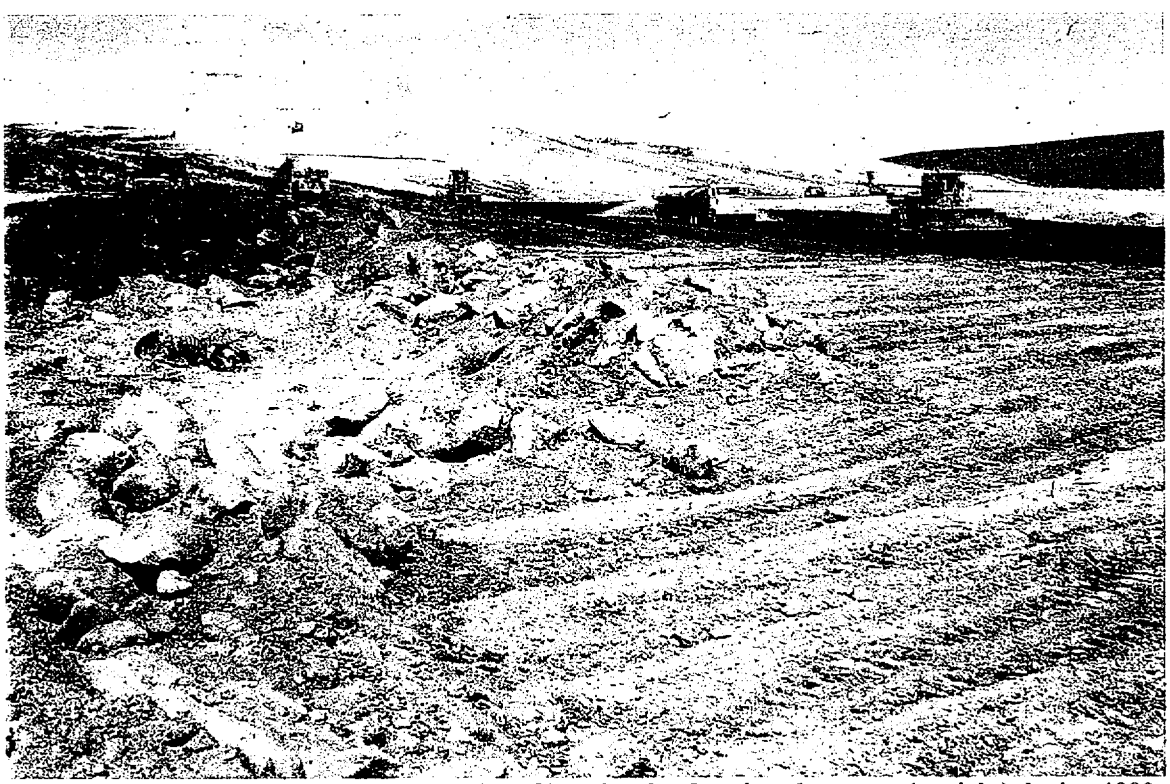


Photo A.3.2 Random fill placement (at left) and radon barrier placement (at right) during 1989 construction. The Middle Dump borrow area is in the distant center of the photo. (Jul 1989)

Photo A.4.1 Moisture conditioning of radon barrier material during 1989 construction. (Jul 1989)

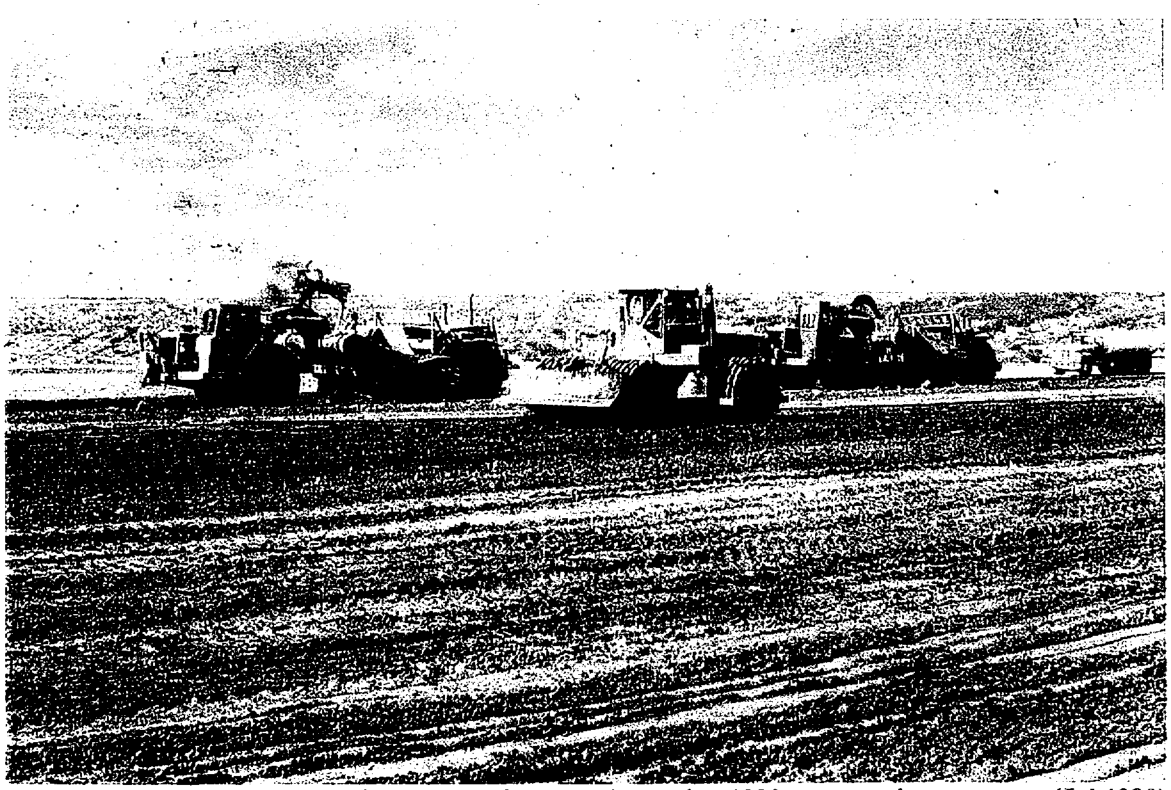


Photo A.4.2 Compaction of radon barrier material during 1989 construction. (Jul 1989)

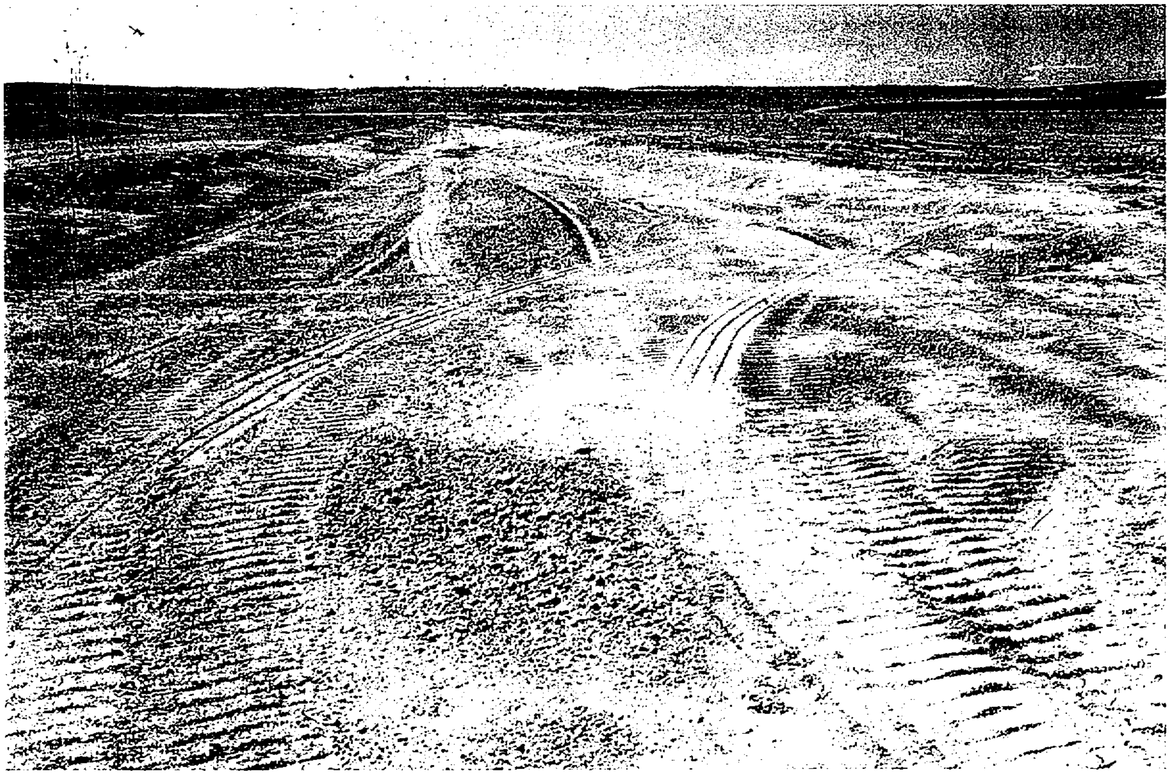


Photo A.5.1 Looking southward up the south low-flow channel from junction with west low-flow channel. Channels have been shaped and topsoil placed to edge of channel prior to rock placement. One of the cover soil stockpiles is on the right side of the photo. (Sep 1989)

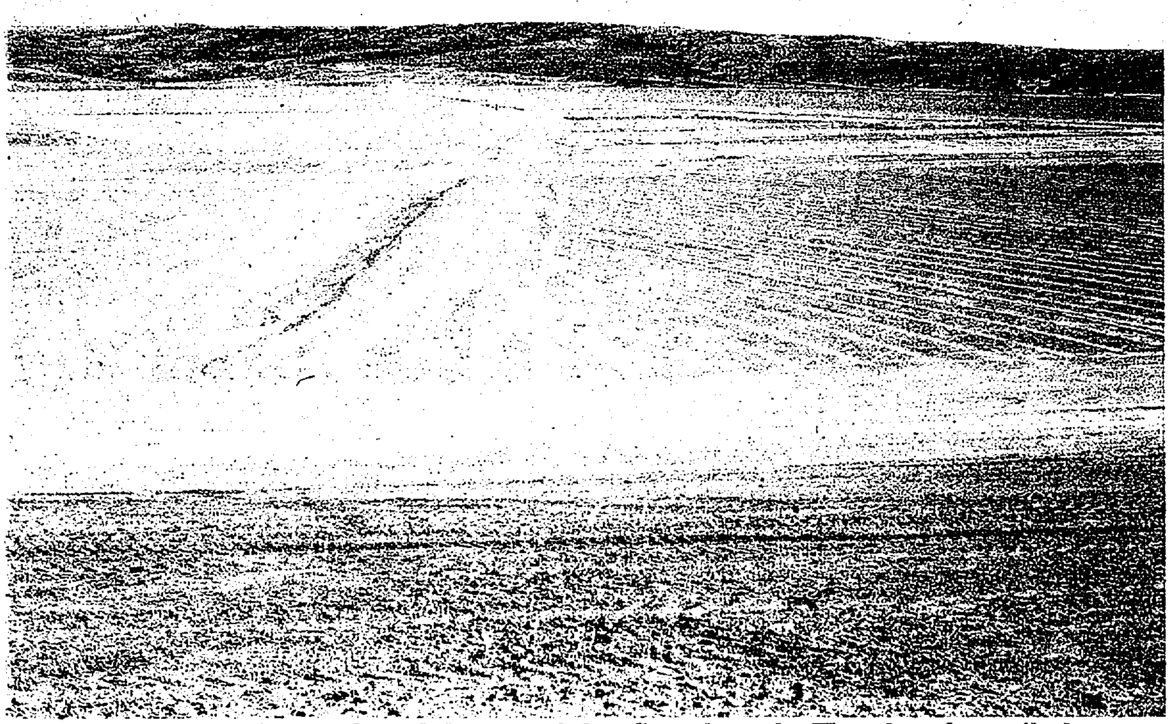


Photo A.5.2 Looking northward down south low-flow channel. The edge of topsoil placement and the wick area is the gray area in the center of the photo. (Sep 1989)

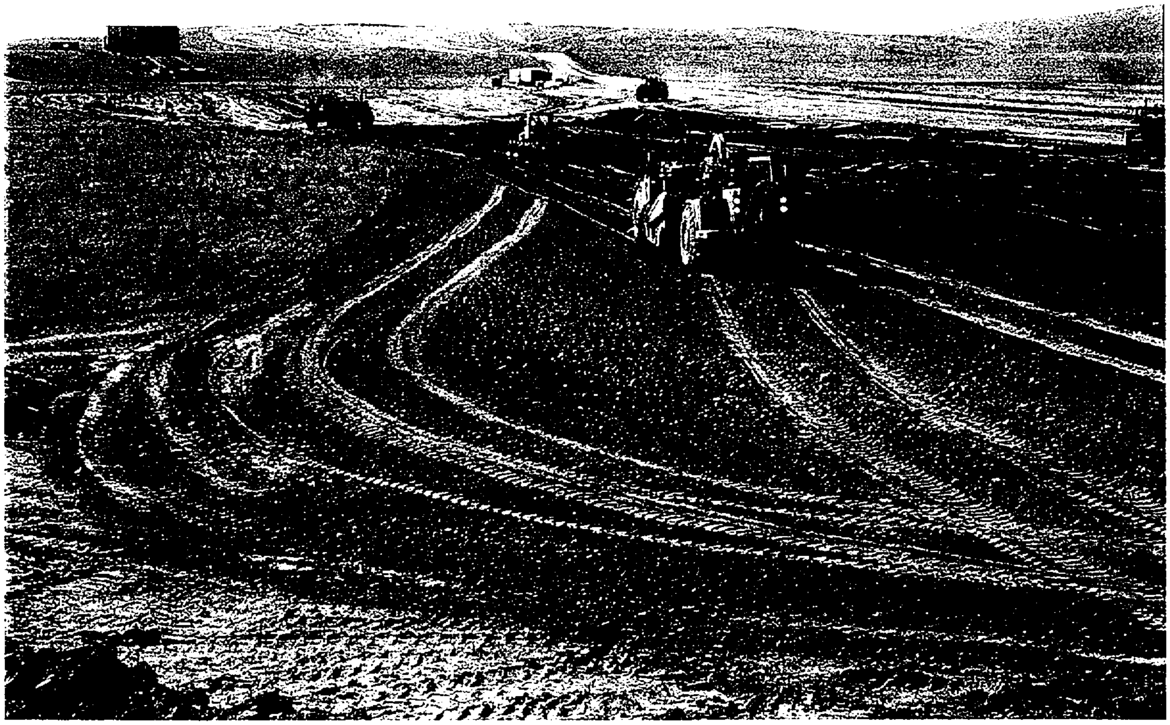


Photo A.6.1 Radon barrier placement during 2000-2001 construction. Water storage tanks are at left and the Middle Dump borrow area is in the distance. (Apr 2001)

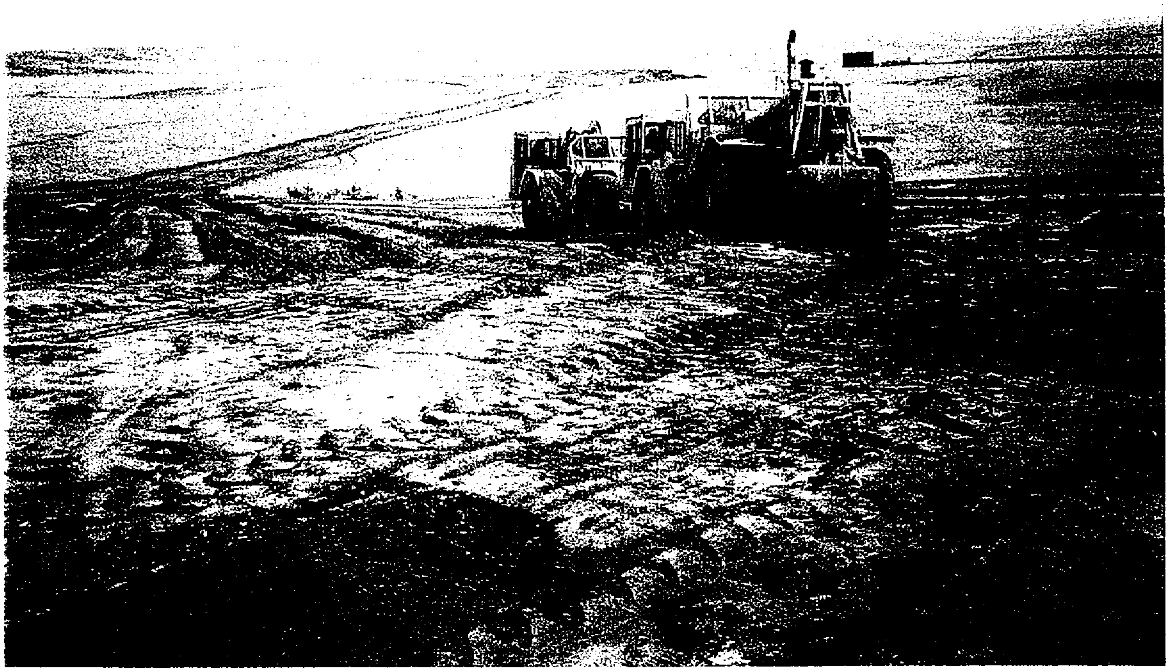


Photo A.6.2 Looking toward fill placement area from Middle Dump borrow area during 2000-2001 construction. Typical Middle Dump materials are in the foreground. (Nov. 2000)

Photo A.7.1 **Random fill placement during 2000-2001 construction at left side of photo. Temporary topsoil stockpile is at right side of photo. (Apr 2001)**

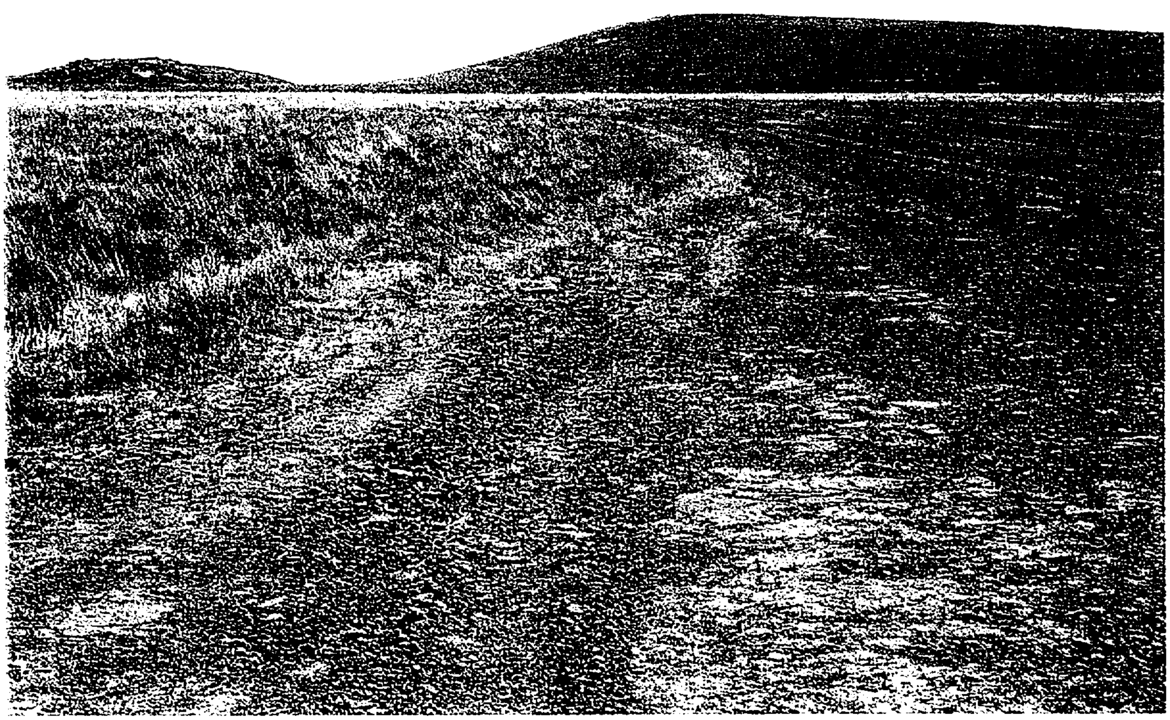


Photo A.7.2 **Looking south along eastern side of fill placement area in 2001, showing transition between existing vegetated cover and new topsoil. Part of the slope setback area can be seen in the distance. (Jun 2001)**

Photo A.8.1 Regraded Middle Dump borrow area and haul road after 2000-2001 construction. Fill placement area and water storage tanks are in the distance. (Jun 2001)

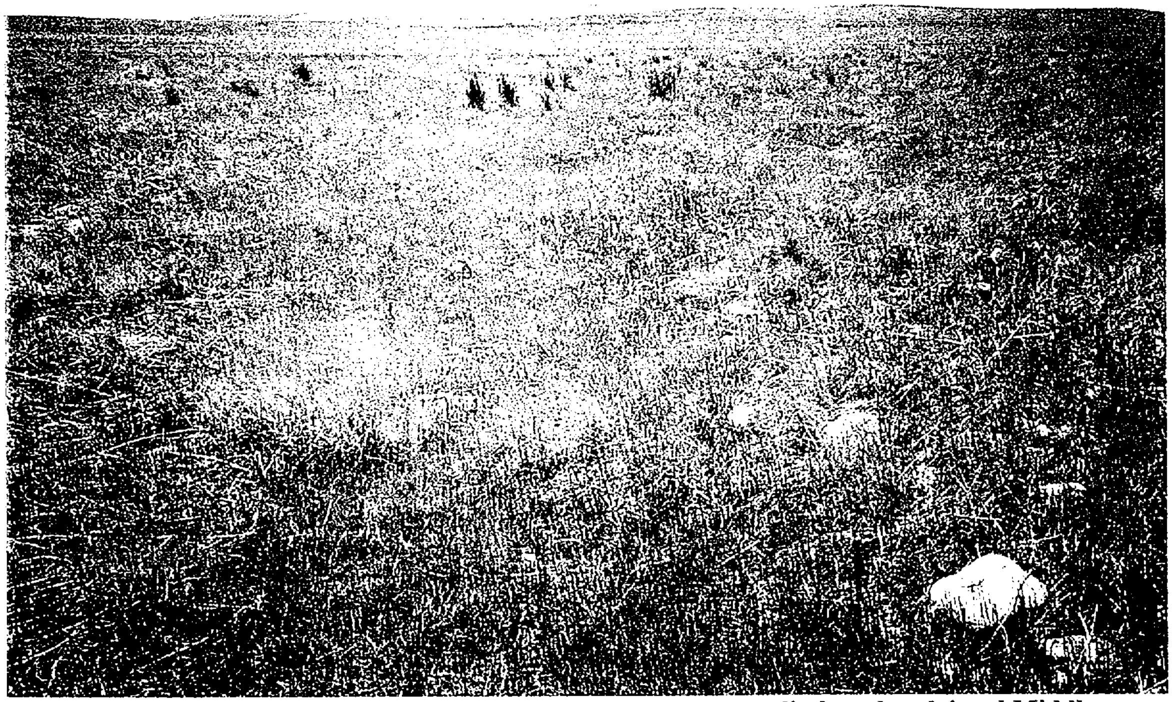


Photo A.8.2 Looking up west low-flow channel toward western limb and reclaimed Middle Dump borrow area after 2000-2001 construction. (Jun 2001)

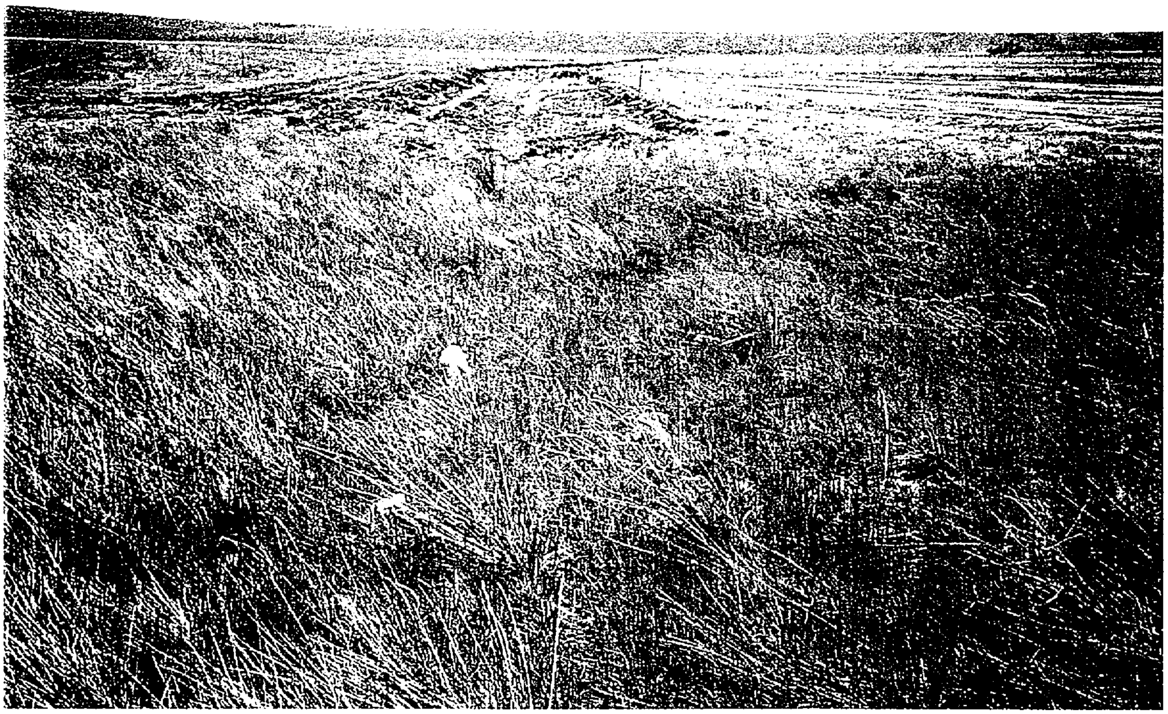


Photo A.9.1 Looking up south low-flow channel across fill placement area after 2000-2001 construction. Old portion of south low-flow channel is in foreground. (Jun 2001)

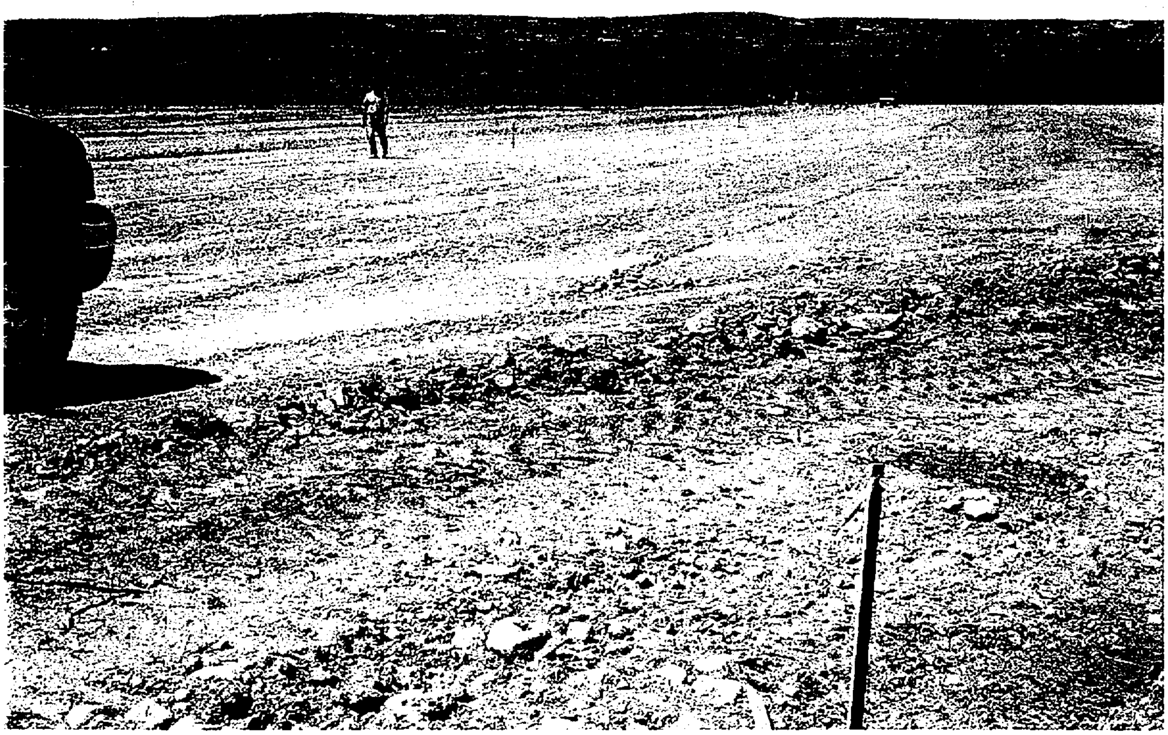


Photo A.9.2 Looking northwest across fill placement area after 2000-2001 construction. Final grading of topsoil is taking place. The first lift of rock in the south low-flow channel is in the foreground. (Jun 2001)

Photo A.10.1 Reclaimed embankment (looking north), with rock-covered crest on left and downstream slope on right. (Oct 2000)

Photo A.10.2 Reclaimed tailings basin looking northwest, with North Dump and North Diversion Channel in the distance. (Oct 2000)

Photo A.11.1 Final topsoil grading. (Jun 2001)

Photo A.11.2 Topsoil Stockpile 25 area. (Jun 2001)

Photo A.12.1 Looking south at south low-flow channel. (Jun 2001)

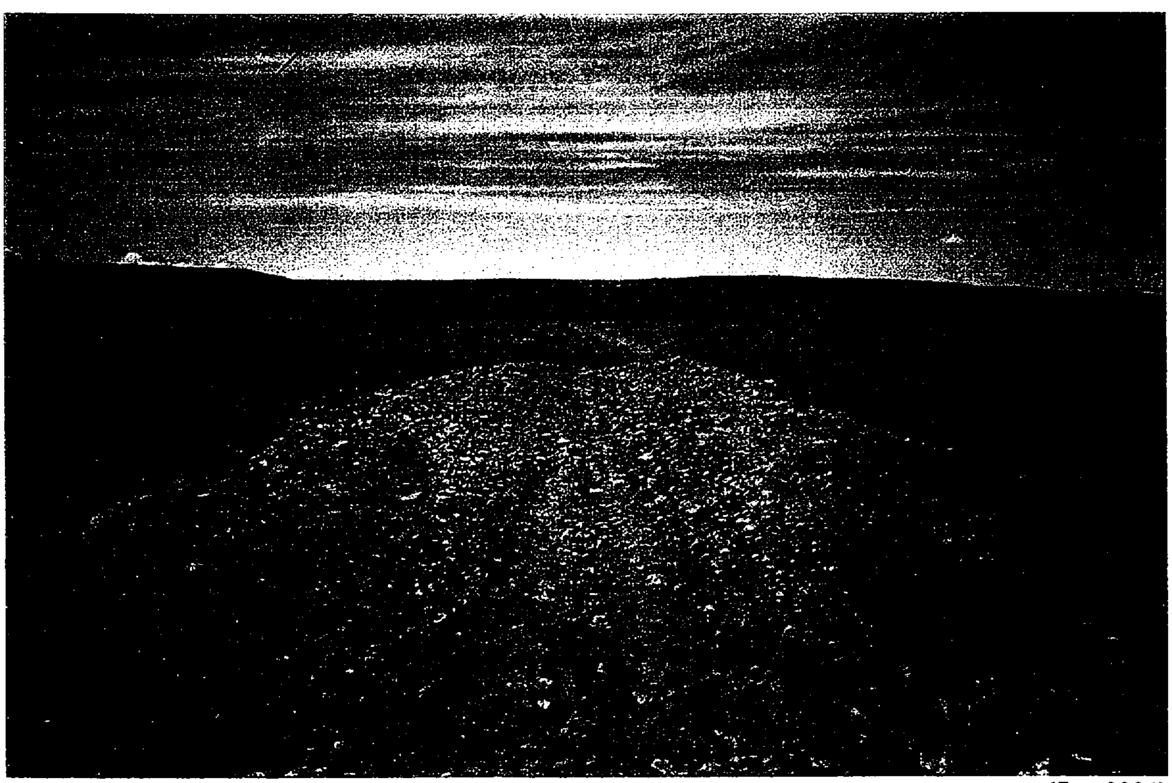


Photo A.12.2 Looking north at south low-flow channel. (Jun 2001)

Photo A.13.1 **Looking north down south low-flow channel, with accumulation of windblown soil in channel. (Aug 2001)**

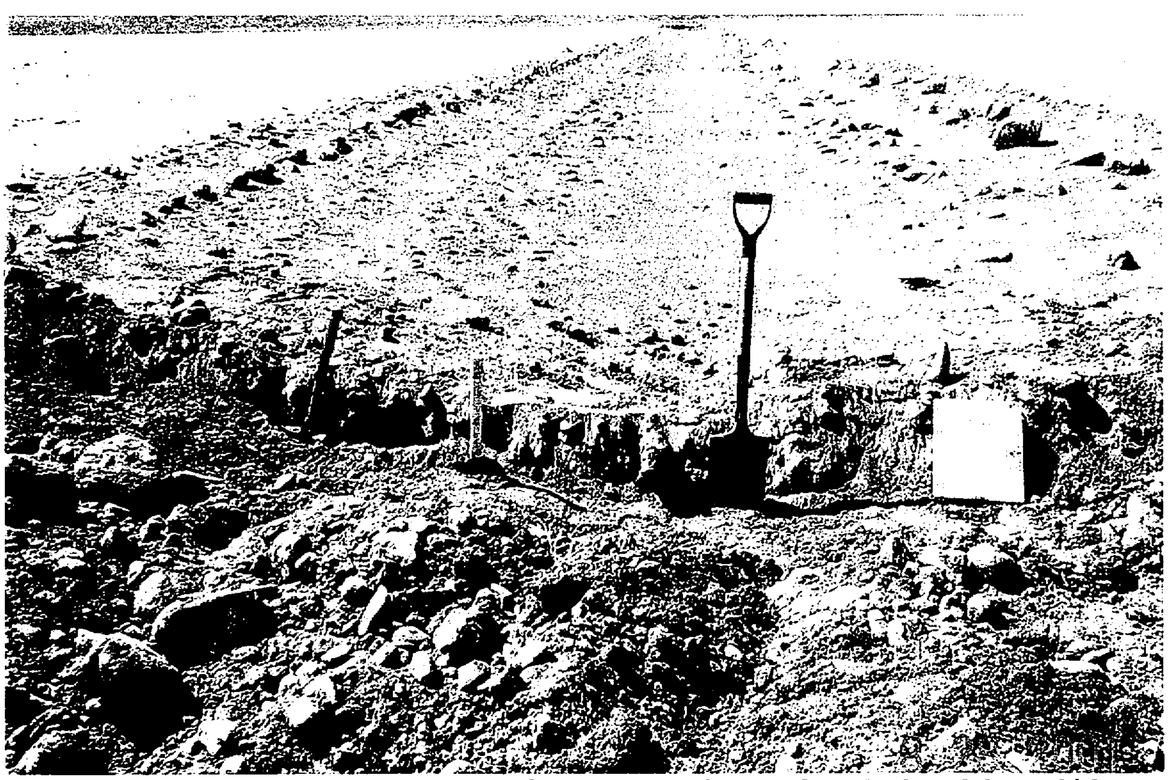


Photo A.13.2 **Looking south up south low-flow channel, with trench to check rock layer thickness and particle-size distribution. (Aug 2001)**

Photo A.14.1 **Trench across old section of south low-flow channel, checking rock layer thickness and particle-size distribution.** **(Aug 2001)**

Photo A.14.2 **Trench across section of west low-flow channel (looking east).** **(Aug 2001)**

Photo A.15.1 Looking up west low-flow channel (looking west). The western limb and Middle Dump borrow area are in the distance. (Aug 2001)

Photo A.15.2 Upper end of North diversion channel (looking east). (Aug 2001)

APPENDIX B

FIELD ENGINEER REPORTS

SHEPHERD MILLER INCORPORATED

Project: Highland 100548-3
Area: Tailings Basin
Name: CS
Date: 24 Oct 00

FIELD ENGINEER DAILY REPORT

Weather Conditions: Cloudy, clearing to partly cloudy, 50-60°F

Work Performed: Carr Construction mobilized to the site on Oct 23 with 3 Cat ~~251~~ 621 scrapers and 3 Cat ~~657~~ scrapers. Cat 14G grader and Cat 815 wedgefoot compactor were on site on Oct 24. Fuel tank set up on Oct 24. Contractor started blading topsoil from haul roads and stripping topsoil from the borrow area. Random fill placement started Oct 23 at SW corner of fill area. Random fill placement through end of day Oct 24 along S side of fill area.

Dozer expected to arrive on Wednesday.

Testing or Surveying Performed: No tests conducted. Checking of Contractor staking by SMI. Two borrow area samples collected for testing.

Scraper cycle time from long stockpile to fill: 3 min
Scraper cycle time from borrow area to fill: 9 min

Discussion with Contractor or Client: SMI held contractor safety meeting at 12:30. All Carr Construction personnel attended and signed attendance list.

Pronghorn Pump and Repair personnel on site at end of day and met with Carr Const. personnel about water supply for earthwork. Water supply system is operational and waiting for Carr to provide piping head frame for loading.

Key Decisions or Construction Modifications:

1. Carr would like to extend borrow area to SE side of Middle Dump. SMI to extend topo survey on side of dump on Oct 25.
2. Area of topsoil stripping on perimeter of fill area outlined on map and staked out by Contractor. SMI checked stake locations. Topsoil to be stockpiled just outside of stripped areas.
3. Low-flow channel extent shown to contractor. Low-flow channel rock stockpiles (3) shown to contractor. South end of low-flow channel needs to excavated (in topsoil stripping area).
4. SMI gave Contractor map with finished grade elevations and fill limits.

~~Comments:~~

Visitors: Scott and Glen Blakeley with Pronghorn Pump and Repair

Signature: Clint Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548
Area: TAILINGS BASIN
Name: GREG VAN HEEL
Date: OCT 25, 2000

FIELD ENGINEER DAILY REPORT

Weather Conditions: CLOUDY & SHOWERS, 50°F

Work Performed: CARR CONST CONTINUING FILL PLACEMENT - RANDOM FILL AREA ONLY - NO COVER MAT'L PLACED YET. OF THE TWO CLOSEST BORROW STOCKPILES, SOUTHERN ONE HAS BEEN USED UP & NORTHERN ONE IS ALMOST DEPLETED AS WELL. SCRAPERS WORKING IN PAIRS IN LARGE BORROW AREA - A PUSH/PULL METHOD IS BEING USED AND SCRAPERS ARE GETTING FULLY LOADED.

6 SCRAPERS, 1 SHEEPSFOOT (815), 1 DOZER, 1 Lg. WATER TRUCK

Testing or Surveying Performed: NO COMPACTION TESTING PERFORMED. I USED GPS EQUIPMENT FOR TOPOGRAPHY SURVEY ON SOUTHERN SLOPE OF LARGE BORROW AREA. I THEN PLACED STAKES TO SHOW NEW EXTENTS OF SURVEYED AREA SO CONTRACTOR COULD SEE BORROW LIMITS.
IN ADDITION, I SURVEYED TWO ALLUVIAL OUTWASH AREAS NORTH OF THE SITE (AT TOE OF EXISTING HILLS). THIS WAS DONE FOR FUTURE WORK.

Discussion with Contractor or Client: BOOMER ASKED WHEN WE WOULD BEGIN SAND CONE COMPACTION TESTS. I TOLD HIM THAT ON FRIDAY (10/27) CLINT & I WOULD RETURN TO SITE FOR TESTING. HE SAID THAT HE WILL BE PLACING COVER MAT'L BY THEN AND WILL BE READY FOR TESTING.

Key Decisions or Construction Modifications: SOUTH SLOPE OF MAIN BORROW AREA EXTENDED. BORROW AREA NOW LARGER.

Comments: /

Visitors: /

Signature: Greg Van Heel 10/25/2000

SHEPHERD MILLER
INCORPORATED

Project: Highland 100548-3
Area: Tailings Basin
Name: Clint Strachan, Greg van Heel
Date: October 27, 2000

FIELD ENGINEER DAILY REPORT

Weather Conditions: Partly cloudy, Windy, 45°F

Work Performed: Contractor was placing random fill on south end of fill placement area and starting first lift of cover. Borrow material was from borrow area only, as the 2 stockpiles have been used up. Contractor estimate of stockpile volume 16,500 cy (SMI estimate 15,000 cy). Borrow area primarily silty clay with pockets of silty sand and siltstone boulders. Contractor ~~from~~ separating boulders from fill in the borrow area or in the fill placement area. Contractor scraper cycle time ~5 minutes from fill placement area to borrow area (round trip). All equipment operating. Contractor moisture-conditioning fill with ~~compact~~ compactor and grader. Contractor has sufficient water supply.

Testing or Surveying Performed: Conducted 8 sand-cone tests on top surface of random fill. Collected 2 bulk samples from borrow area for testing.

Cycle time for scrapers: 5 min
Load value average: 14 cy (used by contractor)

Discussion with Contractor or Client: (1) Contractor will be ready for testing of first lift of cover by mid-day Monday. Preliminary sand cone test results on random fill provided (all passing). (2) Contractor ~~placing~~ has placed ~~~~ 5000 to 10,000 cy/day and plans on 5000-6,000 cy ~~~~ per day next week, with 2 working areas. (3) Monte Carr had 2 areas of concern in contract: (a) site preparation ~~~~ cost, and (b) random fill volume. SMI to talk to Exxon ~~~~ about contract modification. Suggested adjusting random fill unit cost and change topsoil stripping to unit price.

Key Decisions or Construction Modifications: Contractor may remove topsoil as needed and directly place on completed areas.

Comments: SMI to bring another finished grade map for Monte Carr.

Visitors: —

Signature: Clint Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland 100548-3
Area: Tailings Basin
Name: Clint Strachan
Date: 30 OCT 00

FIELD ENGINEER DAILY REPORT

Weather Conditions: Partly cloudy, 50-60°F

Work Performed: Contractor placing first and second lift of cover on South end of fill area, also placing random fill in evaporation pond area.

Borrow material from borrow area primarily silty clay with some pockets of sand, organics and siltstone boulders. Contractor picking out boulders in borrow area and on fill. Moisture conditioning of cover material with Cat 815 and grader working well.

Testing or Surveying Performed: Conducted 10 sand cone tests on first and second lift of cover.

Discussion with Contractor or Client: Contractor ready for additional random fill tests on Tuesday as well as more cover material tests.

Discussed how compaction is being achieved along stake rows. Contractor is using 10 to 20-foot offsets for each lift of cover, then compacting stake row at start of next lift.

Key Decisions or Construction Modifications: None

Comments:

Visitors: John Strachan

Signature: Clint Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548
Area: TAILINGS BASIN
Name: GREG VAN HEEL
Date: OCT 31, 00

FIELD ENGINEER DAILY REPORT

Weather Conditions: INTERMITTENT RAIN, HEAVY AT TIMES, 40°F

Work Performed: CARR CONSTRUCTION CONTINUING COVER FILL IN MORNING. IN AFTERNOON, CREW WAS WORKING AT THE RANDOM FILL/COVER BOUNDARY, PLACING SOME FILL ON BOTH AREAS.

Testing or Surveying Performed: PERFORMED 5 SANDCONE TESTS ON COVER MAT'L.

Discussion with Contractor or Client: TESTING SHOWED GOOD COMPACTION & MOISTURE, BUT SOME AREAS WERE A SANDY MATERIAL. I TALKED TO GALEN & BOOMER ABOUT KEEPING THE SANDY MATERIAL OUT OF THE COVER FILL. THEY SAID THEY WOULD TRY TO LIMIT THIS MAT'L TO RANDOM FILL AREA, BUT IT IS DIFFICULT DUE TO VARIABILITY IN STOCKPILE.

Key Decisions or Construction Modifications: Ø

Comments: CONTRACTOR STOPPED WORK 45 MINUTES EARLY DUE TO BAD WEATHER.

Visitors: Ø

Signature: Greg Van Heel

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND 100548-03
Area: TAILINGS BASIN
Name: GREG VAN HEEL
Date: NOV 1, 2000

FIELD ENGINEER DAILY REPORT

Weather Conditions: HEAVY RAIN & SNOW

Work Performed: NONE

Testing or Surveying Performed: NONE

Discussion with Contractor or Client: CARR WILL NOT BE WORKING TODAY DUE TO BAD WEATHER. 6 INCHES OF SNOW RECEIVED OVERNIGHT WITH MORE PRECIPITATION PREDICTED ~~TO~~ FOR TODAY. GALEN INDICATED THAT SITE WAS DRESSED UP & HAD POSITIVE DRAINAGE ON COVER MAT'L, BUT PONDING MAY OCCUR ON RANDOM FILL. ALSO, ACCESS TO SITE DIFFICULT DUE TO MUDDY CONDITIONS.

Key Decisions or Construction Modifications: CONTRACTOR WILL CALL US WHEN WORK RESUMES (MAYBE NOT UNTIL FRIDAY).

Comments:

Visitors:

Signature: Greg Van Heel

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland 100548-3
Area: Tailings Basin
Name: Clint Strachan
Date: 4 NOV 00

FIELD ENGINEER DAILY REPORT

Weather Conditions: Clear, Windy, 40°F

Work Performed: Contractor placing final 2 lifts on south end of fill placement area (Q and R lines) as well as random fill in evaporation pond area.

Contractor using same equipment, with one scraper down for repairs. Contractor pumping collected runoff from evaporation pond area with sump pump to facilitate random fill placement. Work areas okay, but surrounding ground still wet from precipitation earlier in the week.

Borrow area materials continue to be silty clays with siltstone boulders and sand pockets

Testing or Surveying Performed: Collected 2 borrow area samples for testing.

Conducted 16 sand cone tests in completed cover areas. Two areas did not meet density requirements - contractor notified and will re-work these areas Monday morning.

Discussion with Contractor or Client: Review of contractor schedule and surveying requirements. Discussion of test results and re-working of designated areas.

SMI to be on site Monday for testing (weather permitting).

Key Decisions or Construction Modifications: None

Comments:

Visitors:

Signature: Clint Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND
Area:
Name: GREG VAN HEEL
Date: NOV 6 2000

FIELD ENGINEER DAILY REPORT

Weather Conditions: COLD & WINDY 15° - 20° F

Work Performed: CARR CONSTRUCTION PLACING FILL WEST OF EVAP CELLS. COLD WEATHER IS CAUSING GROUND TO FREEZE SO CREW IS PLACING COVER IN SMALL AREA SO IT CAN BE FINISHED IN A SINGLE DAY. DUE TO FREEZING CONDITIONS WATER IS NOT BEING ADDED TO FILL - SOME AREAS TOO DRY TO PASS.

Testing or Surveying Performed: 4 SAND CONE COMPACTION TESTS TAKEN - 2 PASSING & 2 FAILING.

Discussion with Contractor or Client: COLD WEATHER IS PREVENTING CREW FROM ACHIEVING MOISTURE DENSITY REQUIREMENTS. I SPOKE WITH CLINT S. AND BOOMER - BOTH AGREED THE BEST SOLUTION IS TO STOP WORK & CONTINUE WHEN WEATHER WARMS UP (MAYBE NOT UNTIL SPRING).

Key Decisions or Construction Modifications:

Comments: TOMORROW CREW WILL PLACE REMAINING RANDOM FILL & 1ST LIFT OF COVER. ALSO POSITIVE DRAINAGE WILL BE ESTABLISHED. WORK WILL THEN TERMINATE.

Visitors:

Signature:

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: HIGHLAND
Area:
Name: GREG VAN HEEL
Date: NOV 7, 2000

FIELD ENGINEER DAILY REPORT

Weather Conditions: COLD & VERY WINDY (WHITEOUT CONDITIONS) 15°F

Work Performed: NONE

Testing or Surveying Performed: NONE

Discussion with Contractor or Client: I ARRIVED ON SITE EARLY AM TO FIND EQUIPMENT PARKED AND CONTRACTOR NOT ON SITE. I SPOKE WITH SOMEONE AT THE SITE OFFICE WHO SAID BOOMER SENT HIS CREW HOME AS THEY WERE ARRIVING (DUE TO WHITEOUT CONDITIONS)

Key Decisions or Construction Modifications:

Comments: RANDOM FILL AREAS HAVE NOT ALL BEEN BROUGHT UP TO GRADE, SO WE HAVE SOME LOW AREAS. THIS WILL LIKELY LEAD TO PONDING & SOFT CONDITIONS DURING A THAW PERIOD.

Visitors:

Signature: Greg Van Heel

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland 100548-2
Area: Tailings Basin
Name: CLS
Date: 9 April 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Clear 50°F strong winds

Work Performed: Carr Construction mobilized to site last week. Equipment spread: 4 Cat 627 E scrapers, 1 Cat water wagon, 1 Cat 140G grader, 1 Cat 815 wedgefoot compactor. Contractor had re-worked last lift of cover from November. Contractor was stripping an stockpiling topsoil and placing random fill on April 9.
Compactor broke down in late afternoon. Water supply to be hooked up today. Tanks on site.
Contractor working 7:00 am to 4:30 pm weekdays.

Testing or Surveying Performed: 8 sand cone tests conducted on area reworked last week (~~[illegible]~~ Q to R zone.)
Borrow area samples (2) collected for lab testing.

Discussion with Contractor or Client: Compactor repair may take 2 days
Tested area appears dry and soft. Discussed areas needing testing and areas needing grade stakes at 100' spacing. Confirmed that grade stake marks are to final (top of topsoil) grade.

Key Decisions or Construction Modifications: None

Comments: Small puddles from precip over the weekend; ponded water just south of R line (at edge of fill from 2000). Contractor pumping water from pond ~~to random fill~~ for compaction. Work started April 6.

Visitors:

Signature: Curt Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland 100548-2
Area: Tailings Basin
Name: CLS
Date: 10 April 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: cloudy 32°F, humid, breezy, light snowfall

Work Performed:
1 Stripping and stockpiling topsoil
2 placing final cover lift on passed areas of fill (between Q & R lines)
3 placing fill in random fill area

Testing or Surveying Performed: 8 sand cone tests in reworked area (P to Q zone)

Discussion with Contractor or Client: Compactor repair started - 1 to 2 days to re-weld broken part
Areas of fill requiring re-working identified
Areas where topsoil has been stripped to be rolled with compactor prior to placing first lift
Areas of vegetation within no-topsoil area to be bladed, then rolled prior to first lift
Pumping areas over evap ponds to be left for a day or two prior to additional compaction

Key Decisions or Construction Modifications: None

Comments: Storm to hit tonight; will communicate with contractor on conditions on Wed and Thurs.

Visitors:

Signature: Clint Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland 100548-2
Area: Tailings Basin
Name: CLS
Date: 13 April 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: partly cloudy, 40°F, strong winds

Work Performed: Contractor did not work on April 11 due to snow and wind; resumed work on April 12. Work conducted April 12 and 13:

1. stripping and topsoiling topsoil
2. placing ~~fill~~ final cover fill between R and S lines
3. placing fill in random fill area

~~Compactor repaired and working 2 & 3 above~~

Testing or Surveying Performed: 8 sand cone tests (between Q and R lines) in recompacted area.

2 samples collected from active zone in borrow area for ~~&~~ laboratory testing.

Discussion with Contractor or Client: Areas of ~~too~~ reworking or additional rolling identified. Passing areas identified.

Contractor will be ready for testing in area south of R line on Monday. Contractor will be ready for ~~grade~~ additional grade stakes on Monday.

Key Decisions or Construction Modifications: None

Comments: Fill moisture has been at optimum

Visitors: Brett Strachan

Signature: Clint Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland 100548-2
Area: Tailings Basin
Name: CLS
Date: 16 April 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Clear to partly cloudy, ~~50~~ 45-50°F, breezy

Work Performed: Contractor placing and compacting cover fill on south end of fill area (R and S lines).

Testing or Surveying Performed: 12 sand cone tests (between R and S+100 lines) and one test in recompacted area (R line)

Eric Woodland and Victor Mendoza arrived on site in pm to install grade stakes on 100-foot centers.

Discussion with Contractor or Client: Contractor needs more water for compaction. Discussed larger pump for pumping system with John and Glen Blakeley. Glen can get 1 80 gpm pump. ~~I agreed to~~

I suggested that Glen or Scott Blakely find the pump. I will contact Exxon and it is likely that ~~they~~ Mark Hoffman will okay additional water supply cost.

Key Decisions or Construction Modifications: Blakeleys to find pump to supply additional water for Contractor (if supply can be accommodated with just a larger pump).

Comments: One area along S line too dry and loose; other areas tested okay.

Visitors:

Signature: Clint Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland
Area: Tailings Basin 100548-2
Name: Clint Strachan
Date: 17 April 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Clear, breezy, 30-50°F

Work Performed: Contractor placing random fill in low area (old evap pond area) and in ponded water area along R line. Wet areas being ~~sp~~ surrounded and squeezed for future compaction.
Contractor placing cover south of R line.

Testing or Surveying Performed: Sand cone compaction tests (12) by SMI.
GPS surveying by SMI completed in areas needed for now by the Contractor.

Discussion with Contractor or Client: Additional water supply requested by Contractor. Currently Pronghorn Pump & Repair equipment is supplying over 60 gpm. Additional water would require an additional pipeline (separate from the 3" line currently in use). Estimated cost for additional line and pump is $10,000 to $12,000. Decision left up to Exxon, who decided to continue with existing supply. Contractor wanted extra water supply in order to bring additional equipment to the site.

Key Decisions or Construction Modifications: None

Comments: Random fill area tested and passed. Cover areas tested and passed. Retested areas from 16 April ~~[illegible]~~ retested and passed. Contractor may be ready for testing on Thursday.

Visitors:

Signature: Clint Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland
Area: Tailings Basin 100548-2
Name: Clint Strachan
Date: 19 April 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Partly cloudy, 50-60°F, high winds

Work Performed: Contractor placing cover ~~on~~ between Q and R lines. Area South of R line complete and ready for testing of final lift. Contractor placing random fill at end of day (short on water). High winds are drying out surfaces.

Testing or Surveying Performed: Sand cone compaction tests (12) by SMI in S line area of final ~~8~~ lift. Two borrow area samples collected.

Discussion with Contractor or Client: ~~B~~ Final cover grades to be based on 100-ft grid. Topsoil placement to be based on 100-ft grid.

Key Decisions or Construction Modifications: None

Comments: Warm temperatures and high winds have dried out the upper 0.1-foot depth of prepared areas. Moistures were most likely within range when construction was completed, but ~~are~~ are dry of optimum when tested 1 to 2 days later.

Visitors:

Signature: Clint Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland
Area: Tailings Basin 100548-2
Name: Clint Strachan
Date: 20 April 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Cloudy, 40°F, east wind, humid

Work Performed: Contractor placing cover between P and Q lines. Contractor rained out in afternoon.

Testing or Surveying Performed: Sand cone compaction tests (12) by SMI in Q to R line area (final lift)

Discussion with Contractor or Client: Contractor will conduct final grading of ~~to~~ top of cover surface in areas passing compaction tests.

Key Decisions or Construction Modifications: None

Comments: Contractor may be out of compaction water in afternoon, and may switch to topsoil stripping.

Visitors:

Signature: Clint Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland
Area: Tailings Basin 100548-2
Name: Clint Strachan
Date: 24 April 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Partly cloudy, 60°F, breezy

Work Performed: Contractor rained out on Friday afternoon (20 April). Storm over the weekend produced several inches of wet snow at site.

Contractor did not work on Monday (23 April) and today due to wet ground. Contractor may work on Wednesday if the site has dried out.

Testing or Surveying Performed: Two sand cone tests conducted in borrow area.

Discussion with Contractor or Client: Discussed ground conditions with John Smith (Carr Construction).

Key Decisions or Construction Modifications: None

Comments: Standing water in random fill ~~None~~ area; puddles in completed area of fill.

Visitors: Don Poulter

Signature: Clint Strachan

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland Reclamation Proj
Area: P100 + P150 + Q + Q5
Name: Don Poulter
Date: May 1, 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: 45°, Windy from NE, Partly Sunny (AM)

Work Performed: +50° Breezy from NE, Sunny (noon)
2:30 pm. Wind Shift from W - Very Windy.
ON SITE 8:30 - 3:45 (No lunch break) 7¼ hrs.
QA Sand Cone Tests P+100 to P+150, 10+00 - 13+00
Q+0 Q+50, 9+100 to 14+100

Testing or Surveying Performed: Sand Cones as noted Above

Discussion with Contractor or Client: First Fill [illegible] [illegible] [illegible] of previous week placed [illegible] ~ 2" [illegible]" completed P100 - P[illegible] and Q → Q+50; Continuation Work P150 - Q and P50 - S100 in AM. Contractor filling in low area @ [illegible] around 'P' [illegible] [illegible] pending. Random Fill around 'O' + 1100 area.

Key Decisions or Construction Modifications:

Comments: QA Test #1 of May 1 '01 - Bad TEST - observation of area showed test area 'pumped' from Scraper traffic. Area to be retested. (Notified contractor of intent to retest.

Visitors:

Signature: Don A Poulter

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland
Area: tailing Pond Cover
Name: Don Poulter
Date: May 04, 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Cloudy, Cold (35-40°) Damp, Breezy w/ Gusts (From East)

Work Performed: Contractor Working in N to P area from 9+100 to 12+100. Contractor Reworking Soft area I P+050 from 12+175 to 14+175.

Testing or Surveying Performed: QA tests on Final grade between P+Q Lines.
Retested Failed Test Area from May 1 '01 (P+100, 14+010) @ 6" below grade

Discussion with Contractor or Client: Discussed reworking of soft area.
Approved South of P+700 to P+1200 and Q+1200 + West End as ready for final grade survey and topsoil - Compaction O.K.

Key Decisions or Construction Modifications: None

Comments: Contractor working ~~[illegible]~~ very well.
P+100 to R5 used as traffic route from 12+000 + 13+000 QA tested kept in areas not over compacted by traffic. ~~[illegible]~~ P+100 + P+150 for 9+100 + 10+100 - turn around area - grade lift not tested in this area.

Visitors:

Signature: [signature]

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highlands Proj.
Area: Tailings Area
Name: Don Poulter
Date: May 8 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Sunny Warm, (±70°) Windy

Work Performed: Contractor placing fill in Area from N to O+100 and 11+100 to 12+100 - Worked area west of this yesterday
Also working M to N from 11+000 to 12+100
Conducted grading of final surface at east end of 'P' on some fill work at east end of 'O'

Rutted area of 'P' line west of 12+000 ripped and drying. May be recompacted May 9 or 10.

Testing or Surveying Performed: QA TESTS (Sandcone)
O+000, 11+000 - 1 test
N+000 - O+1000, 11+100 - 13+000 - 3 tests
P+000 + P+050, 13+100 - 14+100 - 2 tests
(these tests are voided - area to be reworked as noted below)
O+000 - M+100, 13+000 - 13+100 - 4 tests
M+150 - N+050, 12+000 - 12+100 - 1 test

Discussion with Contractor or Client: Discussed pumping in area of #5 + #6 (P - P+50 13+100 to 14+100) Surface compacted okay but lower layer wet and not carrying traffic loads. Contractor to rip area to allow lower material to dry out.

Key Decisions or Construction Modifications:

Comments: Contractor left site before clearing additional areas for QA tests. Completed available test locations. Attempted manual prep of test areas in M to N area. One site okay and tested - others have compaction foot imprints too deep to achieve could surface. Briefly observed construction procedures - Walked work areas to note boundaries prior to leaving site.
- Survey crew on site today
on site @ 11:45 - left @ 6:30

Visitors: None

Signature: [signature]

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland Project
Area: Tailing Impoundment
Name: Don Poulter
Date: May 10, 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Sunny: AM ≈ 50° Mod. Breeze; Noon ≈ 70° Mod wind w/ Gusts

Work Performed: Topsoil Removal South of 'M' 11+000 to 14+800
fill in area of N+100 to P+000 and 10+100 + 11+000

Testing or Surveying Performed: QA Tests in Work area plus
Completion of May 8 + 9 work areas. Tests include
below grade check tests.

Discussion with Contractor or Client: None

Key Decisions or Construction Modifications: None

Comments: Work was progressing in orderly manner
Fill placement/compaction going well - compactor
Keeps up w/ scrapers O.K. Tests taken @ level representative
of fill placed in area to date (Based on observation
of construction procedures

Visitors: On site 8:45 –

Signature: Don A Poulter

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland
Area: Tailings Basin Fill Area
Name: D. Poulter
Date: May 15, 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Cloudy Warm Windy + Very Windy

Work Performed: Contractor Finish Grade in all areas North of line and East of 11+00
Placing Fill in Northern area (L to M Line from 10 to +15)

Testing or Surveying Performed: QA Tests in O to N between 10+100 and 11+100 and in E between L+M 11 to 14. Observed fill placement procedures in work area. Lifts placed @ ± 4" to 6".

Discussion with Contractor or Client: Contractor expects all fill to be completed today or tomorrow (May 16, 2001). Last test may fail (L+30, 12+160). Work area from L to L+100 and 11+000 13+000 should be rolled again before additional fill placed. Contractor advised of such. Contractor reworked area prior to additional fill.

Key Decisions or Construction Modifications:

Comments: Test #5 in top lift that will be trimmed off for topsoil. st #6 @ grade for top of cover in adjacent area. [illegible] of M+100 to N+000 and 9+100 to 10+000 - fill is well packed overall (qualitative judgement using probe and observing surface after fine grading) - recompaction of area based on t #5 not recommended.

Visitors:

Signature: Don A Poulter

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland
Area: Tailings Basin Fill Area
Name: D. Poulter
Date: May 17 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Sunny, Warm Lt to Mod. Breeze (from N.) - A.M.

Work Performed: Contractor completing fill in L to M area (finish grade) and reworked soft pumping areas in L + M lines. Contractor began topsoil placement in SE area.

Testing or Surveying Performed: QA tests in 9+100 to 10+100 and O+100 to M+100, QA Tests M to M+100 and 11+000 to 14+100, QA tests L+100 to M+000 from 13+155 to 14+130

Discussion with Contractor or Client: Cleared areas tested for final grade and topsoil placement.

Key Decisions or Construction Modifications:

Comments: Test No 5 in top lift of material to be trimmed to final grade for topsoil placement. Test #6 in material @ cover grade Examination of area + qualitative judgement (pushing probe into fill) area M+100 to N+000 and from 9+100 to 10+000 fill is generally well compacted - Based on Results of #6 - area not recommended for recompaction and retest - (Subsequently found that area tested May 15 @ 119 pcf.) - Test # 9 is area where soft subsoil subexcavated after fill placed but pumping in area noted on [illegible]. Test # for material replaced to grade 50 x 150 x 2 ft ≈ 555 yd3 & one test okay.

Visitors:

Signature: [signature]

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland
Area: Tailings Basin Fill Area
Name: Don Poulter
Date: May 22, 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Mostly Cloudy, Windy (N-NW), Cold (50°) A.M. / Stronger Winds in P.M. - Cooler (Cold?) Clear and warmer at end of Day.

Work Performed:
A.M. Contractor topsoiling S.E area east of channel and Borrow Area. Contractor began cutting ~~[illegible]~~ drainage ditch.

P.M. Completed Drainage ditch excavation and continued topsoil Placement

Testing or Surveying Performed: QA tests on L to M Line including Retest of #8 from May 15'01 in L to L+100, 12+100 + 13+000 area. QA test along P-line from 12+000 to 16+000

Discussion with Contractor or Client: Notified Contractor L to M okay for final grading and topsoil. Mentioned the need to wheel roll shallow ruts and small soil windrows. Care should be taken to roll along stake lines.
- Borrow Ready to Survey
- Ditch not surveyed properly. Stakes don't connect - dam be built to drain - O.K. (Discuss w/ Clint

Key Decisions or Construction Modifications:

Comments: L to M areas appear well compacted. Re. Retest of #8 (5/15/01). Area is well compacted and suitable. Although test location (#6 5/22/01 retest) is not identical to failed test location test is representative of reworked area.

Low area noted @ end of day along P+100 from ± 12+100 + 14+000 - to discuss w/ Clint and Contractor

Visitors:

Signature: Don A Poulter

File: DAILY.DWG

SHEPHERD MILLER
INCORPORATED

Project: Highland
Area: Tailings Basin Fill Area
Name: D. Poulter
Date: May 24, 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Clear, Mod. Wind w/ Gusts, Warm ±65° (A.M)

Work Performed: Contractor placing topsoil on east side of ditch (±12+000) and in area of L to M+100 13+000 to 16+000.
- Late A.M. Contractor filled low area along P+100 from 12+100 to 14+000 (see discussion w/ Contractor)
- Regrading Along M and M+100 from 11 to 13+000 - See discussion and comments below.

Testing or Surveying Performed: Observation of work area/procedures only - no QA tests performed this day.
Walked ditch excavated May 22.
Walked final surface area from L to O from 11+00 to 14+00 for observation before topsoil placement.

Discussion with Contractor or Client: Walked over low area sited along P+100 from ±12+100 to 14+000 (May 22 '01) with Contractor. He agreed area was low. Area to receive fill and wheel-rolled into place.
- Observed completed work in this area (P+100), and final grade looks okay and no low area. Contractor also bladed smooth the P to P100 from 14+000 to 16000 to remove ruts and provide proper drainage.
Discussed need to correct final grade along M & M+100 from 11 to 13+000

Key Decisions or Construction Modifications: Contractor to 'field-fit' tie-in with existing ditch at north and south end of work area.

Comments: Ditch excavation looks good. Tie-in w/ existing ditch at North end should be easy 'field fit'. Upper (south) end is wet and needs to be dried out before connection to be made.
Traffic Routing from stockpile has rutted areas M + M+100 and 15+000 + 15+100
- notified Contractor the rutting by traffic - to be bladed smooth prior to topsoil in the area
± M line from 11+100 + 13+000 needs to be fine graded, also ± M+100 line from 11+000 + 13+00. All other lines appear okay.

Visitors:

Signature: [signature]

File: DAILY.DWG

SHEPHERD MILLER INCORPORATED

Project: Highland Project
Area: Tailing Basin Fill area
Name: Don Poulter
Date: June 1, 2001

FIELD ENGINEER DAILY REPORT

Weather Conditions: Clear, warm, breezey / moderate

Work Performed: Site Observations of topsoil placement and final grading.
Contractor completed topsoil and grading of area East of 13+100. Still working west of 13+100'. Most of the topsoil placed - final grading majority of work remaining. Observed final grading & T.S. placement in various areas.

Testing or Surveying Performed: ——

Discussion with Contractor or Client: Discussed the salvaging of topsoil and other suitable materials to use as topsoil. Areas outside of cross-section T.S. stockpiles - estimate quantity be load count for payment. Contractor to blade T.S. over road and from site - time + material. Contractor to repair rutted area of access road on way out - time + material. Diversion ditch to be completed by Monday P.M.

Key Decisions or Construction Modifications: Use of T.S. outside of X-section as noted above.

Comments: Completed work looks satisfactory and suitable for tilling & seeding.
- Site observation by C. Strachan & D. Poulter.
- Contractor to 'feather' edge of topsoil along north side west of 13+100 - Other areas look O.K.

Visitors:

Signature: [signature]

File: DAILY.DWG

Highlands Project
Tailings Basin Area
June 5, 2001

DRAINAGE Ditch Observations

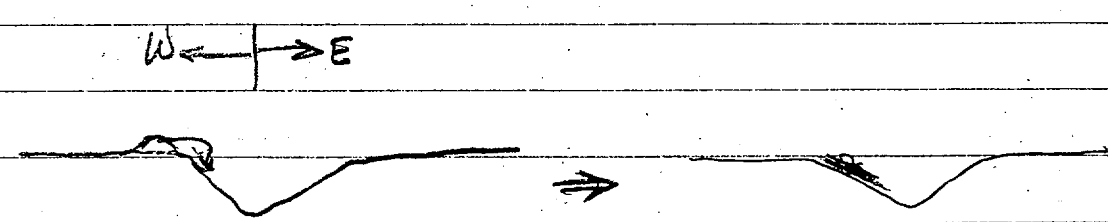
1) Overall ditch construction and rock armor (riprap) placement is okay. Structure and riprap meets intent of design.

2) Pictures taken of ditch and rock placement.

3) Rock appears 'dirty' w/ oversized material. Existing ditch walked and rock observed for comparison to current construction. No difference was noted. Once area revegetated, ditch will be continuous in appearance.

- Items discussed with Contractor for final shaping of ditch

a) from 9+00, 12+00 to tie-in with existing ditch (lower end) small berm exists along west side - needs to blade it level with cover/topsoil to allow drainage into ditch.



looking downstream

6) Check tie-in to existing ditch. First 200 ft appears 'high' - especially 0-50 ft. Needs to re-blade invert to assure drainage.

- Contractor to final grade ditch as discussed above Wednesday, June 6, 2001.

General

- Contractor working areas west of 14+000
- All topsoil placement and grading to be complete June 6, 2001. Area east of 14+000 looks good - no areas of re-work noted.
- Area appears graded per design - no low spots or reverse grades were observed.
- All work to be completed June 6, 2001

- No additional trips for site observations planned.
- Final site observation to be scheduled w/ NRC later this year.

[signature]

Note

* Contractor "feather" north side of work area as noted on June 1, 2001 site visit. (see daily report)